BRIGHAM AND
WOMEN'S HOSPITAL

HARVARD
MEDICAL SCHOOL

Department of Radiology
75 Francis Street
Boston, Massachusetts 02115
Tel: 617-732-7389; Fax: 617-582-6033
www.spl.harvard.edu/~kikinis
kikinis@bwh.harvard.edu

Ron Kikinis, M.D.
Professor of Radiology
Director, Surgical Planning Laboratory
Robert Greenes Distinguished Director of Biomedical Informatics

April 27, 2012

Division of Extramural Activities Support, OER
National Institutes of Health
6705 Rockledge Drive, Room 2207, MSC 7987
Bethesda, MD 20817

To Whom It May Concern:

On behalf of the Brigham and Women's Hospital Signing Official, Leigh Curley (Senior Grants Administrator), please find enclosed the annual progress report for grant U54 EB005149, the "National Alliance for Medical Image Computing (NA-MIC)" on which I am the Principal Investigator.

If you have any questions, please do not hesitate to contact my office.

Thank you.

Sincerely,

Ron Kikinis, M.D.

Form Approved Through 06/30/2012

OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			U54 EB005149

Total Project Period
From: 9/17/2004 Through: 6/30/2014

Requested Budget Period
From: 7/1/2012 Through: 6/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NAMIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Ron Kikinis, M.D
75 Francis Street
Boston, MA 02115

2b. E-MAIL ADDRESS
kikinis@bwh.harvard.edu

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
Radiology

2d. MAJOR SUBDIVISION
SPL

2e. Tel: 617-732-7389 Fax: 617-582-6033

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
Brigham and Women's Hospital
75 Francis Street
Boston, MA 02115

3b. Tel: 617-954-9660 Fax: 617-954-9680

3c. DUNS: 030 811 269

4. ENTITY IDENTIFICATION NUMBER
1042312909A1

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No. FWA00000484

6c. NIH-Defined Phase III Clinical Trial ☒ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Barbara E Beirer, M.D.
Senior Vice President, Research
75 Francis Street, Boston, MA 02115

Tel: 617-954-9660 Fax: 617-954-9680

E-MAIL: BWHGC@partners.org

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)
Organizational Name: Brigham and Women's Hospital
DUNS: 030 811 269
Street 1: 75 Francis Street
Street 2:
City: Boston County:
State: MA Province:
Country: USA Zip/Postal Code: 02115
Congressional Districts: 8th

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD
8a. DIRECT $3,475,023 8b. TOTAL $3,868,419

9. INVENTIONS AND PATENTS ☒ No ☐ Yes
If "Yes," ☐ Previously Reported ☐ Not Previously Reported

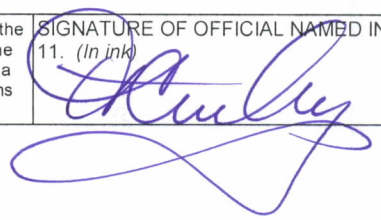
11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Leigh Curley, Senior Grant Administrator

TEL: 617-954-9660 FAX: 617-954-9680 E-MAIL: BWHGC@partners.org

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)*



DATE 4/26/12

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

Summary

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 7/1/2012	THROUGH 6/30/2013	GRANT NUMBER U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
	PD/PI						
Administration Core 6					198,629	70,259	268,879
Dissemination Core 5					40,812	14,692	55,504
Training Core 4					87,556	31,520	119,076
Core 2					3,289	1,184	4,472
SUBTOTALS →					330,276	117,655	447,932

CONSULTANT COSTS	6,000
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	1,110
TRAVEL	34,900
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	11,200
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 501,142
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	1,814,931
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	1,158,946
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 3,475,023

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM	THROUGH	GRANT NUMBER
	7/1/2012	6/30/2013	U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Ron Kikinis	PD/PI						
SUBTOTALS →							

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	
TRAVEL	
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$**
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	1,156,161
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	724,628
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 1,880,789

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			2U54EB005149

Total Project Period
From: 09/17/2004 Through: 06/30/2014

Requested Budget Period
From: 07/01/2011 Through: 06/30/2012

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NAMIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Ross Whitaker
72 S Central Campus Dr., RM 3750
Salt Lake City, UT 84112

2b. E-MAIL ADDRESS
whitaker@sci.utah.edu

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
SCI Institute

2d. MAJOR SUBDIVISION

2e. Tel: 801-587-9549 Fax: 801-585-6513

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
University of Utah
1471 East Federal Way
Salt Lake City, UT 84102

3b. Tel: 801-581-3006 Fax: 801-581-3007

3c. DUNS: 009095365

4. ENTITY IDENTIFICATION NUMBER
87-6000525

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☒ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Laurel Duncan
1471 East Federal Way
Salt Lake City, UT 84102

Tel: 801-581-3006 Fax: 801-581-3007

E-MAIL: ospawards@osp.utah.edu

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)

Organizational Name: University of Utah

DUNS: 009095365

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $120,074 8b. TOTAL $180,712

Street 1: 72 S Central Campus Dr., RM 3750

Street 2:

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes," ☐ Previously Reported ☐ Not Previously Reported

City: Salt Lake City County: Salt Lake

State: Utah Province:

Country: USA Zip/Postal Code: 84112

Congressional Districts: UT 2nd

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Brent Brown, Director Office of Sponsored Projects

TEL: 801-581-3006 FAX: 801-581-3007 E-MAIL: ospawards@osp.utah.edu

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)*

DATE APR 06 2012

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 07/01/2012	THROUGH 06/30/2013	GRANT NUMBER 2U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Ross Whitaker	PD/PI	0.5			7,922	1,901	9,823
Jonathan Bronson	Grad Student		4.5	3.0	31,875	3,188	35,063
Manasi Datar	Grad Student		4.5	3.0	31,875	3,188	35,063
MiaoMiao Zhang	Grad Student		4.5		19,125	1,912	21,037
SUBTOTALS →					90,797	10,189	100,986

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	
TRAVEL Domestic Travel	7,308
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)* Computer Services	11,780
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 120,074
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 120,074

BUDGET JUSTIFICATION	GRANT NUMBER 2U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

See Attached

CURRENT BUDGET PERIOD	FROM 07/01/2011	THROUGH 06/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

No unobligated balance above 25%

Budget Justification for Ross Whitaker for Core 1

Senior Personnel:

Dr. Ross Whitaker: Ross Whitaker is a Professor of Computer Science and a member of the Scientific Computing and Imaging Institute. We request two weeks support for work on this part of Core 1. Whitaker is the PI of the Algorithms Core and he advises staff, students, and postdoctoral fellows associated with this project in the development of methods for geometric correspondence, segmentation, and statistical analysis.

Other Personnel:

Graduate Students: Support is requested for three graduate students. The graduate students will assist Dr. Whitaker and the Post Doctoral Associate to complete the aims. They will conduct basic research and develop software module. We request that two graduate students receive 12 months support and the third to receive 9 months support.

Other Expenses

Benefits:
The benefits rate is calculated based on an average of the amount charged to the position / person over a period of a few months. As such the rate will vary based upon the position / person. The percentage rates applied are below:

Dr. Whitaker: 24%
Graduate Students: 10%

Travel:
We are requesting travel funds $7,308, which will enable researchers from the University of Utah to attend the yearly workshops and collaborative meetings at Harvard University.

Other Direct Costs:
The Scientific Computing and Imaging Institute, which maintains the central computational systems, networks, and software, has mandatory computing facility costs that are assessed by FTE (a full time equivalence status). The Governmental Accounting Division of the University of Utah approved the computing facility model on October 21, 2002. This covers software and hardware maintenance, network connections, etc.

University of Utah, Indirect Costs: The University of Utah's indirect costs rate is calculated from the total direct costs less capital (<$5,000) equipment. The negotiated rate is 50.5%.

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 2U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Ross Whitaker	FROM 07/01/2011	THROUGH 06/30/2012

APPLICANT ORGANIZATION
University of Utah

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NAMIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?

NO

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?

NO

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

NO

GRANT NUMBER
2U54EB005149

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☒ DHHS Agreement dated: April 27, 2007 ☐ No Facilities and Administrative Costs Requested.

☐ No DHHS Agreement, but rate established with _____ Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 120,074 x Rate applied 50.50 % = F&A costs $ 60,638

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
2U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
rosswhitaker	Ross Whitaker	Ph.D.	9368	PI		0.5		
	Jonathan Bronson			Grad Student			4.5	3.0
	Manasi Datar			Grad Student			4.5	3.0
	MiaoMiao Zhang			Grad Student			4.5	

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			2U54EB005149

Total Project Period
From: 09/17/2004 Through: 06/30/2014

Requested Budget Period
From: 07/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NAMIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Guido Gerig
72 S Central Campus Dr., RM 3750
Salt Lake City, UT 84112

2b. E-MAIL ADDRESS
gerig@sci.utah.edu

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
SCI Institute

2d. MAJOR SUBDIVISION

2e. Tel: 801-585-0327 Fax: 801-585-6513

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
University of Utah
1471 East Federal Way
Salt Lake City, UT 84102

3b. Tel: 801-581-3006 Fax: 801-581-3007

3c. DUNS: 009095365

4. ENTITY IDENTIFICATION NUMBER
87-6000525

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☒ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Laurel Duncan
1471 East Federal Way
Salt Lake City, UT 84102

Tel: 801-581-3006 Fax: 801-581-3007

E-MAIL: ospawards@osp.utah.edu

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)
Organizational Name: University of Utah

DUNS: 009095365

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $115,092 8b. TOTAL $173,214

Street 1: 72 S Central Campus Dr., RM 3750

Street 2:

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes," ☐ Previously Reported ☐ Not Previously Reported

City: Salt Lake City County: Salt Lake

State: Utah Province:

Country: USA Zip/Postal Code: 84112

Congressional Districts: UT 2nd

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Brent Brown, Director Office of Sponsored Projects

TEL: 801-581-3006 FAX: 801-581-3007 E-MAIL: ospawards@osp.utah.edu

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)*

DATE APR 06 2012

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 07/01/2012	THROUGH 06/30/2013	GRANT NUMBER 2U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Guido Gerig	PD/PI	0.6			9,985	2,097	12,082
Marcel Prastawa	Senior Scientist	0.6			4,114	1,234	5,348
Post Doc (TBD)	Post Doc	6.0			29,744	6,544	36,288
James Fishbaugh	Grad Student		4.5	3.0	29,625	2,963	32,588
Emmanuel Bitaud	Undergrad Student	6.0			5,841	0	5,841
SUBTOTALS →					79,309	12,838	92,147

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)* Computer supplies (Software, licenses, etc) - $1,828	1,828
TRAVEL Domestic Travel	9,500
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)* Computer Services - $10,867 Publication / Documentation - $750	11,617
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 115,092
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 115,092

BUDGET JUSTIFICATION	GRANT NUMBER 2U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

See Attached

CURRENT BUDGET PERIOD	FROM 07/01/2011	THROUGH 06/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

No unobligated balance above 25%

Budget Justification for Guido Gerig for Core 1

Senior Personnel:

Dr. Guido Gerig: Guido Gerig is a Professor of Computer Science and a member of the Scientific Computing and Imaging Institute. We request 5% or 0.6 months support for work on this part of Core 1.

Dr. Marcel Prastawa: Marcel Prastawa is a Research Assistant Professor in the Scientific Computing and Imaging Institute. We request 5% or 0.6 months support for work on this part of Core 1.

Other Personnel:

Dr. Stanley Durrleman: Stanley Durrleman is a Post Doctoral Associate in the Scientific Computing and Imaging Institute. We request 50% or 6 months support for work on this part of Core 1.

James Fishbaugh: James Fishbaugh is a Graduate Student in the Scientific Computing and Imaging Institute. We request that James receive 12 months support.

Emmanuel Bitaud: Emmanuel Bitaud is an Undergraduate Student in the Scientific Computing and Imaging Institute. We request that Emmanuel receive 6 months support.

Other Expenses

Benefits:
The benefits rate is calculated based on an average of the amount charged to the position / person over a period of a few months. As such the rate will vary based upon the position / person. The percentage rates applied are below:

Dr. Gerig: 21%
Dr. Prastawa: 30%
Dr. Durrleman: 22%
James Fishbaugh: 10%
Emmanuel Bitaud: 0% (Undergraduate Students do not receive benefits)

Travel:
We are requesting travel funds $9,500, which will enable researchers from the University of Utah to attend the yearly workshops and collaborative meetings at Harvard University.

Materials and Supplies and Publication/Documentation:
We are requesting Materials and Supplies funds $1,829, to purchase appropriate software and licenses for research on this project. We also request $750 in Publication/Documentation costs for presentations and documentation of research.

Other Direct Costs:
The Scientific Computing and Imaging Institute, which maintains the central computational systems, networks, and software, has mandatory computing facility costs that are assessed by FTE (a full time equivalence status). The Governmental Accounting Division of the University of Utah approved the computing facility model on October 21, 2002. This covers software and hardware maintenance, network connections, etc.

University of Utah, Indirect Costs: The University of Utah's indirect costs rate is calculated from the total direct costs less capital (<$5,000) equipment. The negotiated rate is 50.5%.

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 2U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Guido Gerig	FROM 07/01/2011	THROUGH 06/30/2012

APPLICANT ORGANIZATION
University of Utah

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NAMIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?

NO

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?

NO

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

NO

GRANT NUMBER
2U54EB005149

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☒ DHHS Agreement dated: April 27, 2007 ☐ No Facilities and Administrative Costs Requested.

☐ No DHHS Agreement, but rate established with _____ Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 115,092 x Rate applied 50.50 % = F&A costs $ 58,122

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
2U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
GUIDO_GERIG	Guido Gerig	Ph.D.	9163	PI	09/54	0.6		
Prastawa	Marcel Prastawa	Ph.D.	3288	Senior Scientist	01/80	0.6		
sylvaingouttard	Sylvain Gouttard			Post Doc		6.0		
	James Fishbaugh			Grad Student			4.5	3.0
	Emmanuel Bitaud			Undergrad Student		6.0		

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			5U54EB005149

Total Project Period
From: 09/17/2004 Through: 06/30/2014

Requested Budget Period
From: 07/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing: Core 1 A

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Polina Golland
The Stata Center
32 Vassar St., 32-D470
Cambridge, MA 02139

2b. E-MAIL ADDRESS
polina@csail.mit.edu

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
Computer Science and Artificial Intelligence Agenc

2d. MAJOR SUBDIVISION
CSAIL

2e. Tel: 617-253-8005 Fax: 617-258-7840

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
Massachusetts Institute of Technology
77 Massachusetts Avenue
Cambridge, MA 02139

3b. Tel: 671-253-3992 Fax:

3c. DUNS: 00-142-5594

4. ENTITY IDENTIFICATION NUMBER
04-210-3594

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a):	If Not Exempt ("No" in 6a):
☐ No ☐ Yes	Exemption No.	IRB approval date

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☒ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Laureen Horton
Manager, Grants and Contracts
77 Massachusetts Avenue, E19-750
Cambridge, MA 02139
Tel: 617-253-3992 Fax: 617-253-4734
E-MAIL: laureena@mit.edu

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)
Organizational Name: Massachusetts Institute of Technology
DUNS: 00-142-5594
Street 1: 77 Massachusetts Ave
Street 2:
City: Cambridge County: Middlesex
State: MA Province:
Country: USA Zip/Postal Code: 02139
Congressional Districts: MA-008

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD
8a. DIRECT $115,278 8b. TOTAL $175,040

9. INVENTIONS AND PATENTS ☒ No ☐ Yes
If "Yes," ☐ Previously Reported ☐ Not Previously Reported

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Laureen Horton

TEL: 617-253-3992 FAX: 617-253-4734 E-MAIL: laureena@mit.edu

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. (In Ink) Laureen Horton DATE 4/3/13

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 07/01/2012	THROUGH 06/30/2013	GRANT NUMBER 5U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Golland	PD/PI			.75	10,322	2,890	13,212
Grimson	CO-I			.20	3,328	931	4,260
Postdoctoral Associate	PhD	4.13			16,522	6,113	22,635
DeOliveira	Project Support Staff	.66			2,568	950	3,519
Research Assistant	PhD	9.03			23,109	0	23,109
Lab Allocation		12			7,959	2,944	10,904
SUBTOTALS →					63,809	13,830	77,639

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	
TRAVEL Domestic	20,000
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)* Computer Services $1,800 & RA Tuition $15,837	17,637
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	$ 115,278
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	$ 115,278

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

No changes to report

CURRENT BUDGET PERIOD	FROM 7/1/2011	THROUGH 6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

None

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Polina Golland	FROM 7/1/2012	THROUGH 6/30/2013

APPLICANT ORGANIZATION
Massachusetts Institute of Technology

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing: Core 1 A

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?

No change since the previous submission.

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?

No significant change since previous submission.

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

No.

Program Director/Principal Investigator (Last, first, middle): Kikinis, Ron

GRANT NUMBER
5U54EB005149

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☐ DHHS Agreement dated: _____ ☐ No Facilities and Administrative Costs Requested.

☒ No DHHS Agreement, but rate established with ONR Date 7/1/2010

CALCULATION*

Entire proposed budget period: Amount of base $ 88,536 67.5 % = F&A costs $ 59,762

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
2U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- PD/PI
- Co-Investigator
- Faculty Collaborator
- Staff Scientist (doctoral level)
- Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)
- Grad Rsch Asst (Graduate Research Assistant)
- Undergrad Rsch Asst (Undergraduate Research Assistant)
- Rsch Asst (Research Assistant/Coordinator)
- Technician
- Consultant
- Biostatistician
- Other (Specify)

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
PGolland	Polina	PhD	4807	PI	12/71			.75*
EGrimson	W. Eric L. Grimson	PhD	1958	CO-I	04/53			.20*
	Fern DeOliveira	n/a		Project Support	10/76	.60		
	Adrian Dalca	Masters Track		Research Assistant	07/85	2.0		
	Amelia Arbisser	Masters Track		Research Assistant	5/89	4.5		
	Michal Depa	PhD Track		Research Assistant	4/85	2.0		
	Danial Lashkari	PhD		Research Assistant	5/83	2.0		
	Ramesh Sridharan	PhD Track		Research Assistant	4/87	4.25		
WACHINGER	Christian Wachinger	PhD		Postdoc	2/82	1.30		

Boston University Sponsored Programs

25 Buick Street
Boston, Massachusetts 02215
T 617-353-4365 F 617-353-6660

BOSTON UNIVERSITY

April 9, 2012

Ron Kikinis, M.D.
Department of Radiology
Brigham and Women's Hospital
75 Francis Street
Boston, MA 02215

Re: Boston University Letter of Intent to enter into a subcontract with Brigham and Women's Hospital
Proposal Title: "National Alliance for Medical Image Computing (NAMIC): Core 1A"
NIH Prime Award Number: 2U54EB005149
Boston University Principal Investigator: Professor Allen Tannenbaum

Dear Professor Kikinis:

This letter is to inform you that the Trustees of Boston University intend to enter into a subcontract with Brigham and Women's Hospital in support of Professor Tannenbaum's proposed research efforts. The proposed period of performance for this subcontract is 7/1/2012 through 6/30/2013, with an estimated total cost of $168,230. The scope of work is attached.

Boston University is familiar with NIH policy and is prepared to establish the necessary written interorganizational agreement with Brigham and Women's Hospital consistent with that policy and to ensure compliance with all pertinent Federal regulations and policies, including the Conflict of Interest policies.

However, the University reserves the right to negotiate the terms, conditions, and provisions included in any subcontract prior to its acceptance. Specifically, the University will not accept any publication restrictions or access restrictions on foreign nationals. Such restrictions are contradictory to the University's mission of educating students and openly publishing its research results.

If you need additional information, contact Timothy O'Brien at 617-353-4057 or, by email, at timob@bu.edu.

Sincerely,

Timothy O'Brien
Senior Research Administrator

Boston University Authorization: _____
Susan Mankiewicz
Director of Research Accounting

Enclosures

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			5U54EB005149

Total Project Period
From: 07/01/2012 Through: 06/30/2013

Requested Budget Period
From: 07/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NA-MIC Core 1a)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR
(Name and address, street, city, state, zip code)
Tannenbaum, Allen Robert
Department of ECE
8 St. Mary's Street (Photonics Building)
Boston University
Boston, MA 02115

2b. E-MAIL ADDRESS
tannenba@bu.edu

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
ECE/BME

2d. MAJOR SUBDIVISION
ECE

2e. Tel: 617-353-6521` Fax: 617-353-7337

3a. APPLICANT ORGANIZATION
(Name and address, street, city, state, zip code)
Trustees of Boston University
881 Commonwealth Avenue
Boston, MA 02115-1300

3b. Tel: 617-353-4365 Fax: 617-353-6660

3c. DUNS: 049435266

4. ENTITY IDENTIFICATION NUMBER
104210347A1

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☒ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☒ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Joan Kirkendall - Director
OSP - 25 Buick Street
Boston, MA 02215-1300

Tel: 617-353-4365 Fax: 617-353-6661

E-MAIL: joank@bu.edu

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)

Organizational Name: Trustees of Boston University

DUNS: 049435266

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $102,767 8b. TOTAL $168,230

Street 1: 881 Commonwealth Avenue

Street 2:

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes, ☐ Previously Reported
☐ Not Previously Reported

City: Boston	County: Suffolk
State: MA	Province:
Country: USA	Zip/Postal Code: 02215-1300

Congressional Districts: MA-008

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Susan Mankiewicz, Director of Research Accounting

TEL: 617-353-4365	FAX: 617-353-6660	E-MAIL: timob@bu.edu

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.	SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)* Susan	DATE 4-9-12

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 7/1/2012	THROUGH 6/30/2013	GRANT NUMBER 5U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Allen Tannenbaum	PD/PI			2	29,983	7,766	37,749
Arie Nakhmani	Postdoc	12			50,000	12,950	62,950
SUBTOTALS					79,983	20,716	100,699

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	
TRAVEL	2,068
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	$ 102,767
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	65,463
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	$ 102,767

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

There have been no significant changes.

CURRENT BUDGET PERIOD	FROM 7/1/2012	THROUGH 6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

None.

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Allen Tannenbaum	FROM 7/1/2011	THROUGH 6/30/2012

APPLICANT ORGANIZATION
Boston University

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NA-MIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?

No.

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?

No.

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

No.

Program Director/Principal Investigator (Last, first, middle): Kikinis, Ron

GRANT NUMBER
5U54EB005149

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☒ DHHS Agreement dated: 02/13/2012 ☐ No Facilities and Administrative Costs Requested.

☐ No DHHS Agreement, but rate established with _____ Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 102,767 x Rate applied 63.7 % = F&A costs $ 65,463

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
5U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- PD/PI
- Co-Investigator
- Faculty Collaborator
- Staff Scientist (doctoral level)
- Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)
- Grad Rsch Asst (Graduate Research Assistant)
- Undergrad Rsch Asst (Undergraduate Research Assistant)
- Rsch Asst (Research Assistant/Coordinator)
- Technician
- Consultant
- Biostatistician
- Other (Specify)

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
anry123	Arie Nakhmani	Ph.D.	5142	Postdoc	06/75	12		
TANNENBA123	Allen Tannenbaum	Ph.D.	5155	PD	01/53			2

Subcontract – The University of North Carolina at Chapel Hill
Core 1A

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			5 U54EB005149

Total Project Period
From: 09/17/2004 Through: 06/30/2014

Requested Budget Period
From: 07/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NAMIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Martin Styner
University of North Carolina at Chapel Hill
Department of Psychiatry
CB# 7160
Chapel Hill, NC 27599-7160

2b. E-MAIL ADDRESS
styner@cs.unc.edu

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
Psychiatry

2d. MAJOR SUBDIVISION
School of Medicine

2e. Tel: 919-966-1648 Fax: 919-843-7650

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
University of North Carolina at Chapel Hill
Office of Sponsored Research
104 Airport Drive, Suite 2200, CB# 1350
Chapel Hill, NC 27599-1350

3b. Tel: 919-966-3411 Fax: 919-962-3352

3c. DUNS: 608195277

4. ENTITY IDENTIFICATION NUMBER
1566001393A1

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☐ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Sherrie Settle, Director, Proposal Management
Office of Sponsored Research, Admin.Office Bldg
Suite 2200, 104 Airport Dr.,
Chapel Hill, NC 27599-1350
Tel: 919-966-3411 Fax: 919-962-3352
E-MAIL: ResAdminOSR@unc.edu

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)
Organizational Name: University of North Carolina at Chapel Hill
DUNS: 608195277
Street 1: 329 Medical School Wing C
Street 2: CB# 7160
City: Chapel Hill County: Orange
State: NC Province:
Country: USA Zip/Postal Code: 27599
Congressional Districts: NC-004

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD
8a. DIRECT $ 113,958 8b. TOTAL $ 165,274

9. INVENTIONS AND PATENTS ☒ No ☐ Yes
If "Yes," ☐ Previously Reported ☐ Not Previously Reported

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Barbara Entwisle, Vice Chancellor for Research

TEL: (919) 966-3411 FAX: (919) 962-3352 E-MAIL: resadminosr@unc.edu

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)* — DATE 4-2-12

Acting for
Barbara Entwisle, PhD

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 7/1/2012	THROUGH 6/30/2013	GRANT NUMBER 5U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Martin Styner	PD/PI	1.8			17,505	4,433	21,938
Beatriz Paniagua	Postdoctoral Research Associate	9.0			35,250	5,338	40,588
Ravikiran Janardhana	Graduate Research Assistant	12.0			28,050	2,590	30,640
SUBTOTALS →					80,805	12,361	93,166

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)* Project Related Supplies	631
TRAVEL Conference Travel	9,100
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)* Tuition $7,048 Computer Services $4,013	11,061
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 113,958
CONSORTIUM/CONTRACTUAL COSTS – DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS – FACILITIES AND ADMINISTRATIVE COSTS – 48%	51,316
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 165,274

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

None

CURRENT BUDGET PERIOD	FROM 07/01/2011	THROUGH 6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

None

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Martin Styner	FROM 7/1/2011	THROUGH 6/30/2012

APPLICANT ORGANIZATION
The University of North Carolina at Chapel Hill

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NA-MIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?
Yes. Please see attached other support document.

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?
No

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?
No

Program Director/Principal Investigator (Last, first, middle): Kikinis, Ron

GRANT NUMBER
5U54EB005149

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)
N/A		

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☒ DHHS Agreement dated: 11/06/2007 ☐ No Facilities and Administrative Costs Requested.

☐ No DHHS Agreement, but rate established with _____ Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 106,910 x Rate applied 48 % = F&A costs $ 51,316

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
5U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
MARTIN_STYNER	Martin Styner	PhD		Subcontract PI		2.1		
BPANIAGUA	Beatriz Paniagua	PhD		Postdoc		12.0		
	Ravikiran Janardhana	BS		Grad Rsch Asst		12.0		
XIUJUAN_GENG	Xiujuan Geng	PhD		Staff Scientist		2.58		

OTHER SUPPORT

STYNER, MARTIN

***denotes new funding since previous submission**

ACTIVE

R01 MH091645 (Styner, PI) 09/08/10-03/31/15 1.38 Cal Months
NIH/NIMH $344,047
Developmental Brain Atlas Tools and Data Applied to Humans and Macaques
This project generates a publicly available resource comprised of a developmental macaque brain MRI database with the corresponding computational toolbox for brain atlas building.
Role: Investigator

P30 HD03110 (Piven) 08/01/97-06/30/13 1.16 Cal Months
NIH/NICHD $2,038,727
UNC Developmental Disabilities Research Center $157,319 (Core)
The major goals of this Neurodevelopmental Disorders Research Center NDRC are to promote and support basic and applied research on the pathogenesis and treatment of mental retardation and developmental disabilities, and to coordinate educational and training efforts.
Role: Co-director Developmental Neuroimaging Core

P01 DA022446 (Johns, PI) 08/15/08-05/31/13 0.6 Cal Months
NIH/NIDA $1,504,090
Neurobiological and Behavioral Consequences of Cocaine Use in Mother/Infant Dyads
Neuroimaging Core $227,738
This program project is a multidisciplinary, translational research project employing animal and human projects to focus on the elucidation of neurobiological and behavioral characteristics and responses of mothers that have used primarily cocaine during pregnancy and of offspring prenatally exposed to cocaine that might impact negatively on normal mother infant interactions.
Role: Co-Investigator

R01 HD055741 (Piven) 07/01/07-06/30/13 0.90 Cal Months
NIH (NICHD) $2,866,557
A Longitudinal MRI Study of Infants at Risk for Autism: Autism Centers of Excellence (ACE) Network
Neuroimaging Core $ 495,782 (Core)
The center proposes a four-site collaborative network plus a data coordinating center to examine the brain structure and behavior of infants at high risk for autism (siblings of autistic individuals) using a longitudinal design from six to twenty-four months of age.
Neuroimaging Core: The neuroimaging core is responsible for development, validation and application of image segmentation and analysis to pediatric MRI/DTI of over 400 subjects acquired at 4 different imaging sites.
Role: Co-PI Imaging Core, UNC site PI

R01 MH086633 (Zhu, PI) 03/01/10-11/30/13 0.60 Cal Months
NIH/NIMH $222,750
Statistical Analysis of Biomedical Imaging Data in Curved Space
The project proposes to analyze imaging, behavioral, and clinical data from two large neuroimaging studies of schizophrenia and autism.
Role: Investigator

R01 HD059854 (Hazlett, PI) 09/30/09-08/31/12 0.45 Cal Months
NIH/NICHD $483,184
A Longitudinal MRI Study of Brain Development in Fragile X Syndrome
This study will examine how the trajectory and growth of brain development in infants with FXS compares to early brain development in infants (at high-risk for autism) who later develop an autism spectrum disorder and in infants with typical brain development.
Role: Investigator

R01 MH070890 (Gilmore, PI) 07/13/04-01/31/15 0.45 Cal Months
NIH/NIMH $471,221
Early Brain Development in Twins
This project will continue our study of early childhood brain development in twins, using structural MRI, diffusion tensor imaging, and cognitive
assessments.
Role: PI

U24 AA020024, AA020022 (Crews, PI) 09/01/10-08/31/15 1.2 Cal Months
NIH/NIAAA $301,480 Science core
UNC-CH NADIA $294,380 Admin Core
Scientific & Administrative Cores
The purpose of this application is to develop a Consortium for the initiative “Neurobiology of Adolescent Drinking in Adulthood” (NADIA). The NADIA will coordinate a diverse group of basic neuroscientists in a multidisciplinary research project to clearly define the persistent effects of adolescent alcohol exposure on adults, and to begin to explore the neurobiological mechanisms.
Role: Investigator

(Gilmore, PI) 12/01/10-11/30/15 0.60 Cal Months
NIH / UC Irvine $74,583
Fetal Programming of the Newborn and Infant Human Brain
The objective of this proposed study is to evaluate the impact of the intrauterine environment on intra-individual variation in brain structure and white matter integrity in the human newborn, and on developmental changes in these outcomes over the first year of postnatal life.
Role: Investigator

P50 MH064065 (Gilmore, PI) 07/01/01-07/31/12 0.48 Cal Months
NIH/NIMH $1,289,153
Silvio O. Conte Center: Prospective Studies of the Pathogenesis of Schizophrenia
This Center seeks to identify neurodevelopmental mechanisms in the pathogenesis of schizophrenia by characterizing the developmental trajectory of susceptibility and disease onset.
Role: PI

P50 MH078105-01A2S1 (Gunnar, PI) 07/01/09-06/30/12 0.48 Cal Months
NIH / University of Minnesota $74,441
Early Experience, Stress and Neurobehavioral Development Center, the neurobiology of adverse early care in rhesus infants.
This project aims to understand the neurodevelopmental alterations caused by infant maltreatment in rhesus monkeys via neuroimaging (sMRI, DTI). The purpose of this supplement is to build the structural, diffusion-weighted and connectivity rhesus brain atlases needed at the earliest ages (2 weeks, 3 months and 6 months), as well as the computational toolboxes for the longitudinal analysis of neurodevelopmental changes. The generation of these atlases and the novel macaque neonate tools will provide the Center with a wealth of brain measurements needed to quantify early neurodevelopment and the effect of stress related neuropathology in macaques.
Role: PI of Subcontract

R01 NS061965 (Escolar, PI) 04/01/08-03/31/13 1.2 Cal Months
NIH $11,531
DTI as a tool to identify infants with Krabbe Disease in need of urgent treatment
Krabbe disease (KD) an inherited fatal neurodegenerative disease can be treated by umbilical cord transplantation only at the presymptomatic phase. We plan to utilize diffusion tensor imaging (DTI) as an early diagnostic tool for evaluating the necessity of treatment.
Role: Investigator

*R01 MH092335 (Santelli, PI) 07/01/11-04/30/16 0.48 Cal Months
NIH $347,562
Genome-wide Identification of Variants Affecting Early Human Brain Development
The primary objective of the current application is to use cutting-edge techniques in genomics to identify common and rare genetic variants which impact brain development in the early postnatal period, an extremely dynamic time which may be critical in the etiology of psychiatric illnesses.
Role: Investigator

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			5U54EB005149

Total Project Period
From: 09/17/2004 Through: 06/30/2014

Requested Budget Period
From: 7/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NA-MIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Stephen R. Aylward
28 Corporate Drive
Clifton Park, NY 12065

2b. E-MAIL ADDRESS
stephen.aylward@kitware.com

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT

2d. MAJOR SUBDIVISION

2e. Tel: (518) 371-3971 Fax:

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
Kitware, Inc.
28 Corporate Drive
Clifton Park, NY 12065

3b. Tel: (518) 371-3971 Fax:

3c. DUNS: 10926207

4. ENTITY IDENTIFICATION NUMBER
14-1802694

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☒ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☐ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Vicki Rafferty
Contracts Administrator
28 Corporate Drive, Clifton Park, NY 12065

Tel: (518) 371-3971 Fax:

E-MAIL: contracts@kitware.com

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)

Organizational Name: Kitware, Inc.

DUNS: 10926207

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $151,236 8b. TOTAL $329,691

Street 1: 28 Corporate Drive

Street 2:

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes, ☐ Previously Reported ☐ Not Previously Reported

City: Clifton Park	County: Saratoga
State: NY	Province:
Country: USA	Zip/Postal Code: 12065

Congressional Districts: NY-20

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Stephen R. Aylward, Ph.D. / Director of Medical Imaging Research

TEL: (518) 371-3971	FAX:	E-MAIL: stephen.aylward@kitware.com

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)*

DATE 04/05/12

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 7/1/2012	THROUGH 6/30/2013	GRANT NUMBER 5U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Stephen Aylward	PD/PI	2.3			28,498		28,498
William Schroeder	Co-Investigator	.2			3,477		3,477
Luis Ibanez	Co-Investigator	2.3			21,638		21,638
Julien Finet	Co-Investigator	5.6			34,973		34,973
Casey Goodlet	Co-Investigator	5.2			39,600		39,600
SUBTOTALS →					128,168		128,168

CONSULTANT COSTS	0
EQUIPMENT *(Itemize)*	0
SUPPLIES *(Itemize by category)*	0
TRAVEL	23,068
INPATIENT CARE COSTS	0
OUTPATIENT CARE COSTS	0
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	0
OTHER EXPENSES *(Itemize by category)*	0
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 151,236
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	0
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	0
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 151,236

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

Stephen R. Aylward, Ph.D. (PI) is Director of Medical Imaging Research at Kitware as well as the founder and manager of Kitware's North Carolina office. Dr. Aylward is also an adjunct associate professor in the Department of Computer Science at UNC; treasurer (previously I was the president) for the Insight Software Consortium which helps to manage ITK, IGSTK, and other open-source packages; associate editor for IEEE Transactions on Medical Imaging; and a member of various conference program committees including SPIE Medical Imaging and MICCAI. Prior to joining Kitware, he was a tenured associate professor of Radiology, Computer Science, and Surgery at UNC.

Dr Aylward will serve as PI of Kitware's effort. He will provide considerable project management expertise and supervise the researchers and engineers assigned to the development of Slicer, the support of the TBI DBP, and the service core.

William J. Schroeder, Ph.D. (Co-Investigator) is the President and founder of Kitware. Dr. Schroeder is one of the lead developers of the Visualization Toolkit (VTK), a lead author of the VTK Users Guide, and a world-renowned leader in the field of open-source software.

Dr. Schroeder will serve as a co-investigator with Dr. Aylward. He will provide exceptional project management guidance to Dr. Aylward as well as guidance on the use of VTK and Kitware's other tools.

CURRENT BUDGET PERIOD	FROM 7/1/2012	THROUGH 6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Stephen Aylward	FROM 7/1/2011	THROUGH 6/30/2012

APPLICANT ORGANIZATION
Kitware Inc.

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NA-MIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?
No.

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?
Yes. Dr. Aylward is assuming the role of PI. Dr. Schroeder will continue to help guide this project, but at a significantly reduced effort. Dr. Aylward will now have effort allocated to all three Cores at Kitware.

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?
No.

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***

All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)
07/01/2012-06/30/2013	0	

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***

In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS

Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☐ DHHS Agreement dated: _____ ☐ No Facilities and Administrative Costs Requested.

☒ No DHHS Agreement, but rate established with DCAA / DCMA Date 01/11/2011

CALCULATION*

Entire proposed budget period: Amount of base $ 151,236 Rate applied 67/39.5 % = F&A costs $ 178,455

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

Labor Overhead = 67% *Direct Labor

G&A = 39.5% *(Direct Labor + Labor Overhead + Travel)

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
5U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
Aylward	Stephen Aylward	PhD		PI		.691		
	Jean-C. Filion-Robinet	MS		Co-Investigator		2.6		
julien.finet	Julien Finet	MS		Co-Investigator		3.33		
	Roland Kwitt			Co-Investigator		1.05		
Pace	Danielle Pace	MS		Co-Investigator		2.51		
Kitware	William Schroeder	PhD		Co-Investigator		.2		

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			5U54EB005149

Total Project Period
From: Through:

Requested Budget Period
From: 07/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NA-MIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Dr. James Miller, PhD
KW C223
1 Research Circle
GE Research
Niskayuna NY 12309

2b. E-MAIL ADDRESS
millerjv@ge.com

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
Interventional and Therapy

2d. MAJOR SUBDIVISION
Diagnostics and Biomedical Technologies

2e. Tel: 518-387-4005 Fax: 518-387-5589

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
GE Global Research
1 Research Circle
Niskayuna, NY 12309

3b. Tel: 518-387-5493 Fax:

3c. DUNS: 086188401

4. ENTITY IDENTIFICATION NUMBER
14-0689340

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No. FWA00005680

6c. NIH-Defined Phase III Clinical Trial ☒ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Thomas Cotrofeld
Contract Administrator
1 Research Circle, Niskayuna NY 12309

Tel: 518-387-5493 Fax:

E-MAIL: cotrofe@crd.ge.com

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)

Organizational Name: GE Global Research

DUNS: 08-618-8401

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $161,194 8b. TOTAL $310,341

Street 1: 1 Research Circle

Street 2:

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes," ☐ Previously Reported ☐ Not Previously Reported

City: Niskayuna County: Schenectady

State: NY Province:

Country: USA Zip/Postal Code: 12309

Congressional Districts: 21

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Peter Serpentino, Business Programs Manager

TEL: (518) 387-7196 FAX: E-MAIL: serpenti@ge.com

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)*

DATE 4-12-12

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 7/1/2012	THROUGH 6/30/2013	GRANT NUMBER 5U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Miller, James	PD/PI	1.79			17,815	6,948	24,763
Cao, Kunlin	Electrical Engineer	2.63			17,249	6,727	23,976
Li, Rui	Project Engineer	2.64			17,290	6,743	24,034
Veeraraghavan, Harini	Computer Scientist	2.61			17,115	6,674	23,789
Zhu, Yingxuzn	Electrical Engineer	2.61			17,115	6,674	23,789
SUBTOTALS →					86584	33,766	120,351

CONSULTANT COSTS none	
EQUIPMENT *(Itemize)* computer	3000
SUPPLIES *(Itemize by category)* none	
TRAVEL Domestic	28,179
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)* Audit costs Conference Fees	9,663
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 161,194
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	149,147
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 310341

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

See attached.

CURRENT BUDGET PERIOD	FROM 7/1/2012	THROUGH 6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

None.

BUDGET JUSTIFICATION

GE Global Research is part of the Engineering sub-core of NA-MIC. GE Global Research will focus on three of the aims of the Engineering sub-core: Architecture, End-user platform, and Computational platform. In this capacity, GE Global Research will provide architectures and tools for interactive exploratory and translational image analysis.

PERSONNEL ($120,351)

James V Miller, PhD (Site Principal Investigator, 1.79 calendar months)

Dr. Miller is a Senior Scientist in the Interventional and Therapy Lab at GE Global Research. Dr. Miller has developed many segmentation, detection, and registration methods for CT, MR, and PET imaging. Dr. Miller was the chief architect of the image-processing pipeline for the Insight Toolkit. For NA-MIC, Dr. Miller developed the 3D Slicer Execution Model, Lightbox and Compare View modes, as well as NA-MIC's first software dashboarding system. Dr. Miller will serve as the Site PI for the GE Global Research team. He will work on the NA-MIC Kit architecture and will provide architectures for interactive segmentation, exploratory image analysis, and translational image analysis.

Harini Veeraraghavan, PhD (Co-Investigator, 2.61 calendar months)

Dr. Veeraraghavan is a Scientist in the Biomedical Image Processing Lab at GE Global Research. Dr. Veeraraghavan has a machine learning background and has develop interactive segmentation tools that are integrated in the NA-MIC Kit. Dr. Veeraraghavan will continue to develop architectures and tools for interactive segmentation and exploratory image analysis.

Yingxuan Zhu, PhD (Co-Investigator, 2.61 calendar months%)

Dr. Zhu is a Scientist in the Image Analytics Lab at GE Global Research. Dr. Zhu has a background in hyper spectral and multi-parametric image analysis and interactive methods. Dr. Zhu will develop architectures and tools for multivariate and temporal image sequences.

Rui Li, PhD (Co-Investigator, 2.64 calendar months)

Dr. Li is a Scientist in the Image Analytics Lab at GE Global Research. Dr. Li has a background in tracking and radiation therapy. Dr. Li will develop components of the computing architecture.

Kunlin Cao, PhD (Co-Investigator, 2.63 calendar months)

Dr. Cao is a Scientist in the Biomedical Image Processing Lab at GE Global Research. Dr. Cao has an image registration background and has previously integrated registration algorithms with the NA-MIC Kit. Dr. Cao will develop architectures and tools for interactive registration.

SUPPLIES

[None requested]

EQUIPMENT ($3,000)

GE will purchase computers in years one and three of the grant to match the hardware capabilities needed for the Computational platform aim and interactive segmentation using GPGPU methods.

TRAVEL ($28,179)

Travel to NA-MIC events (All Hands Meetings, Summer Project Weeks) is included in the budget. These events are major working meetings for the NA-MIC community. Travel also includes collaboration meetings to other NA-MIC engineering and algorithm sites. Also, travel to major conferences in the field is included as they provide opportunities to disseminate NA-MIC. These meetings are well attended by the NA-MIC community and provide additional opportunities for collaboration within the grant.

1 trip – 1 person – 2 days to Atlanta, GA	$955
1 trip – 2 people – 3 days to Boston, MA	$1,604
1 trip – 2 people – 3 days to Boston, MA	$1,633
1 trip – 2 people – 3 days to Boston, MA	$1,633
1 trip – 2 people – 3 days to Boston, MA	$1,604
1 trip – 4 people – 5 days to Boston, MA	$5,386
1 trip – 2 people – 5 days to Nice, France	$7,705
1 trip – 2 people – 5 days to San Francisco, CA	$4,209
1 trip – 3 people – 6 days to Salt Lake City, UT	$5,054

OTHER EXPENSES ($9,663)

GE will use Amazon EC2 and S3 services for cloud computing and cloud storage development and evaluation.

Conference Fees ($4,036)

ISBI conference fees of $1000 per person

MICCAI Conference fees of $1000 per person

Audit Fees ($1,127)

2012 Audit ($598)

2013 Audit ($529)

INDIRECT COSTS ($149,147)

Cost Type	Cost Rate	Base Amount	Indirect Costs
Overhead	98.500%	$120,351	$118,546
EAC	5.700%	$279,739	$15,945
B&P	4.200%	$279,739	$11,749
Cost of Money- Direct Labor	2.404%	$120,351	$2,893
Cost of Money - Project Costs	0.005%	$279,739	$14
Total Indirect Costs			$149,147

The Defense Contracts Audit Agency responsible for reviewing and auditing GE Global Research is located in Schenectady, NY. GE Global Research indirect rates are negotiated and approved by the Defense Contract Management Area Operations in E. Hartford, CT. A copy of the latest approved cost agreement is attached.

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Miller. James	FROM 7/1/2011	THROUGH 6/30/2012

APPLICANT ORGANIZATION
GE Global Research

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NA-MIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period? Two other programs will be ended during this next reporting period.

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project? No

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget? No

GRANT NUMBER
5U54EB005149

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)
NONE		

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☐ DHHS Agreement dated: _____ ☐ No Facilities and Administrative Costs Requested.

☒ No DHHS Agreement, but rate established with DCMA, East Hartford, CT Date June, 23, 2011

CALCULATION*

Entire proposed budget period: Amount of base $ 161194 x Rate applied 93 % = F&A costs $ 149147

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
5U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
millerjv	Miller, James	PhD	8650	PD/PI	02/67	3		
	Veeraraghavan, Harini	PhD	3913	Staff Scientist	12/77	1		
	Zhu, Yingxuan	PhD	6534	Staff Scientist	11/77	3		
	Li, Rui	PhD	8596	Staff Scientist	6/73	1.5		
	Cao, Kunlin	PhD	9878	Staff Scientist	11/82	1.5		

OTHER SUPPORT

Miller, James V.

ACTIVE

1 U54 EB005149 (Kikinis) 8/1/2004 – 6/30/2014 1 calendar
NIH/NCBC $153,000
National Alliance for Medical Image Computing (NA-MIC)

The goal of this project is to provide computational tools and open systems technologies to form a national infrastructure for image analysis. This infrastructure is being driven and demonstrated through a variety of clinical research projects, namely Huntington's Disease, Radiation Therapy, Traumatic Brain Injury, and Atrial Fibrillation.

5 P41 RR013218-10 (Kikinis) 8/1/2008 – 5/31/2013 1.1 calendar
NIH/NCRR $71,000
Neuroimaging Analysis Center (NAC)

The goal of this project is to develop pioneering solutions in neuroimage analysis, leveraging the local scientific resources in the BWH environment. These technologies are being applied in the study of schizophrenia, in the study of multiple sclerosis, and in developing image guided neurosurgery techniques.

1 R01 EB006733-01A2 (Shen) 9/17/2008 – 8/31/2012 1 calendar
NIH/NIBIB $65,000
Development and Dissemination of Robust Brain MRI Measurement Tools

This project aims at developing and widely distributing a software package for robust measurement of brain structure in MR images, via collaboration with the National Alliance for Medical Image Computing (NA-MIC) that will integrate this software into the 3D Slicer (currently being developing in NA-MIC). This particular software package will include a brain image registration and warping algorithm, called HAMMER, and an algorithm for computer-based segmentation of white matter lesions (WMLs), which can arise from a variety of pathologies including vascular pathology and multiple sclerosis.

HHSN276201000488P (Miller) 6/1/2010 – 6/30/2012 0 calendar
NIH/NLM $82,000
Enhancing the Insight Toolkit for research, education, and clinical interoperability

The goal of this project is to enhance the Insight Toolkit's use and utility in algorithm research, clinical research, education, and in the development of commercial clinical applications. This program focuses on low-level ITK architectures that will broaden the use of the Insight Toolkit by simplifying APIs, redesigning the filter architecture to run without a pipeline, providing ITK architectures for GPUs, and improving ITK's connectivity to the clinic through DICOM services.

OVERLAP

Under the National Alliance of Medical Image Computing (NA-MIC), the goal is to establish a national infrastructure of computational tools across of a variety of imaging applications. Under NA-MIC funding, we are developing a plugin architecture for Slicer 3, interactive segmentation methods, and exploratory image analysis methods. Under the Neuroimaging Analysis Center (NAC), the goal is to develop pioneering solutions in neuroimage analysis, leveraging the local scientific resources in the BWH environment. Under the NAC, we are developing an architecture for comparing image sets, advanced methods for processing diffusion imagery, and technology that integrates structural atlases with functional ontologies. Under the R01, we are integrating two specific algorithms with the NAMIC Kit. One is a spatial normalization approach; the other is a lesion detection and segmentation approach. The Insight Toolkit project focuses on general low level image analysis, computing, and connectivity architectures that will benefit projects such as NAC, NAMIC, and the R01 but are not the focus of those other efforts.

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			5U54EB005149

Total Project Period
From: 9/17/2004 Through: 6/30/2014

Requested Budget Period
From: 7/1/2012 Through: 6/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NA-MIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Steve Pieper
55 Kirkland Street
Cambridge MA, 02138

2b. E-MAIL ADDRESS
pieper@isomics.com

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
Isomics, Inc.

2d. MAJOR SUBDIVISION
Isomics, Inc.

2e. Tel: 617 596 2719 Fax: 617 945 1304

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
Steve Pieper
55 Kirkland Street
Cambridge MA, 02138

3b. Tel: 617 596 2719 Fax: 617 945 1304

3c. DUNS: 11-862-8226

4. ENTITY IDENTIFICATION NUMBER
04-3577579

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☐ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Steve Pieper, CEO
55 Kirkland Street
Cambridge, MA 02138

Tel: 617 596 2719 Fax: 617 945 1304
E-MAIL: pieper@isomics.com

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)
Organizational Name: Isomics, Inc.
DUNS: 11-862-8226

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD
8a. DIRECT $149,493 8b. TOTAL $183,877

Street 1: 55 Kirkland Street
Street 2:

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes, ☐ Previously Reported ☐ Not Previously Reported

City: Cambridge	County: Middlesex
State: MA	Province:
Country: USA	Zip/Postal Code: 02138

Congressional Districts: Massachusetts 8th

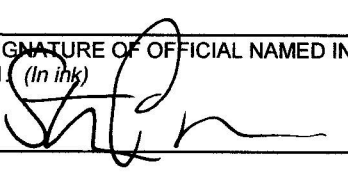
11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Steve Pieper, CEO

TEL: 617 596 2719	FAX: 617 945 1304	E-MAIL: pieper@isomics.com

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11 *(In ink)*



DATE
April 5, 2012

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 7/1/2012	THROUGH 6/30/2013	GRANT NUMBER 5U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Steve Pieper, PhD	PD/PI	2.06			30,677	9,816	40,493
SUBTOTALS →					30,677	9,816	40,493

CONSULTANT COSTS Alexander Yarmarkovich, Senior Engineer	100,000
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)* Miscellaneous computer supplies and software	4,500
TRAVEL Travel to NA-MIC events and collaborator sites	4,500
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 149,493
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	34,384
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 183,877

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

No budget items have changed significantly.

CURRENT BUDGET PERIOD	FROM 7/1/2012	THROUGH 6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

None.

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Pieper, Steve	FROM 7/1/2011	THROUGH 6/30/2012

APPLICANT ORGANIZATION
Isomics, Inc.

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NA-MIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?

Only small changes in other support for the PI - see Other Support page for details.

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?

No

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

No

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***

All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***

In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS

Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☐ DHHS Agreement dated: _____ ☐ No Facilities and Administrative Costs Requested.

☒ No DHHS Agreement, but rate established with Prime Contractor Per NIH Regulations Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 149,493 x Rate applied 23 % = F&A costs $ 34,384

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
5U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
STEVE.PIEPER	Steve Pieper	PhD	2482	PI	05/63	2.06		

For New and Renewal Applications (PHS 398) – DO NOT SUBMIT UNLESS REQUESTED
For Non-competing Progress Reports (PHS 2590) – Submit only Active Support for Key Personnel

PHS 398/2590 OTHER SUPPORT

Pieper, S.D.

ACTIVE

P41 RR13218 (Kikinis) 08/1/98-07/31/08, renewed 8/1/08-7/31/13 5.12 calendar
NIH/NCRR $1,716,603
Neuroimaging Analysis Center (NAC): Develop and apply image analysis technology for MR brain scans and related fields.

U54 GM072977 (Kikinis) 9/1/2010 - 8/30/2014 2.08 calendar
NIH/NIBIB (Roadmap) $3,965,176
National Alliance for Medical Image Computing: Develop national infrastructure for image algorithms and software methodology

P41 RR13218 (Kikinis) 9/17/2011 - 9/16/2012 1.65 calendar
NIH/NCRR $35,447 (subcontract only)
Supplement to Neuroimaging Analysis Center (NAC): Refine manual editing and DICOM transfer capabilities of 3D Slicer.

P41 RR13218 (Kikinis) 9/13/2011 – 5/31/2012 2.0 calendar
NIH/NCRR $73,800
Supplement to Neuroimaging Analysis Center (NAC): Improve python programming interface to 3D Slicer and provide training materials.

367012 (Fichtinger) 6/1/2011 – 6/30/2016 0.67 calendar
Cancer Care Ontario $CAN 10,000 (subcontract only)
Improving 3D Slicer for Adaptive Radiotherapy

OVERLAP: Remaining time is allocated to administrative tasks and not covered by direct personnel costs. In the event that other projects are funded, time will be re-allocated to compensate.

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

Form Approved Through 06/30/2012 2012-3901 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
	5	U54	EB005149-08

Total Project Period
From: 09/17/2004 Through: 06/30/2014

Requested Budget Period
From: 07/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NAMIC CORE 1B)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Grethe, Jeffrey S.
9500 Gilman Drive, MC0446
La Jolla, CA 92093-0446

2b. E-MAIL ADDRESS
jgrethe@ncmir.ucsd.edu

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
Center for Research in Biological Systems

2d. MAJOR SUBDIVISION
School of Medicine

2e. Tel: 858-822-0703 Fax: 858-246-0644

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
The Regents of the Univ of Calif.
University of California San Diego
9500 Gilman Drive, MC0934
La Jolla, California 92093-0934

3b. Tel: 858-534-8832 Fax: 858-534-0280

3c. DUNS: 80-435-5790

4. ENTITY IDENTIFICATION NUMBER
1956006144A1

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☒ No ☐ Yes		

6b. Federal Wide Assurance No. FWA00004495

6c. NIH-Defined Phase III Clinical Trial ☒ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Judith Wheaton, Contract/Grant Officer
9500 Gilman Drive, MC0934
La Jolla, California 92093-0934

Tel: 858-534-8832 Fax: 858-534-0280

E-MAIL: jwheaton@ucsd.edu

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No. A3033-01

10. PROJECT/PERFORMANCE SITE(S)

Organizational Name: University of California San Diego

DUNS: 80-435-5790

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $50,578 8b. TOTAL $78,144

Street 1: 9500 Gilman Drive

Street 2: MC0934

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes, ☐ Previously Reported ☐ Not Previously Reported

City: La Jolla	County:
State: CA	Province:
Country: USA	Zip/Postal Code: 92093-0934

Congressional Districts: 53

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Rachel Cook, Grant Analyst

TEL: 858-822-4109 FAX: 858-822-0834 E-MAIL: vchsgrants@ucsd.edu

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)*

DATE 4/10/12

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 07/01/2012	THROUGH 06/30/2013	GRANT NUMBER 5U54EB005149-08

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Grethe, Jeffrey	PD/PI	0.12			1,387	546	1,933
Little, David	Programmer	4.0			26,449	10,421	36,870
SUBTOTALS					27,836	10,967	38,803

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)* Computer media/software/licenses, optical media, office/printing/photographic supplies, professional textbooks	5,031
TRAVEL Domestic	6,000
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)* UCSD Network Communication, project-specific costs	760
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 50,578
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	27,566
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 78,144

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149-08

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

None

CURRENT BUDGET PERIOD	FROM 07/01/11	THROUGH 06/30/12

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

None

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149-08	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Jeffrey S. Grethe	FROM 07/01/11	THROUGH 06/30/12

APPLICANT ORGANIZATION
The Regents of the Univ. of Calif., U.C. San Diego

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NAMIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?
Yes, please see attached updated support page.

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project? No

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget? No

OTHER SUPPORT - GRETHE, JEFFREY S.

Active

NIH Neuroscience Blueprint HHSN271200800035C $1,354,509 09/01/08-08/31/13 1.2 cal
via NIDA (UCSD PI: Martone / Role: UCSD Co-PI)
Operation, Support and Enhancement of the Neuroscience Information Framework
Provide access to and annotate web-based resources for neuroscience, including a registry of databases, data and literature through single-query interface.

NIH/NIMH 1R01 MH084819-03 (multiple PIs: Makeig and Grethe) $253,241 04/17/09 - 02/28/12 .6 cal
A Human Electrophysiology, Associated Anatomic Data and Integrated Tool Resource
Current technology allows recording of brain electrical and/or magnetic activity from 256 or more scalp sites with high temporal resolution, plus concurrent behavioral and other psychophysiological time series, while dense human intracranial data are routinely acquired during some brain surgery and surgery planning procedures. Subject anatomic magnetic resonance (MR), computerized tomography (CT), and/or diffusion tensor (DT) head images may also be available. Standard analysis approaches extract only a small part of the rich information about human brain dynamics contained in these data. We propose a collaboration between the UCSD Swartz Center for Computational Neuroscience (home to the EEGLAB software environment development project), the UCSD Center for Research in Biological Systems (home to the Biomedical Informatics Research Network (BIRN) coordinating center), and leaders in six other human electrophysiological research communities to develop a public 'Human Electrophysiology, Associated Anatomic Data and Integrated Tool Sharing (HeadIT) Resource.' This framework will be built on the BIRN Data Repository framework (http://www.nbirn.net/bdr), thereby expanding its scope and capabilities. The HeadIT resource will share existing, high-quality, well-documented data sets, allowing their archival preservation and continued public availability for re-analysis and meta-analysis with increasingly powerful analysis tools.

NIH 5U54 EB0051489-07 (Role: UCSD PI) $59,344 09/30/10-09/29/14 .84 cal
National Alliance for Medical Image Computing
(subcontract from BWH PI:Kikins)
The National Alliance for Medical Imaging Computing (NAMIC) is a multi-institutional, interdisciplinary team of computer scientists, software engineers, and medical investigators who develop computational tools for the analysis and visualization of medical image data. The purpose of the center is to provide the infrastructure and environment for the development of computational algorithms and open source technologies, and then oversee the dissemination of these tools to the medical research community. As a part of Core Project 2 (Grid Computation and Data Integration Environment), we are investigating ways to improve quality and turnaround time of neuroscience experimental research by combining interactive assistance to improve/accelerate workflow creation and autonomous capabilities for workflow refinement and execution on grids.

DE-SC0004949 (UCSD PI: Ellisman / Role: CoI) $178,007 07/15/10-07/14/13 .48 cal
DOE (subcontract through CalTech / Dr.Victoria Orphan)
Syntrophic Interactions and Mechanisms Underpinning Anaerobic Methane Oxidation
Combining advanced imaging techniques to study syntrophic methane-oxidizing microbial consortia maintained in sediment microcosms.

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***

All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)
None		

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***

In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS

Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☒ DHHS Agreement dated: 05/12/2010 ☐ No Facilities and Administrative Costs Requested.

☐ No DHHS Agreement, but rate established with _____ Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 50,578 x Rate applied 54.5 % = F&A costs $ 27,566

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
5U54EB005149-08

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
jgrethe	Grethe, Jeffrey	Ph.D.		PI	09/66	0.12		
	Ruiz, Marco	B.S.		Program Analyst	07/72	4.2		

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			EB005149

Total Project Period
From: 11/01/2007 Through: 06/30/2013

Requested Budget Period
From: 07/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Imaging Computing (NAMIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Marcus, Daniel S.
Washington University School of Medicine
Department of Radiology
510 South Kingshighway, Campus Box 8225
St. Louis, MO 63110

2b. E-MAIL ADDRESS
dmarcus@wustl.edu

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
Radiology

2d. MAJOR SUBDIVISION
School of Medicine

2e. Tel: 314-362-9988 Fax: 314-362-3882

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
Washington University
660 South Euclid, Campus Box 8018
St. Louis, MO 63110

3b. Tel: 314.747.4134 Fax: 314.362.0315

3c. DUNS: 06-855-2207

4. ENTITY IDENTIFICATION NUMBER
1430653611A1

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☐ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Connie Motoki, Senior Contracts Mgr., OSRS
One Brookings Drive, Campus Box 1054
St. Louis, MO 63130

Tel: 314.935.9443 Fax: 314.935.5862

E-MAIL: wucontracts@msnotes.wustl.edu

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)

Organizational Name: Washington University

DUNS: 06-855-2207

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $76,491 8b. TOTAL $116,266

Street 1: 660 South Euclid

Street 2: Campus Box 8018

City: St. Louis County: St. Louis City

State: MO Province:

Country: U.S.A. Zip/Postal Code: 63110

Congressional Districts: MO-01

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes, ☐ Previously Reported ☐ Not Previously Reported

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Teri Medley, Interim Director, Office of Sponsored Research Services

TEL: 314.747.4134 FAX: 314.362.0315 E-MAIL: msosrs@wustl.edu

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)*

Acting for Teri Medley

DATE 4/4/12

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 07/01/2012	THROUGH 06/30/2013	GRANT NUMBER EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Marcus, Daniel S.	PD/PI	0.60			6,846	1,378	8,224
Kuman, Sunil	Programmer Analyst	11.16			52,173	12,439	64,612
SUBTOTALS					59,019	13,817	72,836

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	
TRAVEL PI travel to semi-annual all-hands meetings, programmer events, and ad hoc meetings.	3,655
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 76,491
CONSORTIUM/CONTRACTUAL COSTS – DIRECT COSTS	76,491
CONSORTIUM/CONTRACTUAL COSTS – FACILITIES AND ADMINISTRATIVE COSTS	39,775
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 116,266

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

BUDGET JUSTIFICATION	GRANT NUMBER
	EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

No change.

CURRENT BUDGET PERIOD	FROM	THROUGH
	07/01/2011	06/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

N/A

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Marcus, Daniel S.	FROM 07/01/2011	THROUGH 06/30/2012

APPLICANT ORGANIZATION
Washington University

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
NATIONAL ALLIANCE FOR MEDICAL IMAGING COMPUTING (NAMIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?
No

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?
No.

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?
No.

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

GRANT NUMBER
EB005149

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☒ DHHS Agreement dated: 02/24/2010, provisional 07/01/2013 ☐ No Facilities and Administrative Costs Requested.

☐ No DHHS Agreement, but rate established with _____ Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 76,491 x Rate applied 52.0 % = F&A costs $ 39,775

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
dmarcus	Marcus, Daniel S.	Ph.D.	4950	PI	08/72	0.60		
	Milchenko, Mikhail V.	Ph.D.	2577	staff scientist	10/77	6.00		
	Kumar, Sunil		4234	Programmer / Analyst	02/81	5.00		
	Siram, Aditya	BS	4062	Programmer / Analyst	05/78	3.50		

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM	THROUGH	GRANT NUMBER
	7/1/2012	6/30/2013	U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Ron Kikinis	PD/PI	0.22			3,289	1,184	4,472
SUBTOTALS →					3,289	1,184	4,472

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	
TRAVEL	
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 4,472
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	575,638
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	346,470
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 926,580

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			2U54EB005149

Total Project Period
From: 09/17/2004 Through: 06/30/2014

Requested Budget Period
From: 07/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NAMIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Rob MacLeod
72 S Central Campus Dr., RM 3750
Salt Lake City, UT 84112

2b. E-MAIL ADDRESS
macleod@cvrti.utah.edu

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
SCI Institute

2d. MAJOR SUBDIVISION

2e. Tel: 801-585-7596 Fax: 801-585-6513

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
University of Utah
1471 East Federal Way
Salt Lake City, UT 84102

3b. Tel: 801-581-3006 Fax: 801-581-3007

3c. DUNS: 009095365

4. ENTITY IDENTIFICATION NUMBER
87-6000525

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☒ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Laurel Duncan
1471 East Federal Way
Salt Lake City, UT 84102

Tel: 801-581-3006 Fax: 801-581-3007

E-MAIL: ospawards@osp.utah.edu

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)
Organizational Name: University of Utah

DUNS: 009095365

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $109,629 8b. TOTAL $164,991

Street 1: 72 S Central Campus Dr., RM 3750

Street 2:

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes," ☐ Previously Reported ☐ Not Previously Reported

City: Salt Lake City County: Salt Lake

State: Utah Province:

Country: USA Zip/Postal Code: 84112

Congressional Districts: UT 2nd

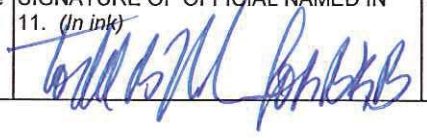
11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Brent Brown, Director Office of Sponsored Projects

TEL: 801-581-3006 FAX: 801-581-3007 E-MAIL: ospawards@osp.utah.edu

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)*



DATE APR 06 2012

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 07/01/2012	THROUGH 06/30/2013	GRANT NUMBER 2U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Rob MacLeod	PD/PI	0.5			6,749	1,620	8,369
Josh Cates	Post Doc	7.68			38,072	12,564	50,636
Grad Student (TBD)	Grad Student		4.5	3.0	31,875	3,188	35,063
SUBTOTALS →					76,696	17,372	94,068

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)* Computer supplies (Software, licenses, etc)	2,325
TRAVEL Domestic Travel	4,000
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)* Computer Services	9,236
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 109,629
CONSORTIUM/CONTRACTUAL COSTS – DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS – FACILITIES AND ADMINISTRATIVE COSTS	
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 109,629

BUDGET JUSTIFICATION	GRANT NUMBER 2U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

See Attached

CURRENT BUDGET PERIOD	FROM 07/01/2011	THROUGH 06/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

No unobligated balance above 25%

Budget Justification for Rob MacLeod

Senior Personnel:

Dr. Rob MacLeod: Rob MacLeod is an Associate Professor of Bioengineering and a member of the Scientific Computing and Imaging Institute. We are requesting two weeks support for work on this project.

Other Personnel:

Dr. Josh Cates: Josh Cates is a Post Doctoral Associate in the Scientific Computing and Imaging Institute. We request 64% or 7.68 months support for work on this project.

Graduate Student (TBD): Graduate Student (TBD) will work in the Scientific Computing and Imaging Institute. We request that the Graduate Student receive 12 months support.

Other Expenses

Benefits:
The benefits rate is calculated based on an average of the amount charged to the position / person over a period of a few months. As such the rate will vary based upon the position / person. The percentage rates applied are below:

Dr. MacLeod: 24%
Dr. Cates: 33%
Graduate Student (TBD): 10%

Travel:
We are requesting travel funds $4,000, which will enable staff to attend the yearly workshops and collaborative meetings at Harvard University.

Materials and Supplies:
We are requesting Materials and Supplies funds $2,326, to purchase appropriate software and licenses for research on this project.

Other Direct Costs:
The Scientific Computing and Imaging Institute, which maintains the central computational systems, networks, and software, has mandatory computing facility costs that are assessed by FTE (a full time equivalence status). The Governmental Accounting Division of the University of Utah approved the computing facility model on October 21, 2002. This covers software and hardware maintenance, network connections, etc.

University of Utah, Indirect Costs: The University of Utah's indirect costs rate is calculated from the total direct costs less capital (<$5,000) equipment. The negotiated rate is 50.5%.

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 2U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Rob MacLeod	FROM 07/01/2011	THROUGH 06/30/2012

APPLICANT ORGANIZATION
University of Utah

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NAMIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?

NO

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?

NO

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

NO

GRANT NUMBER
2U54EB005149

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☒ DHHS Agreement dated: April 27, 2007 ☐ No Facilities and Administrative Costs Requested.

☐ No DHHS Agreement, but rate established with _____ Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 109,629 x Rate applied 50.50 % = F&A costs $ 55,362

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
2U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
rsmacleod	Rob MacLeod	Ph.D.	4911	PI	08/55	0.5		
joshuacates	Josh Cates	Ph.D.	1228	Post Doc	05/72	7.68		
	Josh Blauer			Grad Student			4.5	3.0

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			5U54EB005149

Total Project Period
From: 09/17/2004 Through: 06/30/2014

Requested Budget Period
From: 07/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NA-MIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
HANS JOHNSON
UNIVERSITY OF IOWA
DEPARTMENT OF PSYCHIARTY
W278 GH
IOWA CITY, IA 52242

2b. E-MAIL ADDRESS
HANS-JOHNSON@UIOWA.EDU

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
PSYCHIATRY

2d. MAJOR SUBDIVISION
COLLEGE OF MEDICINE

2e. Tel: 319-353-8587 Fax: 319-353-3003

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
THE UNIVERSITY OF IOWA
2 GILMORE HALL
IOWA CITY, IA

3b. Tel: 319-335-2123 Fax: 319-3352130

3c. DUNS: 0627616710000

4. ENTITY IDENTIFICATION NUMBER
1426004813A1

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No. FWA00003007

6c. NIH-Defined Phase III Clinical Trial ☒ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Jennifer Lassner, Executive Director
2 Gilmore Hall, Div of Sponsored Programs
Iowa City, IA 52242-1320

Tel: 319-335-2123 Fax: 319-335-2130

E-MAIL: NIH@UIOWA.EDU

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)
Organizational Name: THE UNIVERSITY OF IOWA

DUNS: 0627616710000

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $108,903 8b. TOTAL $164,443

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes," ☐ Previously Reported ☐ Not Previously Reported

Street 1:

Street 2:

City: IOWA CITY County: JOHNSON

State: IA Province:

Country: UNITED STATES Zip/Postal Code: 52242

Congressional Districts: IA-002

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Jordan Cohen, Vice President for Research

TEL: 319-335-2123 FAX: 319-335-2130 E-MAIL: NIH@UIOWA.EDU

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 13: Paul Below Acting for Jordan Cohen

DATE: 03/30/2012

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 7/1/2012	THROUGH 6/30/2013	GRANT NUMBER 5U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Johnson, Hans J	PD/PI	2.4			22,236	5,025	27,262
Welch, David	Programmer	9.4			50,438	19,166	69,604
SUBTOTALS →					72,674	24,192	96,866

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)* Storage Expenses	1,155
TRAVEL 4 Trips at $2,720.50	10,882
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 108,903
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 108,903

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

No significant changes from previously recommended

CURRENT BUDGET PERIOD	FROM 7/1/2012	THROUGH 6/30/2013

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

Carryover will not be greater than 25%

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Johnson, Hans J.	FROM 7/1/2011	THROUGH 6/30/2012

APPLICANT ORGANIZATION
University of Iowa

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NA-MIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period? No

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project? No

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget? No

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***

All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***

In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS

Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☒ DHHS Agreement dated: 04/21/2010 ☐ No Facilities and Administrative Costs Requested.

☐ No DHHS Agreement, but rate established with _____ Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 108,903 x Rate applied 51 % = F&A costs $ 55,540

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
5U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
JOHNSON HANS	Johnson, Hans	PhD	7978	PI	04/73	2.4		
	Welch, David			Programmer		9.36		

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
	5	U54	EB005149

Total Project Period
From: 09/30/10 Through: 06/30/2014

Requested Budget Period
From: 07/01/2012 Through: 6/30/13

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NA-MIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR
(Name and address, street, city, state, zip code)
Gregory Sharp
100 Blossom st. Cox 3
Boston, MA 02114-2696

2b. E-MAIL ADDRESS
GCSHARP@PARTNERS.ORG

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
Radiation Oncology

2d. MAJOR SUBDIVISION

2e. Tel: 617-724-3866 Fax:

3a. APPLICANT ORGANIZATION
(Name and address, street, city, state, zip code)
The General Hospital Corporation
55 Fruit St
Boston, MA 02114-2696

3b. Tel: 617-954-9309 Fax: 617-954-9850

3c. DUNS: 073130411

4. ENTITY IDENTIFICATION NUMBER
1042697983A1

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☒ No ☐ Yes		

6b. Federal Wide Assurance No. 00003136

6c. NIH-Defined Phase III Clinical Trial ☒ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Harry W. Orf, Ph.D, Senior Vice President for Research
101 Huntington Avenue Suite 300
Boston, Ma. 02199-7063

Tel: (617) 954-9660 Fax: (617) 954-9850

E-MAIL: MGH-G&C@partners.org

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)
Organizational Name: Massachusetts General Hospital

DUNS: 07-313-0411

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $109,628 8b. TOTAL $$194,043

Street 1: 100 Blossom St. Cox 3

Street 2:

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes, ☐ Previously Reported
☐ Not Previously Reported

City: Boston	County:
State: MA	Province:
Country: USA	Zip/Postal Code: 02114-296

Congressional Districts: MA-009

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Christopher Deceilles, Grant Administrator II

TEL: 617-954-9551	FAX: 617-954-9850	E-MAIL: cdecelles@partners.org

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.	SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)*	DATE

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 7/1/2012	THROUGH 6/30/2013	GRANT NUMBER 5U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Gregory Sharp	PD/PI	0.6			8,004	2,881	10,885
Nadezhda Shusharina	Software Engin	12.0			53,040	19,094	72,134
James Shackleford	Software Eng	2.4			10,600	3,816	14,416
SUBTOTALS →					71,644	25,791	97,435

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	
TRAVEL 4 trips----	12,193
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 109,628
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 109,628

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.
No significant changes.

CURRENT BUDGET PERIOD	FROM 7/1/2011	THROUGH 6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

Unobligated balance is expected due to a delay in the start of first year of project, and a delay in the start date of our second full-time project engineer (James Shackleford) until Jan 2012.

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Gregory C Sharp	FROM 7/1/2011	THROUGH 6/30/2012

APPLICANT ORGANIZATION
Massachusetts General Hospital

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NA-MIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?
NO

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?

NO

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

YES

GRANT NUMBER
5U54EB005149

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☒ DHHS Agreement dated: 12/14/2007 ☐ No Facilities and Administrative Costs Requested.

☐ No DHHS Agreement, but rate established with _____ Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 109,629 x Rate applied 77 % = F&A costs $ 84,414

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
5U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
GCSharp	Greg Sharp	Ph.D		PI		0.6		
	Nadezhda Shusharina			Software Engineer		12.0		
	James Shackleford			Software Engineer		2.4		

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
	5	U54	EB005149-08

Total Project Period
From: 09/17/2004 Through: 06/30/2014

Requested Budget Period
From: 07/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NAMIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Van Horn, John D.
David Geffen School of Medicine at UCLA
Department of Neurology
635 Charles Young Drive South, Suite 225
Los Angeles, CA 90095-7334

2b. E-MAIL ADDRESS
jvanhorn@loni.ucla.edu

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
Neurology

2d. MAJOR SUBDIVISION
David Geffen School of Medicine

2e. Tel: (310)206-2101 Fax: (310)206-5518

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
The Regents of the University of California
UCLA Office of Contract & Grant Admin.
11000 Kinross Avenue, Ste 211
Los Angeles, CA 90095

3b. Tel: (310) 794-0393 Fax: (310) 943-3823

3c. DUNS: 09-253-0369

4. ENTITY IDENTIFICATION NUMBER
1956006143A1

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☐ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Susan Waelder, Senior Grant Analyst
11000 Kinross Avenue, Ste 211
Los Angeles, CA 90095

Tel: (310) 794-0393 Fax: (310) 943-3823

E-MAIL: OCGA7@research.ucla.edu

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)
Organizational Name: David Geffen School of Med. at UCLA
DUNS: 09-253-0369
Street 1: 635 Charles Young Drive South, Suite 225
Street 2:

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD
8a. DIRECT $109,629 8b. TOTAL $168,828

9. INVENTIONS AND PATENTS ☒ No ☐ Yes
If "Yes," ☐ Previously Reported ☐ Not Previously Reported

City: Los Angeles County: Los Angeles
State: California Province:
Country: U.S.A. Zip/Postal Code: 90095-7334
Congressional Districts: CA-030

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Susan Waelder, Senior Grant Analyst

TEL: (310) 794-0393 FAX: (310) 943-3823 E-MAIL: OCGA7@research.ucla.edu

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)* Susan Waelder

DATE 4/5/12

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 07/01/12	THROUGH 06/30/13	GRANT NUMBER 5 U54 EB005149-08

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Van Horn, John D.	PD/PI	2.00			23,697	8,531	32,228
Irimia, Andrei	Postdoc	12.00			48,204	6,267	54,471
Chambers, Micah	Graduate Student Researcher		0.90	0.30	6,546	113	6,659
SUBTOTALS →					78,447	14,911	93,358

CONSULTANT COSTS

EQUIPMENT *(Itemize)*

SUPPLIES *(Itemize by category)*
Computer Supplies……..3,639

3,639

TRAVEL
Travel to NAMIC All-Hands Meetings or Project-Related Meetings……6,500

6,500

INPATIENT CARE COSTS

OUTPATIENT CARE COSTS

ALTERATIONS AND RENOVATIONS *(Itemize by category)*

OTHER EXPENSES *(Itemize by category)*
Technology Infrastructure Fees……..632
Computer time/services……5,500

6,132

SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD		**$** 109,629
CONSORTIUM/CONTRACTUAL COSTS	DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS	FACILITIES AND ADMINISTRATIVE COSTS	59,199
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*		**$** 168,828

BUDGET JUSTIFICATION	GRANT NUMBER 5 U54EB005149-08

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

There is no significant change.

CURRENT BUDGET PERIOD	FROM 07/01/11	THROUGH 06/30/12

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

We estimated there is no unobligated balance.

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 5 U54EB005149-08	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR John D VAN HORN	FROM 07/01/11	THROUGH 06/30/12

APPLICANT ORGANIZATION
UCLA

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NAMIC), Core 2

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?

Yes, some of the grants that Dr. Van Horn participated were terminated in the past year. Dr .Van Horn's updated Other Support is attached.

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?

Yes. Dr. Van Horn's time effort will be increased from 1.20 calendar months to 2.00 calendar months in the next budget period, as he will need to spend more time to finalize the project goals and study results during the last year of the DBP project.

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

No

OTHER SUPPORT

VAN HORN, J.D.

ACTIVE

Mass. General Hosp/Partners (Toga) 07/01/10-06/30/13 2.40 calendar
Prime: NIH U01 MH093765 (Rosen) $331,976 (UCLA/Toga subcontract only)
The Human Connectome Project

This unique large-scale investigation of human neural connectivity has potential to improve understanding of the structure and function relationship in the human brain. As understanding the anatomic and functional connections in the brain may subserve advances in many psychiatric and ne urological diseases, the potential public health benefit of this work is monumental.

Brigham and Women's Hospital (Van Horn) 09/30/10-06/30/13 2.00 calendar
Prime: NIH/ NIBIB U54EB005149 (Kikinis) $109,629
National Alliance for Medical Image Computing (NAMIC) (Core 2D: Driving Biological Project)

This project will develop sophisticated image data processing methodologies for patient-specific consideration of traumatic brain injury (TBI).

RC1 MH088194 (Van Horn) 09/30/09–08/31/11 3.00 calendar
NIH/NIMH $328,928
Informatics Meta-Spaces for the Exploration of Human Neuroanatomy

This project will deliver a robust, content-driven informatics approach to the identification of brains having similar geometry and s hape, the clustering of neuroanatomically similar cases, and t he interactive 3D visualization of the large collections contained in neuroimaging archives.

P41 RR013642 (Toga) 08/01/07-07/31/12 1.80 calendar
NIH/NCRR $723,674
Computational Anatomy and Multidimensional Modeling

The goal of this competitive renewal application will go beyond current atlases and maps of brain that assume a static morphology and prohibit the examination of time varying changes. We will continue to develop the framework and tools to rigorously evaluate dynamic changes in brain structure and function focusing particularly on processes such as development, aging and the progression of specific diseases.

Program Director/Principal Investigator (Last, first, middle): Kikinis, Ron

GRANT NUMBER
5 U54EB005149-08

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)
N/A	0	N/A

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☒ DHHS Agreement dated: 04/27/11 ☐ No Facilities and Administrative Costs Requested.

☐ No DHHS Agreement, but rate established with _____ Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 109,629 x Rate applied 54 % = F&A costs $ 59,199

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
5 U54EB005149-08

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
JDVANHORN	Van Horn, John D.	Ph.D.	4991	Subcontract PI	02/67	1.20		
andrei.irimia	Irimia, Andrei	Ph.D.	8895	Postdoc	05/81	10.0		
	Bowman, Ian	M.S.	6804	Programmer	02/78	3.93		

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			5U54EB005149

Total Project Period
From: 09/17/2004 Through: 06/30/2014

Requested Budget Period
From: 07/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing: Core 2

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Polina Golland
The Stata Center
32 Vassar St., 32-D470
Cambridge, MA 02139

2b. E-MAIL ADDRESS
polina@csail.mit.edu

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
Computer Science and Artificial Intelligence Agenc

2d. MAJOR SUBDIVISION
CSAIL

2e. Tel: 617-253-8005 Fax: 617-258-7840

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
Massachusetts Institute of Technology
77 Massachusetts Avenue
Cambridge, MA 02139

3b. Tel: 671-253-3992 Fax:

3c. DUNS: 00-142-5594

4. ENTITY IDENTIFICATION NUMBER
04-210-3594

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☒ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Laureen Horton
Manager, Grants and Contracts
77 Massachusetts Avenue, E19-750
Cambridge, MA 02139
Tel: 617-253-3992 Fax: 617-253-4734
E-MAIL: laureena@mit.edu

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)
Organizational Name: Massachusetts Institute of Technology
DUNS: 00-142-5594
Street 1: 77 Massachusetts Ave
Street 2:
City: Cambridge County: Middlesex
State: MA Province:
Country: USA Zip/Postal Code: 02139
Congressional Districts: MA-008

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD
8a. DIRECT $17,103 8b. TOTAL $27,558

9. INVENTIONS AND PATENTS ☒ No ☐ Yes
If "Yes," ☐ Previously Reported ☐ Not Previously Reported

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Laureen Horton

TEL: 617-253-3992 FAX: 617-253-4734 E-MAIL: laureena@mit.edu

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)* Laureen Horton DATE 4/2/12

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 07/01/2012	THROUGH 06/30/2013	GRANT NUMBER 5U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Golland	PD/PI			.20	2,753	770	3,523
Postdoctoral Associate	PhD	1.54			6,166	2,281	8,447
DeOliveira	Project Support Staff	.66			2,568	950	3,519
Lab Allocation		12			1,177	435	1,612
SUBTOTALS →					12,663	4,437	17,101

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	
TRAVEL	
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	$ 17,102
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	$ 17,102

BUDGET JUSTIFICATION	GRANT NUMBER
	5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

No changes to report

CURRENT BUDGET PERIOD	FROM	THROUGH
	7/1/2011	6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

None

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Polina Golland	FROM 7/1/2012	THROUGH 6/30/2013

APPLICANT ORGANIZATION
Massachusetts Institute of Technology

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing: Core 2

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?

No change since the previous submission.

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?

No significant change since the previous submission.

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

No.

Program Director/Principal Investigator (Last, first, middle): Kikinis, Ron

GRANT NUMBER
5U54EB005149

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☐ DHHS Agreement dated: _____ ☐ No Facilities and Administrative Costs Requested.

☒ No DHHS Agreement, but rate established with ONR Date 7/1/2010

CALCULATION*

Entire proposed budget period: Amount of base $ 15,489 x Rate applied 67.5 % = F&A costs $ 10,455

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
2U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
PGolland	Polina	PhD	4807	PI	12/71			.20*
WACHINGER	Christian Wachinger	PhD		Postdoc	2/82	1.30		
	Fern DeOliveira	n/a		Project Support	10/76	.60		

Boston University Sponsored Programs

25 Buick Street
Boston, Massachusetts 02215
T 617-353-4365 F 617-353-6660

BOSTON UNIVERSITY

April 9, 2012

Ron Kikinis, M.D.
Department of Radiology
Brigham and Women's Hospital
75 Francis Street
Boston, MA 02215

Re: Boston University Letter of Intent to enter into a subcontract with Brigham and Women's Hospital
Proposal Title: "National Alliance for Medical Image Computing (NAMIC): Core 2"
NIH Prime Award Number: 2U54EB005149
Boston University Principal Investigator: Professor Allen Tannenbaum

Dear Professor Kikinis:

This letter is to inform you that the Trustees of Boston University intend to enter into a subcontract with Brigham and Women's Hospital in support of Professor Tannenbaum's proposed research efforts. The proposed period of performance for this subcontract is 7/1/2012 through 6/30/2013, with an estimated total cost of $12,447. The scope of work is attached.

Boston University is familiar with NIH policy and is prepared to establish the necessary written interorganizational agreement with Brigham and Women's Hospital consistent with that policy and to ensure compliance with all pertinent Federal regulations and policies, including the Conflict of Interest policies.

However, the University reserves the right to negotiate the terms, conditions, and provisions included in any subcontract prior to its acceptance. Specifically, the University will not accept any publication restrictions or access restrictions on foreign nationals. Such restrictions are contradictory to the University's mission of educating students and openly publishing its research results.

If you need additional information, contact Timothy O'Brien at 617-353-4057 or, by email, at timob@bu.edu.

Sincerely,

Timothy O'Brien
Senior Research Administrator

Boston University Authorization: _____

Michael Collins
Asst. VP for Sponsored Programs

Enclosures

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			5U54EB005149

Total Project Period
From: 07/01/2012 Through: 06/30/2013

Requested Budget Period
From: 07/012012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NA-MIC Core 2)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR
(Name and address, street, city, state, zip code)
Tannenbaum, Allen Robert
Department of ECE
8 St. Mary's Street (Photonics Building)
Boston University
Boston, MA 02115

2b. E-MAIL ADDRESS
tannenba@bu.edu

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
ECE/BME

2d. MAJOR SUBDIVISION
ECE

2e. Tel: 617-353-6521` Fax: 617-353-7337

3a. APPLICANT ORGANIZATION
(Name and address, street, city, state, zip code)
Trustees of Boston University
881 Commonwealth Avenue
Boston, MA 02215-1300

3b. Tel: 617-353-4635 Fax: 617-353-6660

3c. DUNS: 049435266

4. ENTITY IDENTIFICATION NUMBER
104210347A1

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☒ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Joan Kirkendall - Director
OSP - 25 Buick Street
Boston, MA 02215-1300

Tel: 617-353-4365 Fax: 617-353-6660

E-MAIL: joank@bu.edu

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)
Organizational Name: Trustees of Boston University

DUNS: 049435266

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $7,613 8b. TOTAL $12,447

Street 1: 881 Commonwealth Avenue

Street 2:

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes, ☐ Previously Reported
☐ Not Previously Reported

City: Boston County: Suffolk

State: MA Province:

Country: USA Zip/Postal Code: 02215-1300

Congressional Districts: MA-008

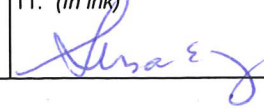
11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Susan Mankiewicz, Dir. of Research Acct.

TEL: 617-353-4365 FAX: 617-353-6660 E-MAIL: timob@bu.edu

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)*



DATE 4-9-13

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 7/1/2012	THROUGH 6/30/2013	GRANT NUMBER 5U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Allen Tannenbaum	PD/PI			0	0	0	0
Peter Karasev	GRA	1.0			2,654	239	2,893
SUBTOTALS →					2,654	239	2,893

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	
TRAVEL	4,720
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	$ 7,613
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	4,834
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	$ 7,613

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

There have been no significant changes.

CURRENT BUDGET PERIOD	FROM 7/1/2012	THROUGH 6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

None.

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Allen Tannenbaum	FROM 7/1/2011	THROUGH 6/30/2012

APPLICANT ORGANIZATION
Boston University

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NA-MIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?

No.

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?

No.

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

No.

Program Director/Principal Investigator (Last, first, middle): Kikinis, Ron

GRANT NUMBER
5U54EB005149

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☒ DHHS Agreement dated: 02/13/2012 ☐ No Facilities and Administrative Costs Requested.

☐ No DHHS Agreement, but rate established with _____ Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 7,613 x Rate applied 63.7 % = F&A costs $ 4,834

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
5U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- PD/PI
- Co-Investigator
- Faculty Collaborator
- Staff Scientist (doctoral level)
- Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)
- Grad Rsch Asst (Graduate Research Assistant)
- Undergrad Rsch Asst (Undergraduate Research Assistant)
- Rsch Asst (Research Assistant/Coordinator)
- Technician
- Consultant
- Biostatistician
- Other (Specify)

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
karasevp123	Peter Karasevi	MSc	8172	GRA	11/86	1.0		
TANNENBA123	Allen Tannenbaum	Ph.D.	5155	PD	01/53			

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			2U54EB005149

Total Project Period
From: 09/17/2004 Through: 06/30/2014

Requested Budget Period
From: 07/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NAMIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Ross Whitaker
72 S Central Campus Dr., RM 3750
Salt Lake City, UT 84112

2b. E-MAIL ADDRESS
whitaker@sci.utah.edu

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
SCI Institute

2d. MAJOR SUBDIVISION

2e. Tel: 801-587-9549 Fax: 801-585-6513

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
University of Utah
1471 East Federal Way
Salt Lake City, UT 84102

3b. Tel: 801-581-3006 Fax: 801-581-3007

3c. DUNS: 009095365

4. ENTITY IDENTIFICATION NUMBER
87-6000525

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☒ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Laurel Duncan
1471 East Federal Way
Salt Lake City, UT 84102

Tel: 801-581-3006 Fax: 801-581-3007

E-MAIL: ospawards@osp.utah.edu

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)

Organizational Name: University of Utah

DUNS: 009095365

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $8,533 8b. TOTAL $12,843

Street 1: 72 S Central Campus Dr., RM 3750

Street 2:

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes," ☐ Previously Reported ☐ Not Previously Reported

City: Salt Lake City County: Salt Lake

State: Utah Province:

Country: USA Zip/Postal Code: 84112

Congressional Districts: UT 2nd

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Brent Brown, Director Office of Sponsored Projects

TEL: 801-581-3006 FAX: 801-581-3007 E-MAIL: ospawards@osp.utah.edu

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)*

DATE APR 06 2012

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 07/01/2011	THROUGH 06/30/2012	GRANT NUMBER 2U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Ross Whitaker	PD/PI	0.25			3,961	951	4,912
Post Doc (TBD)	Post Doc	0.45			2,415	797	3,212
SUBTOTALS →					6,376	1,748	8,124

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	
TRAVEL	
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
Computer Services	409
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 8,533
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 8,533

BUDGET JUSTIFICATION	GRANT NUMBER 2U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

See Attached

CURRENT BUDGET PERIOD	FROM 07/01/2011	THROUGH 06/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

No unobligated balance above 25%

Budget Justification for Ross Whitaker for Core 2

Senior Personnel:

Dr. Ross Whitaker: Ross Whitaker is a Professor of Computer Science and a member of the Scientific Computing and Imaging Institute. We request one week support for work on this part of Core 2. Whitaker's involvement in Core 2 is as the point-of-contact for Atrial Fibrillation DBP.

Other Personnel:

Post Doctoral Associate: The Post Doctoral Associate will assist Dr. Whitaker in completing the prescribed tasks and in the management of the project. They will work directly with investigators in the DBP with software development relating to new algorithms. We request two weeks per year support for Core 2.

Other Expenses

Benefits:
The benefits rate is calculated based on an average of the amount charged to the position / person over a period of a few months. As such the rate will vary based upon the position / person. The percentage rates applied are below:

Dr. Whitaker: 24%
Post Doctoral Associate: 33%

Other Direct Costs:
The Scientific Computing and Imaging Institute, which maintains the central computational systems, networks, and software, has mandatory computing facility costs that are assessed by FTE (a full time equivalence status). The Governmental Accounting Division of the University of Utah approved the computing facility model on October 21, 2002. This covers software and hardware maintenance, network connections, etc.

University of Utah, Indirect Costs: The University of Utah's indirect costs rate is calculated from the total direct costs less capital (<$5,000) equipment. The negotiated rate is 50.5%.

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 2U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Ross Whitaker	FROM 07/01/2011	THROUGH 06/30/2012

APPLICANT ORGANIZATION
University of Utah

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NAMIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?

NO

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?

NO

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

NO

GRANT NUMBER
2U54EB005149

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☒ DHHS Agreement dated: April 27, 2007 ☐ No Facilities and Administrative Costs Requested.

☐ No DHHS Agreement, but rate established with _____ Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 8,533 x Rate applied 50.50 % = F&A costs $ 4,310

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
2U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
rosswhitaker	Ross Whitaker	Ph.D.	9368	PI		0.25		
sylvaingouttard	Sylvain Gouttard			Post Doc		0.45		

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			2U54EB005149

Total Project Period
From: 09/17/2004 Through: 06/30/2014

Requested Budget Period
From: 07/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NAMIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Guido Gerig
72 S Central Campus Dr., RM 3750
Salt Lake City, UT 84112

2b. E-MAIL ADDRESS
gerig@sci.utah.edu

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
SCI Institute

2d. MAJOR SUBDIVISION

2e. Tel: 801-585-0327 Fax: 801-585-6513

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
University of Utah
1471 East Federal Way
Salt Lake City, UT 84102

3b. Tel: 801-581-3006 Fax: 801-581-3007

3c. DUNS: 009095365

4. ENTITY IDENTIFICATION NUMBER
87-6000525

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☒ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Laurel Duncan
1471 East Federal Way
Salt Lake City, UT 84102

Tel: 801-581-3006 Fax: 801-581-3007

E-MAIL: ospawards@osp.utah.edu

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)
Organizational Name: University of Utah
DUNS: 009095365
Street 1: 72 S Central Campus Dr., RM 3750
Street 2:

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $17,048 8b. TOTAL $25,658

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes," ☐ Previously Reported ☐ Not Previously Reported

City: Salt Lake City County: Salt Lake
State: Utah Province:
Country: USA Zip/Postal Code: 84112
Congressional Districts: UT 2nd

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Brent Brown, Director Office of Sponsored Projects

TEL: 801-581-3006 FAX: 801-581-3007 E-MAIL: ospawards@osp.utah.edu

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)*

DATE APR 06 2012

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM	THROUGH	GRANT NUMBER
	07/01/2012	06/30/2013	2U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Guido Gerig	PD/PI						
Marcel Prastawa	Senior Scientist	1.68			11,520	3,456	14,976
SUBTOTALS →					11,520	3,456	14,976

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	
TRAVEL Domestic Travel	1,082
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)* Computer Services	990
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 17,048
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 17,048

BUDGET JUSTIFICATION	GRANT NUMBER 2U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

See Attached

CURRENT BUDGET PERIOD	FROM 07/01/2011	THROUGH 06/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

No unobligated balance above 25%

Budget Justification for Guido Gerig for Core 2

Senior Personnel:

Dr. Guido Gerig: Guido Gerig is a Professor of Computer Science and a member of the Scientific Computing and Imaging Institute. We are not requesting any support for work on this part of Core 2.

Dr. Marcel Prastawa: Marcel Prastawa is a Research Assistant Professor in the Scientific Computing and Imaging Institute. We request 15% or 1.8 months support for work on this part of Core 2.

Other Expenses

Benefits:
The benefits rate is calculated based on an average of the amount charged to the position / person over a period of a few months. As such the rate will vary based upon the position / person. The percentage rates applied are below:

Dr. Gerig: 0% (no effort on Core 2)
Dr. Prastawa: 30%

Travel:
We are requesting travel funds $1,082, which will enable Dr. Prastawa to attend the yearly workshops or collaborative meetings at Harvard University.

Other Direct Costs:
The Scientific Computing and Imaging Institute, which maintains the central computational systems, networks, and software, has mandatory computing facility costs that are assessed by FTE (a full time equivalence status). The Governmental Accounting Division of the University of Utah approved the computing facility model on October 21, 2002. This covers software and hardware maintenance, network connections, etc.

University of Utah, Indirect Costs: The University of Utah's indirect costs rate is calculated from the total direct costs less capital (<$5,000) equipment. The negotiated rate is 50.5%.

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 2U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Guido Gerig	FROM 07/01/2011	THROUGH 06/30/2012

APPLICANT ORGANIZATION
University of Utah

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NAMIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?

NO

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?

NO

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

NO

GRANT NUMBER
2U54EB005149

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☒ DHHS Agreement dated: April 27, 2007 ☐ No Facilities and Administrative Costs Requested.

☐ No DHHS Agreement, but rate established with _____ Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 17,048 x Rate applied 50.50 % = F&A costs $ 8,610

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
2U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
GUIDO_GERIG	Guido Gerig	Ph.D.	9163	PI	09/54			
Prastawa	Marcel Prastawa	Ph.D.	3288	Senior Scientist	01/80	1.68		

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			5 U54EB005149

Total Project Period
From: 09/17/2004 Through: 06/30/2014

Requested Budget Period
From: 07/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NAMIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Martin Styner
University of North Carolina at Chapel Hill
Department of Psychiatry
CB# 7160
Chapel Hill, NC 27599-7160

2b. E-MAIL ADDRESS
styner@cs.unc.edu

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
Psychiatry

2d. MAJOR SUBDIVISION
School of Medicine

2e. Tel: 919-966-1648 Fax: 919-843-7650

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
University of North Carolina at Chapel Hill
Office of Sponsored Research
104 Airport Drive, Suite 2200, CB# 1350
Chapel Hill, NC 27599-1350

3b. Tel: 919-966-3411 Fax: 919-962-3352

3c. DUNS: 608195277

4. ENTITY IDENTIFICATION NUMBER
1566001393A1

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☐ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Sherrie Settle, Director, Proposal Management
Office of Sponsored Research, Admin.Office Bldg
Suite 2200, 104 Airport Dr.,
Chapel Hill, NC 27599-1350

Tel: 919-966-3411 Fax: 919-962-3352

E-MAIL: ResAdminOSR@unc.edu

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)
Organizational Name: University of North Carolina at Chapel Hill
DUNS: 608195277
Street 1: 329 Medical School Wing C
Street 2: CB# 7160
City: Chapel Hill County: Orange
State: NC Province:
Country: USA Zip/Postal Code: 27599
Congressional Districts: NC-004

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD
8a. DIRECT $ 17,130 8b. TOTAL $25,352

9. INVENTIONS AND PATENTS ☒ No ☐ Yes
If "Yes," ☐ Previously Reported ☐ Not Previously Reported

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Barbara Entwisle, Vice Chancellor for Research

TEL: (919) 966-3411 FAX: (919) 962-3352 E-MAIL: resadminosr@unc.edu

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)* Judith A. Smith DATE 4-2-12

Acting for
Barbara Entwisle, PhD

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM	THROUGH	GRANT NUMBER
	7/1/2012	6/30/2013	5U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Martin Styner	PD/PI						
Francois Budin	Research Associate	2.34			10,725	3,225	13,950
SUBTOTALS →					10,725	3,225	13,950

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)* Project Related Supplies	180
TRAVEL Conference Travel	3,000
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 17,130
CONSORTIUM/CONTRACTUAL COSTS – DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS – FACILITIES AND ADMINISTRATIVE COSTS	8,222
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 25,352

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

Clement Vachet has been replaced with Francois Budin, as Clement Vachet has taken up a new position at the University of Utah.

Francois Budin (MS in Computer science engineering, 19.5%, Research Scientist) will perform all tasks previously performed by Clement Vachet. Francois Budin has extensive experience with Slicer programming, especifically in DTI and registration. He is the main author of the DWI and DTI resampling modules in Slicer and is thus perfectly suited for the major task at hand in the next funding year, which is the creation of a DTI atlas based registration analysis wizard for Slicer.

CURRENT BUDGET PERIOD	FROM 07/01/2011	THROUGH 6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

None

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Martin Styner	FROM 7/1/2011	THROUGH 6/30/2012

APPLICANT ORGANIZATION
The University of North Carolina at Chapel Hill

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NA-MIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?
No

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?
No

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?
No

Program Director/Principal Investigator (Last, first, middle): Kikinis, Ron

GRANT NUMBER
5U54EB005149

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)
N/A		

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☒ DHHS Agreement dated: 11/06/2007 ☐ No Facilities and Administrative Costs Requested.

☐ No DHHS Agreement, but rate established with _____ Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 17,130 x Rate applied 48 % = F&A costs $ 8,222

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
5U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
MARTIN_STYNER	Martin Styner	PhD		Subcontract PI				
CLEMENT_VACHET	Clement Vachet	PhD		Staff Scientist		4.8		

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			5U54EB005149

Total Project Period
From: 09/17/2004 Through: 06/30/2014

Requested Budget Period
From: 7/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NA-MIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Stephen R. Aylward
28 Corporate Drive
Clifton Park, NY 12065

2b. E-MAIL ADDRESS
stephen.aylward@kitware.com

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT

2d. MAJOR SUBDIVISION

2e. Tel: (518) 371-3971 Fax:

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
Kitware, Inc.
28 Corporate Drive
Clifton Park, NY 12065

3b. Tel: (518) 371-3971 Fax:

3c. DUNS: 10926207

4. ENTITY IDENTIFICATION NUMBER
14-1802694

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☐ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Vicki Rafferty
Contracts Administrator
28 Corporate Drive, Clifton Park, NY 12065

Tel: (518) 371-3971 Fax:

E-MAIL: contracts@kitware.com

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)
Organizational Name: Kitware, Inc.

DUNS: 10926207

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $16,698 8b. TOTAL $38,768

Street 1: 28 Corporate Drive

Street 2:

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes," ☐ Previously Reported ☐ Not Previously Reported

City: Clifton Park County: Saratoga

State: NY Province:

Country: USA Zip/Postal Code: 12065

Congressional Districts: NY-20

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Stephen R. Aylward, Ph.D. / Director of Medical Imaging Research

TEL: (518) 371-3971 FAX: E-MAIL: stephen.aylward@kitware.com

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)*

DATE 04/05/12

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 7/1/2012	THROUGH 6/30/2013	GRANT NUMBER 5U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Stephen Aylward	PD/PI	0.3			3,477		3,477
Luis Ibanez	Co-Investigator	1.4			13,221		13,221
SUBTOTALS →					16,698		16,698

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	
TRAVEL	
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 16,698
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 16,698

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

Stephen R. Aylward, Ph.D. (PI) is Director of Medical Imaging Research at Kitware as well as the founder and manager of Kitware's North Carolina office. Dr. Aylward is also an adjunct associate professor in the Department of Computer Science at UNC; treasurer (previously I was the president) for the Insight Software Consortium which helps to manage ITK, IGSTK, and other open-source packages; associate editor for IEEE Transactions on Medical Imaging; and a member of various conference program committees including SPIE Medical Imaging and MICCAI. Prior to joining Kitware, he was a tenured associate professor of Radiology, Computer Science, and Surgery at UNC.

Dr Aylward will serve as PI of Kitware's effort. He will provide considerable project management expertise and supervise the researchers and engineers assigned to the development of Slicer, the support of the TBI DBP, and the service core.

William J. Schroeder, Ph.D. (Co-Investigator) is the President and founder of Kitware. Dr. Schroeder is one of the lead developers of the Visualization Toolkit (VTK), a lead author of the VTK Users Guide, and a world-renowned leader in the field of open-source software.

Dr. Schroeder will serve as a co-investigator with Dr. Aylward. He will provide exceptional project management guidance to Dr. Aylward as well as guidance on the use of VTK and Kitware's other tools.

CURRENT BUDGET PERIOD	FROM 7/1/2012	THROUGH 6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Stephen Aylward	FROM 7/1/2011	THROUGH 6/30/2012

APPLICANT ORGANIZATION
Kitware Inc.

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NA-MIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?
No.

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?
Yes. Dr. Aylward is assuming the role of PI. Dr. Schroeder will continue to help guide this project, but at a significantly reduced effort. Dr. Aylward will now have effort allocated to all three Cores at Kitware.

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?
No.

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***

All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)
07/01/2012-06/30/2013	0	

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***

In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS

Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☐ DHHS Agreement dated: _____ ☐ No Facilities and Administrative Costs Requested.

☒ No DHHS Agreement, but rate established with DCAA / DCMA Date 01/11/2011

CALCULATION*

Entire proposed budget period: Amount of base $ 16,698 x Rate applied 67/39.5 % = F&A costs $ 22,070

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

Labor Overhead = 67% *Direct Labor

G&A = 39.5% *(Direct Labor + Labor Overhead + Travel)

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
5U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
Aylward	Stephen Aylward	PHD		PI		.46		
	Ilknur Kaynar-Kabul			Co-Investigator		1.5		

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			5U54EB005149

Total Project Period
From: Through:

Requested Budget Period
From: 07/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NA-MIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Dr. James Miller, PhD
KW C223
1 Research Circle
GE Research
Niskayuna NY 12309

2b. E-MAIL ADDRESS
millerjv@ge.com

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
Interventional and Therapy

2d. MAJOR SUBDIVISION
Diagnostics and Biomedical Technologies

2e. Tel: 518-387-4005 Fax: 518-387-5589

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
GE Global Research
1 Research Circle
Niskayuna, NY 12309

3b. Tel: 518-387-5493 Fax:

3c. DUNS: 086188401

4. ENTITY IDENTIFICATION NUMBER
14-0689340

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No. FWA00005680

6c. NIH-Defined Phase III Clinical Trial ☒ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Thomas Cotrofeld
Contract Administrator
1 Research Circle, Niskayuna NY 12309

Tel: 518-387-5493 Fax:

E-MAIL: cotrofe@crd.ge.com

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)

Organizational Name: GE Global Research

DUNS: 08-618-8401

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $19,474 8b. TOTAL $39,857

Street 1: 1 Research Circle

Street 2:

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes, ☐ Previously Reported ☐ Not Previously Reported

City: Niskayuna	County: Schenectady
State: NY	Province:
Country: USA	Zip/Postal Code: 12309

Congressional Districts: 21

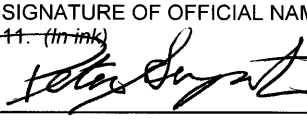
11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Peter Serpentino, Business Programs Manager

TEL: (518) 387-7196	FAX:	E-MAIL: serpenti@ge.com

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN ~~11. (In ink)~~



DATE 4-12-12

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 7/1/2012	THROUGH 6/30/2013	GRANT NUMBER 5U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Miller, James	PD/PI	0.49			4,916	1,917	6,833
Veeraraghavan, Hirini	Computer Scientist	1.08			7,082	2,762	9,844
SUBTOTALS →					11998	4,679	16,677

CONSULTANT COSTS none	
EQUIPMENT *(Itemize)* none	
SUPPLIES *(Itemize by category)* none	
TRAVEL Domestic	2,653
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)* Audit Costs	145
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$**
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	19,474
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	20,383
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 39,857

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

See attached.

CURRENT BUDGET PERIOD	FROM 7/1/2012	THROUGH 6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

None.

BUDGET JUSTIFICATION

GE Global Research will be a liaison for the Atrial Fibrillation DBP and the Engineering Core. In this capacity, GE Global Research will ensure the NA-MIC engineering needs of the Atrial Fibrillation DBP are met, either through direct application of GE Global Research labor and resources or through delegation to the remainder of the Engineering Core.

PERSONNEL ($16,676)

James V Miller, PhD (Site Principal Investigator, 0.49 calendar months)

Dr. Miller is a Senior Scientist in the Interventional and Therapy Lab at GE Global Research. Dr. Miller has developed many segmentation, detection, and registration methods for CT, MR, and PET imaging. Dr. Miller was the chief architect of the image-processing pipeline for the Insight Toolkit. For NA-MIC, Dr. Miller developed the 3D Slicer Execution Model, Lightbox and Compare View modes, as well as NA-MIC's first software dashboarding system. Dr. Miller will serve as the Site PI for the GE Global Research team. He will operate as the main interface between the Engineering Core and the Atrial Fibrillation DBP. In this capacity, he will help the programming staff of the Atrial Fibrillation DBP navigate the NA-MIC Kit and communicate engineering needs specific to this DBP to the remainder of the Engineering Core.

Harini Veeraraghavan, PhD (Co-Investigator, 1.08 calendar months)

Dr. Veeraraghavan is a Scientist in the Biomedical Image Processing Lab at GE Global Research. Dr. Veeraraghavan has a machine learning background and has develop interactive segmentation tools that are integrated in the NA-MIC Kit. Dr. Veeraraghavan will design and implement components of the NA-MIC Kit that address the particular engineering needs of the Atrial Fibrillation DBP.

EQUIPMENT

[None requested]

SUPPLIES

[None requested]

TRAVEL ($2,653)

Travel is to the DBP collaboration site to provide additional face to face opportunities to define requirements and define and evaluate tools in the NA-MIC Kit.

1 trip – 2 people – 4 days to Salt Lake City, UT	$2,653

OTHER DIRECT COSTS ($145)

Audit Fees

2012 Audit ($78)

2013 Audit ($67)

INDIRECT COSTS ($20,383)

Cost Type	Cost Rate	Base Amount	Indirect Costs
Overhead	98.500%	$16,676	$16,426
EAC	5.700%	$35,901	$2,046
B&P	4.200%	$35,901	$1,508
Cost of Money- Direct Labor	2.404%	$16,676	$401
Cost of Money - Project Costs	0.005%	$35,901	$2
Total Indirect Costs			$20,383

The Defense Contracts Audit Agency responsible for reviewing and auditing GE Global Research is located in Schenectady, NY. GE Global Research indirect rates are negotiated and approved by the Defense Contract Management Area Operations in E. Hartford, CT. A copy of the latest approved cost agreement is attached.

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Miller, James	FROM 7/1/2011	THROUGH 6/30/2012

APPLICANT ORGANIZATION
GE Global Research

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NA-MIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period? Two other programs will be ending during this next reporting period.

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project? No.

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget? No.

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)
NONE		

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☐ DHHS Agreement dated: _____ ☐ No Facilities and Administrative Costs Requested.

☒ No DHHS Agreement, but rate established with DCMA, East Hartford, CT Date June, 23, 2011

CALCULATION*

Entire proposed budget period: Amount of base $ 19474 x Rate applied 1.05 % = F&A costs $ 20383

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
5U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
millerjv	Miller, James	PhD	8650	PD/PI	02/67	0.5		
	Veeraraghavan, Harini	PhD	3913	Staff Scientist	12/77	0.5		
	Patwardhan, Kedar	PhD	1751	Staff Scientist	05/80	0.6		

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			5U54EB005149

Total Project Period
From: 9/17/2004 Through: 6/30/2014

Requested Budget Period
From: 7/1/2012 Through: 6/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NA-MIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Steve Pieper
55 Kirkland Street
Cambridge MA, 02138

2b. E-MAIL ADDRESS
pieper@isomics.com

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
Isomics, Inc.

2d. MAJOR SUBDIVISION
Isomics, Inc.

2e. Tel: 617 596 2719 Fax: 617 945 1304

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
Steve Pieper
55 Kirkland Street
Cambridge MA, 02138

3b. Tel: 617 596 2719 Fax: 617 945 1304

3c. DUNS: 11-862-8226

4. ENTITY IDENTIFICATION NUMBER
04-3577579

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☐ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Steve Pieper, CEO
55 Kirkland Street
Cambridge, MA 02138

Tel: 617 596 2719 Fax: 617 945 1304

E-MAIL: pieper@isomics.com

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)

Organizational Name: Isomics, Inc.

DUNS: 11-862-8226

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $17,130 8b. TOTAL $21,070

Street 1: 55 Kirkland Street

Street 2:

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes, ☐ Previously Reported ☐ Not Previously Reported

City: Cambridge	County: Middlesex
State: MA	Province:
Country: USA	Zip/Postal Code: 02138

Congressional Districts: Massachusetts 8th

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Steve Pieper, CEO

TEL: 617 596 2719	FAX: 617 945 1304	E-MAIL: pieper@isomics.com

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.	SIGNATURE OF OFFICIAL NAMED IN 11 *(In ink)*	DATE April 5, 2012

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 7/1/2012	THROUGH 6/30/2013	GRANT NUMBER 5U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Steve Pieper, PhD	PD/PI	.51			7,674	2,456	10,130
SUBTOTALS →					7,675	2,456	10,130

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)* Miscellaneous computer supplies and software	4,000
TRAVEL Travel to NA-MIC events and collaborator sites	3,000
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 17,130
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	3,940
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 21,070

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

No budget items have changed significantly.

CURRENT BUDGET PERIOD	FROM 7/1/2012	THROUGH 6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Pieper, Steve	FROM 7/1/2011	THROUGH 6/30/2012

APPLICANT ORGANIZATION
Isomics, Inc.

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NA-MIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?

Only small changes in other support for the PI - see Other Support page for details.

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?

No

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

No

GRANT NUMBER
5U54EB005149

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☐ DHHS Agreement dated: _____ ☐ No Facilities and Administrative Costs Requested.

☒ No DHHS Agreement, but rate established with Prime Contractor Per NIH Regulations Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 17,130 x Rate applied 23 % = F&A costs $ 3,940

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
5U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
STEVE.PIEPER	Steve Pieper	PhD	2482	PI	05/63	.51		

Form Approved Through 06/30/2012 UCSD 2012-3960 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
	5	U54	EB005149-08

Total Project Period
From: 09/17/2004 Through: 06/30/2014

Requested Budget Period
From: 07/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NAMIC CORE 2)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR
(Name and address, street, city, state, zip code)
Grethe, Jeffrey S.
9500 Gilman Drive, MC0446
La Jolla, CA 92093-0446

2b. E-MAIL ADDRESS
jgrethe@ncmir.ucsd.edu

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
Center for Research in Biological Systems

2d. MAJOR SUBDIVISION
School of Medicine

2e. Tel: 858-822-0703 Fax: 858-246-0644

3a. APPLICANT ORGANIZATION
(Name and address, street, city, state, zip code)
The Regents of the Univ of Calif.
University of California San Diego
9500 Gilman Drive, MC0934
La Jolla, California 92093-0934

3b. Tel: 858-534-8832 Fax: 858-534-0280

3c. DUNS: 80-435-5790

4. ENTITY IDENTIFICATION NUMBER
1956006144A1

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☒ No ☐ Yes		

6b. Federal Wide Assurance No. FWA00004495

6c. NIH-Defined Phase III Clinical Trial ☒ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Judith Wheaton, Contract/Grant Officer
9500 Gilman Drive, MC0934
La Jolla, California 92093-0934

Tel: 858-534-8832 Fax: 858-534-0280

E-MAIL: jwheaton@ucsd.edu

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)
Organizational Name: University of California San Diego

DUNS: 80-435-5790

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $8,565 8b. TOTAL $13,233

Street 1: 9500 Gilman Drive

Street 2: MC0934

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes, ☐ Previously Reported ☐ Not Previously Reported

City: La Jolla	County:
State: CA	Province:
Country: USA	Zip/Postal Code: 92093-0934

Congressional Districts: 53

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Rachel Cook, Grant Analyst

TEL: 858-822-4109 FAX: 858-822-0834 E-MAIL: vchsgrants@ucsd.edu

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)*

DATE 4/10/12

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 07/01/2012	THROUGH 06/30/2013	GRANT NUMBER 5U54EB005149-08

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Grethe, Jeffrey	PD/PI	0.53			6,108	2,406	8,514
SUBTOTALS →					6,108	2,406	8,514

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	
TRAVEL	
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)* UCSD Network Communication	51
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 8,565
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	4,668
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 13,233

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149-08

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

None

CURRENT BUDGET PERIOD	FROM 07/01/2011	THROUGH 06/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

None

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149-08	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Jeffrey S. Grethe	FROM 07/01/11	THROUGH 06/30/12

APPLICANT ORGANIZATION
The Regents of the Univ. of Calif., U.C. San Diego

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NAMIC) - CORE 2

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?
Yes - see attached Support Page.

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project? No

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget? No

OTHER SUPPORT - GRETHE, JEFFREY S.

Active

NIH Neuroscience Blueprint HHSN271200800035C $1,354,509 09/01/08-08/31/13 1.2 cal
via NIDA (UCSD PI: Martone / Role: UCSD Co-PI)
Operation, Support and Enhancement of the Neuroscience Information Framework
Provide access to and annotate web-based resources for neuroscience, including a registry of databases, data and literature through single-query interface.

NIH/NIMH 1R01 MH084819-03 (multiple PIs: Makeig and Grethe) $253,241 04/17/09 - 02/28/12 .6 cal
A Human Electrophysiology, Associated Anatomic Data and Integrated Tool Resource
Current technology allows recording of brain electrical and/or magnetic activity from 256 or more scalp sites with high temporal resolution, plus concurrent behavioral and other psychophysiological time series, while dense human intracranial data are routinely acquired during some brain surgery and surgery planning procedures. Subject anatomic magnetic resonance (MR), computerized tomography (CT), and/or diffusion tensor (DT) head images may also be available. Standard analysis approaches extract only a small part of the rich information about human brain dynamics contained in these data. We propose a collaboration between the UCSD Swartz Center for Computational Neuroscience (home to the EEGLAB software environment development project), the UCSD Center for Research in Biological Systems (home to the Biomedical Informatics Research Network (BIRN) coordinating center), and leaders in six other human electrophysiological research communities to develop a public 'Human Electrophysiology, Associated Anatomic Data and Integrated Tool Sharing (HeadIT) Resource.' This framework will be built on the BIRN Data Repository framework (http://www.nbirn.net/bdr), thereby expanding its scope and capabilities. The HeadIT resource will share existing, high-quality, well-documented data sets, allowing their archival preservation and continued public availability for re-analysis and meta-analysis with increasingly powerful analysis tools.

NIH 5U54 EB0051489-07 (Role: UCSD PI) $59,344 09/30/10-09/29/14 .84 cal
National Alliance for Medical Image Computing
(subcontract from BWH PI:Kikins)
The National Alliance for Medical Imaging Computing (NAMIC) is a multi-institutional, interdisciplinary team of computer scientists, software engineers, and medical investigators who develop computational tools for the analysis and visualization of medical image data. The purpose of the center is to provide the infrastructure and environment for the development of computational algorithms and open source technologies, and then oversee the dissemination of these tools to the medical research community. As a part of Core Project 2 (Grid Computation and Data Integration Environment), we are investigating ways to improve quality and turnaround time of neuroscience experimental research by combining interactive assistance to improve/accelerate workflow creation and autonomous capabilities for workflow refinement and execution on grids.

DE-SC0004949 (UCSD PI: Ellisman / Role: CoI) $178,007 07/15/10-07/14/13 .48 cal
DOE (subcontract through CalTech / Dr.Victoria Orphan)
Syntrophic Interactions and Mechanisms Underpinning Anaerobic Methane Oxidation
Combining advanced imaging techniques to study syntrophic methane-oxidizing microbial consortia maintained in sediment microcosms.

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***

All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)
None		

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***

In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS

Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☒ DHHS Agreement dated: 05/12/2010 ☐ No Facilities and Administrative Costs Requested.

☐ No DHHS Agreement, but rate established with _____ Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 8,565 x Rate applied 54.5 % = F&A costs $ 4,668

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
5U54EB005149-08

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
jgrethe	Grethe, Jeffrey	Ph.D.		PI	09/66	0.55		

CORE 2 Washington University Consortium/Contractual Costs

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			EB005149

Total Project Period
From: 09/30/2010 Through: 06/30/2013

Requested Budget Period
From: 07/01/2012 Through: 06/30/2013

1.TITLE OF PROJECT
National Alliance for Medical Imaging Computing (NAMIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Marcus, Daniel S.
Washington University School of Medicine
Department of Radiology
510 South Kingshighway, Campus Box 8225
St. Louis, MO 63110

2b. E-MAIL ADDRESS
dmarcus@wustl.edu

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
Radiology

2d. MAJOR SUBDIVISION
School of Medicine

2e. Tel: 314-362-9988 Fax: 314-362-3882

3a.APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
Washington University
660 South Euclid, Campus Box 8018
St. Louis, MO 63110

3b. Tel: 314.747.4134 Fax: 314.362.0315

3c. DUNS: 06-855-2207

4.ENTITY IDENTIFICATION NUMBER
1430653611A1

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☒ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☐ No ☐ Yes

5.NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Connie Motoki, Senior Contracts Mgr., OSRS
One Brookings Drive, Campus Box 1054
St. Louis, MO 63130

Tel: 314.935.9443 Fax: 314.935.5862

E-MAIL: wucontracts@msnotes.wustl.edu

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)

Organizational Name: Washington University

DUNS: 06-855-2207

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $8,565 8b. TOTAL $13,019

Street 1: 660 South Euclid

Street 2: Campus Box 8018

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes," ☐ Previously Reported ☐ Not Previously Reported

City: St. Louis	County: St. Louis City
State: MO	Province:
Country: U.S.A.	Zip/Postal Code: 63110

Congressional Districts: MO-01

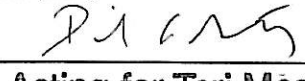
11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Teri Medley, Interim Director Office of Sponsored Research Services

TEL: 314.747.4134 FAX: 314.362.0315 E-MAIL: msosrs@wustl.edu

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)*



DATE 4/4/12

Acting for Teri Medley

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 07/01/2012	THROUGH 06/30/2013	GRANT NUMBER EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Marcus, Daniel S.	PD/PI	0			0	0	0
Siram, Aditya	Programmer analyst	1.20			6,272	1,388	7,660
SUBTOTALS					6,272	1,388	7,660

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	
TRAVEL One trip to semi-annual all-hands meetings or an ad hoc meetings.	905
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 8,565
CONSORTIUM/CONTRACTUAL COSTS – DIRECT COSTS	8,565
CONSORTIUM/CONTRACTUAL COSTS – FACILITIES AND ADMINISTRATIVE COSTS	4,454
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 13,019

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

BUDGET JUSTIFICATION	GRANT NUMBER EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

No change.

CURRENT BUDGET PERIOD	FROM 07/01/2011	THROUGH 06/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

N/A.

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Marcus, Daniel S.	FROM 07/01/2011	THROUGH 06/30/2012

APPLICANT ORGANIZATION
Washington University

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
NATIONAL ALLIANCE FOR MEDICAL IMAGING COMPUTING (NAMIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?
No

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?
No.

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?
No.

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

GRANT NUMBER
EB005149

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☒ DHHS Agreement dated: 02/24/2010, provisional 07/01/2013 ☐ No Facilities and Administrative Costs Requested.

☐ No DHHS Agreement, but rate established with _____ Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 8,565 x Rate applied 52.0 % = F&A costs $ 4,454

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
dmarcus	Marcus, Daniel S.	Ph.D.	4950	PI	08/72	0		
	House, Matthew	MS	4579	Programmer Analyst	9/79	1.0		

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM	THROUGH	GRANT NUMBER
	7/1/2012	6/30/2013	U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Ron Kikinis	PD/PI						
SUBTOTALS →							

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	
TRAVEL	
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$**
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	68,182
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	84,410
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 152,592

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			5U54EB005149

Total Project Period
From: 09/17/2004 Through: 06/30/2014

Requested Budget Period
From: 7/01/2012 Through: 06/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NA-MIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Stephen R. Aylward
28 Corporate Drive
Clifton Park, NY 12065

2b. E-MAIL ADDRESS
stephen.aylward@kitware.com

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT

2d. MAJOR SUBDIVISION

2e. Tel: (518) 371-3971 Fax:

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
Kitware, Inc.
28 Corporate Drive
Clifton Park, NY 12065

3b. Tel: (518) 371-3971 Fax:

3c. DUNS: 10926207

4. ENTITY IDENTIFICATION NUMBER
14-1802694

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☒ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☐ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Vicki Rafferty
Contracts Administrator
28 Corporate Drive, Clifton Park, NY 12065

Tel: (518) 371-3971 Fax:

E-MAIL: contracts@kitware.com

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)

Organizational Name: Kitware, Inc.

DUNS: 10926207

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $68,182 8b. TOTAL $152,592

Street 1: 28 Corporate Drive

Street 2:

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes," ☐ Previously Reported ☐ Not Previously Reported

City: Clifton Park	County: Saratoga
State: NY	Province:
Country: USA	Zip/Postal Code: 12065

Congressional Districts: NY-20

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Stephen R. Aylward, Ph.D. / Director of Medical Imaging Research

TEL: (518) 371-3971	FAX:	E-MAIL: stephen.aylward@kitware.com

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.	SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)*	DATE 04/05/12

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 7/1/2012	THROUGH 6/30/2013	GRANT NUMBER 5U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Stephen Aylward	PD/PI	1.3			15,562		15,562
William Schroeder	Co-Investigator	.1			1,735		1,735
Julien Finet	Co-Investigator	1.9			10,402		10,402
Zach Mullen	Co-Investigator	3.0			16,874		16,874
William Hoffman	Co-Investigator	1.1			17,387		17,387
SUBTOTALS →					62,050		62,050

CONSULTANT COSTS	0
EQUIPMENT *(Itemize)*	0
SUPPLIES *(Itemize by category)*	0
TRAVEL	6,132
INPATIENT CARE COSTS	0
OUTPATIENT CARE COSTS	0
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	0
OTHER EXPENSES *(Itemize by category)*	0
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 68,182
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 68,182

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

Stephen R. Aylward, Ph.D. (PI) is Director of Medical Imaging Research at Kitware as well as the founder and manager of Kitware's North Carolina office. Dr. Aylward is also an adjunct associate professor in the Department of Computer Science at UNC; treasurer (previously I was the president) for the Insight Software Consortium which helps to manage ITK, IGSTK, and other open-source packages; associate editor for IEEE Transactions on Medical Imaging; and a member of various conference program committees including SPIE Medical Imaging and MICCAI. Prior to joining Kitware, he was a tenured associate professor of Radiology, Computer Science, and Surgery at UNC.

Dr Aylward will serve as PI of Kitware's effort. He will provide considerable project management expertise and supervise the researchers and engineers assigned to the development of Slicer, the support of the TBI DBP, and the service core.

William J. Schroeder, Ph.D. (Co-Investigator) is the President and founder of Kitware. Dr. Schroeder is one of the lead developers of the Visualization Toolkit (VTK), a lead author of the VTK Users Guide, and a world-renowned leader in the field of open-source software.

Dr. Schroeder will serve as a co-investigator with Dr. Aylward. He will provide exceptional project management guidance to Dr. Aylward as well as guidance on the use of VTK and Kitware's other tools.

CURRENT BUDGET PERIOD	FROM 7/1/2012	THROUGH 6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Stephen Aylward	FROM 7/1/2011	THROUGH 6/30/2012

APPLICANT ORGANIZATION
Kitware Inc.

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NA-MIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?
No.

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?
Yes. Dr. Aylward is assuming the role of PI. Dr. Schroeder will continue to help guide this project, but at a significantly reduced effort. Dr. Aylward will now have effort allocated to all three Cores at Kitware.

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?
No.

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***

All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)
07/01/2012-06/30/2013	0	

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***

In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS

Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☐ DHHS Agreement dated: _____ ☐ No Facilities and Administrative Costs Requested.

☒ No DHHS Agreement, but rate established with DCAA / DCMA Date 01/11/2011

CALCULATION*

Entire proposed budget period: Amount of base $ 62,050 x Rate applied 67/39.5 % = F&A costs $ 84,410

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

Labor Overhead = 67% *Direct Labor

G&A = 39.5% *(Direct Labor + Labor Overhead + Travel)

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
5U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
Aylward	Stephen Aylward	PHD		PI		.348		
	Jean-C. Filion-Robinet	MS		Co-Investigator		1.27		
	Ilknur Kaynar-Kabul			Co-Investigator		1.65		
	Benjamin Long			Co-Investigator		3.51		

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 7/1/2012	THROUGH 6/30/2013	GRANT NUMBER U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Ron Kikinis	PD/PI	1			14,376	5,175	19,551
Sonia Pujol	Training Expert	9.6			73,180	26,345	99,525
SUBTOTALS →					87,556	31,520	119,076

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	
TRAVEL	10,000
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 129,076
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 129,076

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

No significant changes.

CURRENT BUDGET PERIOD	FROM 7/1/2012	THROUGH 6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

No.

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 7/1/2012	THROUGH 6/30/2013	GRANT NUMBER U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Ron Kikinis	PD/PI						
Tina Kapur	Outreach Manager	3			40,812	14,692	55,504
SUBTOTALS					40,812	14,692	55,504

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	
TRAVEL	3,900
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 59,404
CONSORTIUM/CONTRACTUAL COSTS – DIRECT COSTS	14,950
CONSORTIUM/CONTRACTUAL COSTS – FACILITIES AND ADMINISTRATIVE COSTS	3,438
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 77,792

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

No significant changes.

CURRENT BUDGET PERIOD	FROM 7/1/2012	THROUGH 6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

No.

Form Approved Through 06/30/2012 OMB No. 0925-0001

Department of Health and Human Services
Public Health Services

Grant Progress Report

Review Group	Type	Activity	Grant Number
			5U54EB005149

Total Project Period
From: 9/17/2004 Through: 6/30/2014

Requested Budget Period
From: 7/1/2012 Through: 6/30/2013

1. TITLE OF PROJECT
National Alliance for Medical Image Computing (NA-MIC)

2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR (Name and address, street, city, state, zip code)
Steve Pieper
55 Kirkland Street
Cambridge MA, 02138

2b. E-MAIL ADDRESS
pieper@isomics.com

2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT
Isomics, Inc.

2d. MAJOR SUBDIVISION
Isomics, Inc.

2e. Tel: 617 596 2719 Fax: 617 945 1304

3a. APPLICANT ORGANIZATION (Name and address, street, city, state, zip code)
Steve Pieper
55 Kirkland Street
Cambridge MA, 02138

3b. Tel: 617 596 2719 Fax: 617 945 1304

3c. DUNS: 11-862-8226

4. ENTITY IDENTIFICATION NUMBER
04-3577579

6. HUMAN SUBJECTS ☒ No ☐ Yes

6a. Research Exempt	If Exempt ("Yes" in 6a): Exemption No.	If Not Exempt ("No" in 6a): IRB approval date
☐ No ☐ Yes		

6b. Federal Wide Assurance No.

6c. NIH-Defined Phase III Clinical Trial ☐ No ☐ Yes

5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL
Steve Pieper, CEO
55 Kirkland Street
Cambridge, MA 02138

Tel: 617 596 2719 Fax: 617 945 1304

E-MAIL: pieper@isomics.com

7. VERTEBRATE ANIMALS ☒ No ☐ Yes

7a. If "Yes," IACUC approval Date

7b. Animal Welfare Assurance No.

10. PROJECT/PERFORMANCE SITE(S)

Organizational Name: Isomics, Inc.

DUNS: 11-862-8226

8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT $14,950 8b. TOTAL $18,388

Street 1: 55 Kirkland Street

Street 2:

9. INVENTIONS AND PATENTS ☒ No ☐ Yes

If "Yes, ☐ Previously Reported ☐ Not Previously Reported

City: Cambridge	County: Middlesex
State: MA	Province:
Country: USA	Zip/Postal Code: 02138

Congressional Districts: Massachusetts 8th

11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION *(Item 13)*
Steve Pieper, CEO

TEL: 617 596 2719	FAX: 617 945 1304	E-MAIL: pieper@isomics.com

12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN 11. *(In ink)*

DATE April 5, 2012

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 7/1/2012	THROUGH 6/30/2013	GRANT NUMBER 5U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Steve Pieper, PhD	PD/PI	.43			6,439	2,061	8,500
SUBTOTALS →					6,439	2,061	8,500

CONSULTANT COSTS	
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)* Miscellaneous computer supplies and software	1,000
TRAVEL Travel to NA-MIC events and collaborator sites	5,450
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 14,950
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	3,438
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 18,388

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

No budget items have changed significantly.

CURRENT BUDGET PERIOD	FROM 7/1/2012	THROUGH 6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

PROGRESS REPORT SUMMARY	GRANT NUMBER 5U54EB005149	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Pieper, Steve	FROM 7/1/2011	THROUGH 6/30/2012

APPLICANT ORGANIZATION
Isomics, Inc.

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)
National Alliance for Medical Image Computing (NA-MIC)

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	☒ No Change Since Previous Submission	☐ Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	☒ No Change Since Previous Submission	☐ Change
C. Select Agent Research	☒ No Change Since Previous Submission	☐ Change
D. Multiple PD/PI Leadership Plan	☒ No Change Since Previous Submission	☐ Change
E. Human Embryonic Stem Cell Line(s) Used	☒ No Change Since Previous Submission	☐ Change

SEE PHS 2590 INSTRUCTIONS.

WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.

1. Has there been a change in the other support of Senior/Key Personnel since the last reporting period?

Only small changes in other support for the PI - see Other Support page for details.

2. Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?

No

3. Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?

No

GRANT NUMBER
5U54EB005149

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***
All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***
In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS
Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☐ DHHS Agreement dated: _____ ☐ No Facilities and Administrative Costs Requested.

☒ No DHHS Agreement, but rate established with Prime Contractor Per NIH Regulations Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 14,950 x Rate applied 23 % = F&A costs $ 3,438

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
5U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
STEVE.PIEPER	Steve Pieper	PhD	2482	PI	05/63	.43		

Program Director/Principal Investigator (Last, First, Middle): Kikinis, Ron

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY	FROM 7/1/2012	THROUGH 6/30/2013	GRANT NUMBER U54EB005149

List PERSONNEL *(Applicant organization only)*
Use Cal, Acad, or Summer to Enter Months Devoted to Project
Enter Dollar Amounts Requested *(omit cents)* for Salary Requested and Fringe Benefits

NAME	ROLE ON PROJECT	Cal. Mnths	Acad. Mnths	Summer Mnths	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Ron Kikinis	PD/PI	3			44,925	16,173	61,098
Nicole Aucoin	Program Analyst	3.6			29,293	10,545	39,838
Katie Mastrogiacomo	Sr Res Assistant	6			32,768	11,469	44,236
Marianna Jakab	Webmaster	1.2			9,952	3,483	13,435
Sanjay Manandhar	Project Manager	7.2			34,209	11,973	46,182
Rachana Manandhar	Financial Admin	7.2			28,054	9,819	37,873
Bob McKie	System Admin	1.8			9,952	3,483	13,435
SUBTOTALS →					198,620	70,259	268,879

CONSULTANT COSTS	6,000
EQUIPMENT *(Itemize)*	
SUPPLIES *(Itemize by category)*	1,110
TRAVEL	21,000
INPATIENT CARE COSTS	
OUTPATIENT CARE COSTS	
ALTERATIONS AND RENOVATIONS *(Itemize by category)*	
OTHER EXPENSES *(Itemize by category)*	11,200
SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD	**$** 308,189
CONSORTIUM/CONTRACTUAL COSTS — DIRECT COSTS	
CONSORTIUM/CONTRACTUAL COSTS — FACILITIES AND ADMINISTRATIVE COSTS	
TOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD *(Item 8a, Face Page)*	**$** 308,189

BUDGET JUSTIFICATION	GRANT NUMBER 5U54EB005149

Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

No significant changes.

CURRENT BUDGET PERIOD	FROM 7/1/2012	THROUGH 6/30/2012

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

No.

CHECKLIST

1. PROGRAM INCOME ***(See instructions.)***

All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)

2. ASSURANCES/CERTIFICATIONS ***(See instructions.)***

In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

3. FACILITIES AND ADMINSTRATIVE (F&A) COSTS

Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will ***not*** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

☒ DHHS Agreement dated: 10/20/2011 ☐ No Facilities and Administrative Costs Requested.

☐ No DHHS Agreement, but rate established with _____ Date _____

CALCULATION*

Entire proposed budget period: Amount of base $ 501,142 x Rate applied 78.5 % = F&A costs $ 393,396

Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

*Check appropriate box(es):

☐ Salary and wages base ☒ Modified total direct cost base ☐ Other base *(Explain)*

☐ Off-site, other special rate, or more than one rate involved *(Explain)*

Explanation *(Attach separate sheet, if necessary.):*

ALL PERSONNEL REPORT

Place this form at the end of the signed original copy of the application. Do not duplicate.

GRANT NUMBER
2U54EB005149

Always list the PD/PI(s). In addition, list all other personnel who participated in the project during the current budget period for at least one person month or more, regardless of the source of compensation (a person month equals approximately 160 hours or 8.3% of annualized effort). Use the following abbreviated categories for describing Role on Project:

- **PD/PI**
- **Co-Investigator**
- **Faculty Collaborator**
- **Staff Scientist (doctoral level)**
- **Postdoc (Postdoctoral Scholar, Fellow, or Other Postdoctoral Position)**
- **Grad Rsch Asst (Graduate Research Assistant)**
- **Undergrad Rsch Asst (Undergraduate Research Assistant)**
- **Rsch Asst (Research Assistant/Coordinator)**
- **Technician**
- **Consultant**
- **Biostatistician**
- **Other (Specify)**

If personnel are supported by a Reentry or Diversity Supplement or American Recovery and Reinvestment Act (ARRA) funding, please indicate such after the Role on Project, using the following abbreviations: RS - Reentry Supplement; DS - Diversity Supplement; AF - General ARRA Supplement; ASE - ARRA Summer Experience funding.

Use Cal (calendar), Acad, or Summer to enter months devoted to project.

Commons ID	Name	Degree(s)	SSN (last 4 digits)	Role on Project	DoB (MM /YY)	Cal	Acad	Summer
rk1234	Ron Kikinis	M.D		PI	03/56	3		
TINAKAPUR	Tina Kapur	Ph.D		Investigator		3		
spujol1	Sonia Pujol	Ph.D		Training Expert	01/75	9		
	Nicole Aucoin	BSc		Program Analyst	09/72	3		
	Sanjay Manandhar	M.Sc, MBA		Project Manager		7.20		
	Katie Mastrogiacomo	B.A		Rsch Asst		6		
	Bob McKie	MS/ABD		System Admin				
	Rachana Manandhar	BCom		Financial Admin		7.20		
	Marianna Jakab	M.Sc						

KIKINIS, RON

OTHER SUPPORT

ACTIVE

P41 RR013218 (Kikinis) 09/ 30/98-05/31/13 3.36 Calendar Mnths
NIH/NCRR $1,425,049
Neuroimaging Analysis Center
The goal of this project is to expand our high performance computing facility, focusing on neuroimaging applications in the form of collaborative projects as well as providing training and educational support for the local, national and international scientific community. The main research focus of the NAC is to develop post-processing methods for digital medical imaging data and to use these algorithms for clinical applications.

U54 EB005149 (Kikinis) 09/17/04 - 06/30/14 5.04 Calendar Mnths
NIH/NIBIB $3,521,125
National Alliance for Medical Imaging Computing
NAMIC is a multi-institutional, interdisciplinary team of computer scientists, software engineers, and medical investigators who develop computational tools for the analysis and visualization of medical image data. The purpose of the center is to provide the infrastructure and environment for the development of computational algorithms and open source technologies, and then oversee the training and dissemination of these tools to the medical research community.

P41 RR019703 (Jolesz, Ferenc) 08/01/10-07/31/15 2.04 Calendar Mnths
NIH $2,073,633
Image Guided Therapy Center
This project will develop and make available new, clinically relevant technologies in six discrete TRD Core Projects: 1) Computational Core; 2) Imaging Core; 3) Image-Guidance Core; 4) Neurosurgery Core; 5) Prostate Core and 6) Focused Ultrasound Therapy Core. Our overarching goal is to continue being the leading National Center that reaching effectively across a broad range of constituencies through service, training and dissemination of the novel technologies and methods under development in this Resource.

W81XWH-07 CC-CCA (Shenton/Stein) 06/01/09-05/31/13 0.72 Calendar Mnths
DOD $300,000
Post-Traumatic Stress Disorder (PTSD) and Traumatic Brain Injury (TBI) Clinical Consortium
The main goal of this consortium is to differentiate between PTSD and TBI. The focus of this consortium is to use state-of the-art methods to differentiate these two disorders in order to both better diagnosis TBI and PTSD and to assess treatment and recovery.
Role: Lead Investigator

2P41RR013218-12S1 Supplement (Kikinis) 09/17/09-09/16/12 (NCE) Effort thru parent grant
NIH $72 9,326
NAC ARRA Supplement/Image Analysis of Personalized Medicine
Goals of this project are to improve the usability of the 3D Slicer software for translational clinical research.

3P41RR013218-14S1 (Kikinis) 09/13/2011-05/31/2012 0.24 Calendar Mnths
NIH/NCRR $362,588
NAC Supplement (Neuroimaging Analysis Center)
The goal of this project is improving the user interface and portability of Slicer.

KAPUR, TINA

ACTIVE

P41 RENEWAL (Jolesz, Ferenc) 08/01/10-07/31/15 6.0 Cal. Mos.
NIH $2,073,633
Image Guided Therapy Center
This project will develop and make available new, clinically relevant technologies in six discrete TRD Core Projects: 1) Computational Core; 2) Imaging Core; 3) Image-Guidance Core; 4) Neurosurgery Core; 5) Prostate Core and 6) Focused Ultrasound Therapy Core. Our overarching goal is to continue being the leading National Center that reaching effectively across a broad range of constituencies through service, training and dissemination of the novel technologies and methods under development in this Resource.

U54 EB005149 RENEWAL (Kikinis) 9/01/10 - 8/31/14 3.0 Cal. Mos.
NIH $2,329,717
National Alliance for Medical Imaging Computing
NAMIC is a multi-institutional, interdisciplinary team of computer scientists, software engineers, and medical investigators who develop computational tools for the analysis and visualization of medical image data. The purpose of the center is to provide the infrastructure and environment for the development of computational algorithms and open source technologies, and then oversee the training and dissemination of these tools to the medical research community.

REB013792A (Kapur) 8/15/11 – 7/31/13 1.2 Cal. Mos.
NIH $89,209
Joint Segmentation of MR and CT scans for Gynecologic Cancer Brachytherapy
The goal of this R03 is to develop a multimodal segmentation algorithms to aid brachytherapy planning forgynecologic cancer.

R01 CA111288 (Tempany, Clare) 07/01/06-05/31/16 .60 Cal. Mos.
NIH/Bioengineering Research Partnership $818,115
Enabling Technology for MR-Guided Prostate Interventions
To develop a technology platform for precise trans-perineal needle placement into the prostate for both diagnostic and therapeutic purposes, inside conventional (high-field closed) MRI scanners, under real-time image guidance and monitoring.

R01 HD05796-01A2 (Wells) 09/30/09-08/31/12 .35 Cal. Mos.
NIH $327,206
Tools and Templates for Pediatric Neuroanatomical Analysis
This project aims to construct anatomical templates from medical images that summarize neuroanatomy and its variability in children. Templates of this sort facilitate research that can clarify the anatomical correlates of disorders and diseases. In the long term, this research can lead to improvement in diagnosis and treatment.

R01 CA138419-01A1(Wells/Aylward) 09/29/09-05/31/14 .65 Cal. Mos.
NIH $257,977
Image Registration for Ultrasound – Based Neurosurgical Navigation
This project aims to construct registration algorithms for neurosurgical navigation and deliver them to the research and commercial community in an open source toolkit. These capabilities may eventually lead to improved outcomes in tumor resection.

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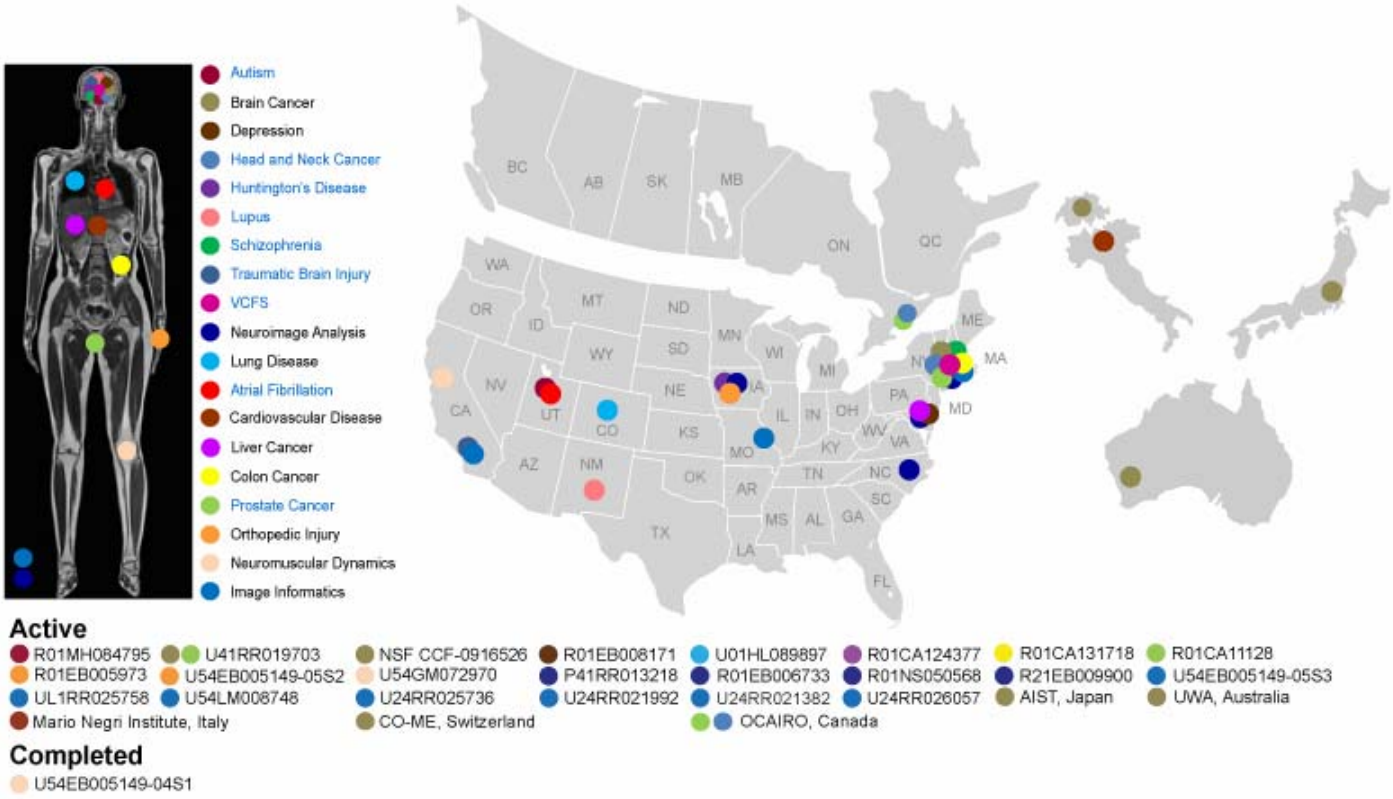
NATIONAL ALLIANCE FOR MEDICAL IMAGE ANALYSIS

A National Center for Biomedical Computing

NIH Roadmap Initiative

Annual Progress Report

July 1, 2011 through April 30, 2012



A Geo-Anatomical Map of NA-MIC Collaborations

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1. INTRODUCTION

The *National Alliance for Medical Image Computing* (NA-MIC) is a multi-institutional, interdisciplinary community of computer scientists, software engineers, and medical investigators who share the common goal of improving healthcare through the development of computational tools for the analysis and visualization of medical image data. The Center continues to provide robust and flexible infrastructure for developing and applying advanced imaging technologies across a range of important biomedical research disciplines. In addition to activities that sustain the NA-MIC Kit and integrity of the Center's software infrastructure, NA-MIC has continued its impressive record of reaching out to the broader biomedical community. This year NA-MIC hosted 15 workshops and courses at national universities and international venues, providing training and exposure to medical researchers in 3D Slicer and other NA-MIC technologies. NA-MIC also launched the first *DTI Tractography Challenge for Neurosurgical Planning* at the 14th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2011) conference in Toronto, Canada, demonstrating its continued commitment to validation. The purpose of the validation effort is to assess the performance of NA-MIC algorithms in a variety of clinical arenas. The Center worked synergistically with the Driving Biological Projects (DBPs) to achieve fundamental advances in shape representation, shape analysis, groupwise registration, diffusion estimation, segmentation and quantification, functional estimation, distortion correction, and clustering. Finally, this year saw the release of Slicer version 4.0 and 4.1 (Slicer4) which represents a significant advance in capabilities and underlying technologies. The software was released at RSNA 2011 in November. As in past years, a detailed presentation of current work was made at the All Hands Meeting in Salt Lake City, Utah, January 9-13, 2012, and can be viewed in detail on the NA-MIC Wiki [http://wiki.na-mic.org/Wiki/index.php/ 2012_Winter_Project_Week].

This represents the 8th Annual Progress Report and second year of the second cycle of funding. The report includes Highlights and Impact statements, individual progress reports from the four DBPs (Atrial Fibrillation, Huntington's Disease, Adaptive Radiotherapy for Head and Neck Cancer, and Traumatic Brain Injury), a science and technology summary from the Computer Science Core (Algorithms, Engineering, and NA-MIC Kit), and a review of Training activities, including the validation effort. The report concludes with a bibliography of 33 peer-reviewed journal articles and 21 peer-reviewed conference reports and the annual recommendations of the External Advisory Board, which met on January 12, 2012 in Salt Lake City, coincident with Winter Project Week.

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2. HIGHLIGHTS

The scope of NA-MIC activities includes advanced medical image analysis research combined with leading edge software processes and computational platforms. To reflect these activities, the NA-MIC Computer Science Core is organized around two teams: Algorithms and Engineering. Their joint output is the NA-MIC Kit which embodies a comprehensive set of analysis techniques in a well architected, documented, and widely used platform as described in the following paragraphs.

Algorithms. The NA-MIC Computer Science Algorithm effort responds to the challenges of the DBPs to expand the horizons of medical image analysis. As a result, the Algorithm activities are typically highly experimental, creating new approaches that are rapidly prototyped, tested, and improved.

Engineering. The NA-MIC Computer Science Engineering effort supports the needs of the Algorithms effort by creating integrated software platforms that support research and eventual deployment of advanced technology. The Engineering team also develops and maintains processes used to build and sustain a large research community.

NA-MIC Kit. The NA-MIC Kit consists of an integrated set of interoperable free open source software (FOSS) packages; developed, supported and deployed using a collaborative, agile, high quality software process. The

NA-MIC Kit has been constructed as a layered architecture to provide a spectrum of capabilities, ranging from compute-intensive algorithms to easy-to-use applications. Hence users and developers can choose to engage the NA-MIC Kit at a variety of levels, including developing extensions which can be readily deployed to the broader biomedical imaging community.

In the following subsections we highlight the accomplishments from this reporting period for algorithms, engineering, and NA-MIC Kit.

2.1. Algorithms

The Algorithms team develops computational methods that support patient-specific analysis of medical images. This effort requires analysis of images that vary significantly from one patient to another, or from one time point to another, presenting distinct challenges to existing state-of-art medical image analysis algorithms. These technical challenges are addressed using four computational approaches: (1) Statistical models of anatomy and pathology; (2) Geometric correspondence; (3) User interactive tools for segmentation; and (4) Longitudinal and time-series analysis. Highlights of these efforts are described in the following sections.

Statistical models of anatomy and pathology. A great deal of progress has been made by using modeling approaches that systematically capture the statistics of a problem domain from a collection of examples and then use these statistics to interpret novel images. Some of the approaches include the following:

- *Non-Parametric Priors for Segmentation* are based on nonparametric, probabilistic models for the automatic segmentation of medical images, given a training set of images and corresponding label maps. The resulting inference algorithms rely on pairwise registrations between the test image and individual training images. The training labels are then transferred to the test image and fused to compute the final segmentation of the test subject.
- *Fast Nearest-Neighbor Lookup in Large Image Databases* has been found to improve segmentation quality. Multi-atlases or nonparametric atlas-based techniques for image segmentation require registration of a test image with a small set of very similar images from a database.
- *Atlases and Registration for DTI Processing* are novel methods that enhance the co-registration of DTI data either to a prior image of the same subject or to an existing atlas with predefined fiber tracts or regional white matter parcellation. These are applied in cases of large brain pathology (e.g., TBI).

Geometric correspondence. Establishing anatomical correspondences between pairs of patients, groups of patients, patients and templates, and individual patients over time is important for automatic and user-assisted image analysis. The ability to establish geometric correspondences, with and without expert guidance, in challenging clinical circumstances is essential for the DBPs. Progress in two areas was realized this year.

- *Stochastic Point Set Registration* provides non-rigid point set registration algorithms that seek an optimal set of radial basis functions to describe the registration. Preliminary results on 2D and 3D data demonstrate the algorithms' robustness to datasets with noise and with missing information.
- *Automatic Correspondences For Shape Ensembles* has seen improvements in robustness of our entropy-based correspondence system. For example, we have developed a method for particles to interact on surfaces using geodesic distances, which improves the behavior of the system on sharp features or convoluted shapes.

User interactive tools for segmentation. The work performed in the past year addresses important aspects of user-interactive segmentation. The patient-specific analysis required by the DBPs has presented images of patients with pathologies and/or injuries that sometimes defy automated approaches. We have focused our research on three principal areas.

- *Control-Based Interactive Segmentation* is a novel contribution based on a modeling formulation that represents interactive segmentation as a feedback system, enabling a principled merging of automated methods and user input.
- *Globally Optimal Segmentation* is a set of methods that rely on global optimization of energy functions via graph cuts. Results on delayed contrast MRI from the Atrial Fibrillation project are quite promising, and this work is currently under review for publication.

- *Patient-Specific Segmentation Framework for Longitudinal MR Images of Traumatic Brain Injury* addresses the need for robust, reproducible segmentations of MR images of TBI and is crucial for quantitative analysis of recovery and treatment efficacy. Validation of this new automatic segmentation compared to expert segmentations of acute and chronic images was provided on 3 longitudinal TBI datasets, demonstrating that joint segmentation of 4D multi-time point data is superior to individual segmentations.

Longitudinal and time-series analysis. An important component of patient-specific data analysis is the ability to analyze multiple images from the same patient over time as a disease or injury progresses or responds to treatment, or to assess neurodevelopment or neurodegeneration. Longitudinal image analysis is important for all four DBPs in this project; we have focused in the past year on the areas described below.

- *Connectivity Changes in Disease* demonstrates a novel probabilistic framework to merge information from diffusion weighted imaging tractography and resting-state functional magnetic resonance imaging correlations to identify connectivity patterns in the brain. The method simultaneously infers the templates of latent connectivity for each population and the differences in connectivity between the groups.
- *Modeling Pathology Evolution* is used in brain tumor patients to monitor the state of disease and to evaluate therapeutic options. This work investigated a joint generative model of tumor growth and of image observation that naturally handles multimodal and longitudinal data, important for TBI.
- *Longitudinal Analysis of DTI Change Trajectories* develops models that represent the growth trajectories of individual subjects to study and understand white matter changes in neurodevelopment, neurodegeneration, and disease progress. Application of this methodology to study early brain development in a longitudinal neuroimaging study, including validation of reproducibility, has been shown.
- *Analysis of Longitudinal Shape Variability via Subject-Specific Growth Modeling* are statistical analyses of longitudinal imaging data which are crucial for understanding normal anatomical development as well as disease progression. We have developed a new type of growth model parameterized by acceleration, whereas standard methods typically control the velocity. This mimics the behavior of biological tissue; cross validation experiments show that our method is robust to missing observations, is less sensitive to noise, and is therefore more likely to capture the underlying biological growth.
- *Longitudinal and Time Series Analysis* are novel methods for longitudinal registration and time series regression. These methods enable compact approximation of an image time-series through an initial image and an initial momentum, resulting in dramatically simplified computations.

2.2 Engineering

The Engineering Team builds bridges between the various NA-MIC cores and ultimately to the wider biomedical computing community. Working with the Algorithms Team, it deploys leading edge biomedical computing tools back to the DBPs, which are then used to perform impactful health research. In addition, the tools developed by the Engineering Team are used to train and disseminate technologies across the research community. The Team places particular focus on developing sustainable communities through the creation of open platforms, quality-inducing software processes, and integration to a broad variety of computational tools and databases. The following describes some of the highlights of the past year's work.

The flagship product from the Engineering Team is the 3D Slicer application. It is the delivery platform for much current work, and it is an enabling technology for the wider biomedical computing community. This past year saw the release of Slicer version 4.0 (Slicer4) which represents a significant advance in capabilities and underlying technologies. Since its release at RSNA in November, Slicer4 has been downloaded over 45,000 times, at a rate of over 100 downloads per day, from users and research groups located around the world. Slicer4 is now a modern, stable platform built with the Qt GUI system (eliminated the previous KWWidgets GUI), and rewritten for simplicity, enabling simpler approaches to debugging, faster startup, and more responsive behavior.

Beyond the core Slicer4 platform, several important features were also added to the application. These include:

- The Slicer Extension Manager is now called the "Slicer Catalog" (an App Store) and will enable the community to create compact modules which extend the core functionality.
- Python has been adopted as the preferred scripting language, a preferred programming language in the scientific computing community. Hence a variety of computational packages are now available to extend Slicer capabilities at run-time.
- Slicer4 includes a DICOM listener and DICOM Query/Retrieve capabilities for integration with standard clinical image management environments and workflows.
- Compatibility with ITK version 4 was developed and continuously maintained over the past year as ITKv4 matured. Slicer will officially switch to ITKv4 in the coming months.
- Slicer Execution Model modules (also known as Command Line Modules) are now available as Nipype tools, enabling local and distributed scripted execution of processing pipelines. Such methods for distributed computing are essential to tackling the Big Data and complex algorithms that current research is producing.
- Finally, a whole host of application improvements have been made including an improved flexible view layout system; a revised implementation of the Expectation Maximization (EM) Segmenter; faster hardware-accelerated volume rendering; improved markups and annotations; improved atlas and model hierarchy support; and a streamlined and revised diffusion MRI implementation.

Community support for NA-MIC and the various NA-MIC Kit tools continues. The goals of this effort are to transition new technologies to the wider community, to enable community members to contribute back to Slicer and the NA-MIC Kit, and to ensure high-quality systems. Beyond some of the support activities mentioned previously, the following are other accomplishments.

- We have begun integrating the SimpleITK module of ITKv4 into Slicer to ensure simple integration capabilities with emerging algorithms.
- Additional open data support has been added to Slicer such as ultrasound (e.g., video) and 4D (e.g., gated CT) data.
- We have integrated the extension writing and the documentation generation processes. The documentation created when an extension is written is now automatically ported to a web host for easier access from within and outside of Slicer, ensuring that documentation resources keep up with the rapid pace of development.

2.3 NA-MIC Kit

The NA-MIC Kit is designed to accelerate the pace of research and facilitate clinical evaluation. Along these lines, the past year realized significant milestones toward the creation of a stable research platform, supporting the ability to easily extend and disseminate novel additions, all in the context of a world-wide, broad research community. Beyond the major highlights related to the Slicer4 application platform described in the previous section, the following are a few of the highlights of the past year.

- CMake and its associated software process tools (CTest, CDash, and CPack) are used to build, test and deploy software in a cross-platform manner. CMake continues one of the most well-known pieces of the NA-MIC Kit, with more than 2,000 known downloads per day (as well as being included by various Linux distributions). CMake 2.8.7 was released with NA-MIC support.
- CDash Package Manager (CDash 2.0.2) was released with support from NA-MIC. One of the most significant contributions to CDash from NA-MIC was the package upload process. This process enables the many Slicer testing machines to upload the executables and packages created during testing to the main CDash server. This, in turn, allows users to download those testing packages and run additional tests or use them in their research. This complete automation of the test-release cycle is a massive time-saver for the Service core and has greatly reduced the time to discover and resolve bugs and to improve the stability of Slicer.
- Significant data integration efforts were completed over the past year. XNAT was greatly improved in its usability and interfaces. DICOM support was greatly enhanced, including the ability to embed Slicer

MRML scene files as DICOM lollipops, meaning that Slicer data exchange across the DICOM standard is now possible. In addition, DCMTK was integrated into the NA-MIC Kit, meaning that DICOM support and functionality was greatly increased.

- NA-MIC supports and nurtures an extensive biomedical research community. Along these lines it develops integration tools and interfaces with other communities. CTK, supported by NA-MIC funding, is one such community and interfaces with other open-source toolkits (e.g., MITK from the German Cancer Research Center in Heidelberg, XIP from Siemens, GIMIAS from UPF in Spain, and OpenMAF from U of Bologna). CTK now provides several innovative GUI and DICOM elements that specifically save GUI space, user-time, and developer effort when building custom medical applications. The NA-MIC Kit also integrated the BRAINSFit system, a collection of programs for registering images with mutual information based metric. BRAINSFit uses the Slicer execution model framework to define the command line arguments and is fully integrated with Slicer using the module discovery capabilities.
- Recent developments are in the process of being integrated into the NA-MIC Kit and the Slicer application platform.
- The Slicer Catalog allows users to install, uninstall, search, browse, and rank Slicer extensions. This user experience is available from within Slicer and over the web, much like the Android and Apple App Stores. Developers can contribute, update, document, and post screenshots on their modules and receive community feedback.
- The analysis infrastructure for Diffusion Weighted MRI (DWI) IO and visualization has been generalized to be used for other time varying acquisitions like multivolume analysis, dynamic contrast enhanced MRI (DCE), and gated cardiac CT.
- To cover the use of Qt and newer versions of VTK (both part of the NA-MIC Kit), advanced charting and analytics options have been demonstrated in Slicer4, and will be fleshed out in the coming year.

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3. IMPACT AND VALUE TO BIOCOMPUTING

NA-MIC impacts the field of biocomputing through a variety of mechanisms. First, NA-MIC produces scientific results, methodologies, workflows, algorithms, imaging platforms, and software engineering tools and paradigms in an open environment that contributes directly to the body of knowledge available to the field. Second, NA-MIC science and technology enables the entire medical imaging community to build on NA-MIC results, methods, and techniques; to concentrate on the new science instead of developing supporting infrastructure; to leverage NA-MIC scientists and engineers to adapt NA-MIC technology to new problem domains; and to leverage NA-MIC infrastructure to distribute its own technology to a larger community.

3.1 Impact within the Center

Within the center, NA-MIC has formed a community around its software engineering tools, imaging platforms, algorithms, and clinical workflows. The NA-MIC calendar includes the All Hands Meeting and Winter Project Week, the Spring Algorithm Meeting, the Summer Project Week, 3D Slicer Mini-Retreats, Core Site Visits, and weekly telephone conferences. These events bring the NA-MIC community and the community at large together to address emerging needs through the joint development and application of methods and systems.

The NA-MIC software engineering tools (CMake, CDash, CTest, CPack) have enabled the development and distribution of a cross-platform, nightly tested, end-user application, known as 3D Slicer, that is a complex union of novel application code, visualization tools (VTK), imaging libraries (ITK, TEEM), data management (DCMTK), user interface libraries (Qt), and scripting languages (Python). The NA-MIC software engineering tools have been essential to the development and distribution of the 3D Slicer imaging platform to the NA-MIC community.

NA-MIC's end-user application, 3D Slicer, supports the research within NA-MIC by providing a base application for visualization, image analysis, and data management. This reporting period marked the introduction of Slicer version 4.0 (Slicer4), which provides a new underlying architecture and a modern user interface using Qt. The 3D Slicer supports multiplanar reformat, oblique reformat, surface and volume rendering, comparison viewers, tracked cursors, and multiple image layer blending. 3D Slicer can communicate with XNAT and DICOM databases to download data and upload results. 3D Slicer provides a multi-layer plugin mechanism, which permits researchers to quickly and easily integrate and distribute their technology with 3D Slicer. Plugins can be authored as separate executables, shared libraries, Python scripts, or as full first class 3D Slicer modules. These plugins can be distributed with 3D Slicer or distributed on a site maintained by the researcher (e.g., on the Neuroimaging Informatics Tools and Resources Clearinghouse, www.nitrc.org). 3D Slicer is available to all Center participants and the external community through its source code repository, official binary releases, and unofficial nightly binary snapshots. There are 8 training modules for 3D Slicer Version 4.1, which educate 3D Slicer Users on basic image review, use of advanced modules, and integration of new technology into 3D Slicer. Webinars are used to introduce the new versions of 3D Slicer.

NA-MIC drives the development of platforms and algorithms through the needs and research of its DBPs. Each DBP has selected specific workflows and roadmaps as focal points for development, with a goal of providing the community with complete end-to-end solutions using NA-MIC tools. Each DBP is connected to at least one member each from the Engineering and Algorithms teams, who together orchestrate NA-MIC activities to support their DBP. The four current DBPs in NA-MIC focus on the personal and longitudinal aspects of pathology and disease. These DBPs are Atrial Fibrillation, Adaptive Radiotherapy for Head and Neck Cancer, Huntington's Disease, and Traumatic Brain Injury. For each roadmap project, the software tools, exemplar data, and a tutorial are provided to the community to allow others to reproduce the results and apply the workflows in their own research programs.

NA-MIC algorithms are designed for and used to address specific needs of the DBPs. Multiple solution paths are explored and compared within NA-MIC, resulting in recommendations to the field. The NA-MIC algorithm groups have collaborated on a broad spectrum of methods for Structural Image Analysis, Diffusion Image Analysis, and Functional Image Analysis and have orchestrated the solutions to the DBP workflows and roadmaps. These efforts have led to fundamental advancements in shape representation, shape analysis, groupwise registration, diffusion estimation, segmentation and quantification, functional estimation, distortion correction, and clustering. To support the current DBPs, the Algorithms Team is focusing on Statistical models of anatomy and pathology, Geometric correspondence, User interactive tools for segmentation, and Longitudinal and time-series analysis.

3.2 Impact within NIH-Funded Research

Within NIH-funded research, NA-MIC is the National Center for Biomedical Computing (NCBC) collaborating center for eight other grants: PAR-05-063: R01EB005973 Automated FE Mesh Development, PAR-05-063: R01CA124377 An Integrated System for Image-Guided Radiofrequency Ablation of Liver Tumors, PAR-07-249: R01EB006733 Development and Dissemination of Robust Brain MRI Measurement Tools, PAR-07-249: R01MH084795 The Microstructural Basis of Abnormal Connectivity in Autism, PAR-07-249: R01CA131718 NA-MIC Virtual Colonoscopy, PAR-07-249: R01EB008171 3D Shape Analysis for Computational Anatomy, PAR-07-249: R01AA016748 Measuring Alcohol and Stress Interaction with Structural and Perfusion MRI, and PAR-08-183: R21EB009900 Johns Hopkins Skull Stripping.

NA-MIC also collaborates or has collaborated with other NIH funded organizations, including: U24RR026057 Collaborative Tools Support Network for BIRN, U24RR025736 BIRN CC, U54GM072970 NCBC Stanford Simbios, U54EB005149-04S1 NA-MIC Collaboration with NITRC, COPDGene® quantitative analysis, R01NS050568 BRAINS Morphology and Image Analysis, NCBC Supplement for Microscopy and Slicer, R01CA111288 NA-MIC Collaboration with Prostate BRP, U24RR021992 fBIRN, U41RR019703 NA-MIC Collaboration with NCIGT, U54LM008748 NCBC I2B2, U24RR021382 mBIRN, P41RR013218 NA-MIC Collaboration with NAC, BrainColor, Real-Time Computing for Image Guided Neurosurgery, UL1RR025758 NA-MIC support for Harvard CTSC Translational Imaging Consortium, Children's Pediatric Cardiology Collaboration with SCI/SPL/Northeastern.

NA-MIC events and tools garner national and international interest. Over 100 researchers participated in the NA-MIC All Hands Meeting and Winter Project Week in January 2012. Attendees were from 19 academic sites and 6 companies. Many of these participants were outside of NA-MIC and were attending the meetings to gain access to the NA-MIC tools and researchers. The Winter Project Week was expanded to include NA-MIC, NAC, NCIGT, CIMIT, and Cancer Care Ontario.

3.3 National and International Impact

NA-MIC collaborations include a number of international communities and organizations, including: Ontario Consortium of Adaptive Interventions for Radiation Oncology (OCAIRO), Computer Aided and Image Guidance Medical Interventions (CO-ME), NA-MIC Collaboration for Neurosurgical Intervention with University Hospital of Marburg Germany, Common Toolkit (CTK), Real Time Computer Simulation of Human Soft Organ Deformation for Computer Assisted Surgery, NA-MIC Collaboration with Research and Development Project on Intelligent Surgical Instruments, and the Vascular Modeling Toolkit Collaboration. NA-MIC collaborates with the organizations at all levels: tools, algorithms, clinical domain, and training.

Components of the NA-MIC Kit are used globally. The software engineering tools of CMake, CDash, and CTest are used by many open-source projects and commercial applications. For example, the K Desktop Environment (KDE) for Linux and Unix workstations uses CMake and CTest. KDE is one of the largest open source projects in the world. Many open source projects and commercial products are benefiting from the NA-MIC related contributions to ITK and VTK. The 3D Slicer version 4 (Slicer4) has been downloaded 16,375 times since its introduction in November 2011. The 3D Slicer also is being used as an image analysis platform in several fields outside of medical image analysis, in particular, biological image analysis, astronomy, and industrial inspection.

NA-MIC science is recognized by the medical imaging community. There are 332 NA-MIC related publications listed on PubMed. Many of these publications are represented in the most prestigious journals and conferences in the field. Overall, there are 516 publications that acknowledge NA-MIC support. Portions of the DBP workflows and roadmaps already are being used by researchers in the broader community and in the development of commercial products.

NA-MIC sponsored several events to promote NA-MIC tools and methodologies. In 2011 alone, NA-MIC hosted 12 workshops and training sessions at 11 domestic and international venues. Several of these workshops were held at international conferences including RSNA, SfN, AAPM, and MICCAI. The workshops and training sessions are individually targeted to meet the specific needs and interests of clinicians, biomedical engineers, or algorithm developers. Four hundred and fifty-seven clinical, biomedical, and algorithm researchers attended these events. Since 2005, two thousand and twelve clinical, biomedical, and algorithm researchers have been trained by NA-MIC. Aside from workshops and training events, NA-MIC had a physical presence at HBM and RSNA in the form of a booth. The booth at RSNA marked the introduction of Slicer4, was available for 54 hours of the conference, and provided attendees a selection of 13 hands-on demonstrations.

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4. DRIVING BIOLOGICAL PROJECTS

The four current DBPs ─ Atrial Fibrillation, Huntington's Disease, Adaptive Radiotherapy for Head and Neck Cancer, and Traumatic Brain Injury ─ are working on specific problems in patient-specific analysis of images that represent broader opportunities for technical innovation in medical image analysis. A summary of progress since July 1, 2011, is provided for each DBP.

4.1 Atrial Fibrillation

Key Investigators

Rob MacLeod, PI, SCI University of Utah, Bioengineering
Josh Cates, Research Associate, SCI University of Utah, Computer Science
Allen Tannenbaum, Boston University, NA-MIC Algorithms
Ross Whitaker, SCI University of Utah, NA-MIC Algorithms
Jim Miller, GE, NA-MIC Engineering
Host Institution: Comprehensive Arrthymia Research and Management Center (CARMA), University of Utah Health Sciences (www.carmacenter.org)

A. Introduction

Tissue remodeling of the atrial wall is the hallmark of Atrial Fibrillation (AF), a progressive cardiac disease that develops over time (months to years). The mechanisms of this transformation are only partially understood, but the current scientific focus on tissue remodeling and its putative role in AF suggests that novel forms of MRI can be used to evaluate new patients, predict success before ablation, analyze outcomes post-ablation, and guide repeat ablations. Such MRI-based therapies, however, urgently require advanced tools and software to support efficient workflows and accelerate the quantification and analysis of images. The CARMA─NA-MIC DBP project is addressing these needs through the development of algorithms and tools for the automated segmentation of heart structures and the MRI-based evaluation of AF progression and recovery.

The CARMA─NA-MIC DBP research and development activities are organized under three Specific Aims as follows:

1. Develop and validate image-based longitudinal diagnostic indices for AF
2. Develop automatic segmentation methods for the left atrium (LA) and adjacent structures
3. Develop an AF scoring scheme to evaluate disease progression and recovery from therapy

B. Research and Progress Report

CARMA─NA-MIC DBP activities over the past year include tangible progress towards Specific Aim 2, as we continue to work closely with collaborators from the Algorithms Team to develop strategies for automated segmentation of the left atrium from LGE-MRI. Yi Gao (BWH) has proposed a multi-atlas segmentation method for the LA endocardium that we have tested on our clinical data and are helping to refine to be more robust. We are also providing data and evaluating results for a project with Liangjia Zhu (Georgia Tech/BU) to evaluate a novel approach to active contour segmentation that includes an automatic identification of seed regions within the LA. More recent work involves a very active collaboration with Ross Whitaker (Utah) to test and refine a novel, globally optimal graph cut algorithm for LA wall segmentation.

In support of these and other collaborations, we released a public LGE-MRI database of 33 AF patient scans taken pre- and post-ablation, along with matching MRA data and manual LA segmentations. We also conducted an internal study of the consistency and accuracy (compared to a probabilistic ground truth) of the manual LA segmentations produced by the technicians at CARMA, to serve as a basis for comparison with automated approaches.

Another focus of DBP activities this year was the development of robust and practical image registration algorithms, which are important for the accomplishment of all DBP Specific Aims. One important research area

is the longitudinal analysis of tissue changes in the LA wall and the pulmonary veins, for which we have identified several common clinical use-cases and, in collaboration with Yi Gao (BWH), have worked out practical pipelines and parameter settings that we are currently implementing in Slicer4. We also have preliminary results for the registration of previously acquired MRI images and scar maps into the imaging space of fluoroscopy-guided ablation procedures. Merging of MRI-based, patient-specific information into the ablation will provide clinicians with a novel means of integrating information with spatial fidelity that they can now only combine in a very qualitative manner.

A major highlight of our work this year on diagnostics and clinical evaluation (Specific Aims 1 and 3) was our development of a more robust automatic approach to post-ablation LA scar segmentation. We presented this new method at SPIE Medical Imaging in February 2012 and are currently implementing it as a Slicer4 module. We are now applying similar approaches to create a robust algorithm for fibrosis segmentation, a much more challenging problem because of the subtle variations in image intensity associated with fibrosis. Initial results have proved accurate when compared to manual ground-truth segmentations. In May 2012, we will participate in a scar and fibrosis segmentation challenge at the IEEE Symposium on Biomedical Imaging, which we co-organized with Kawal Rhode at Kings College, London, and Dana Peters at Yale. The goal of the challenge is to highlight this particularly challenging segmentation problem and support quantitative evaluation of algorithms and then discussion of their relative performance.

C. Plans

Research activities in the next year include further development of automatic segmentation of the LA, through collaboration with Ross Whitaker (Utah) and Allen Tannenbaum (BU), and refinement and testing of our registration techniques for both diagnostic (LGE-MRI to LGE-MRI) and therapeutic (LGE-MRI to fluoroscopy) purposes. We will also continue to focus heavily on developing a more automated approach to segmentation of fibrosis in pre-ablation images. While our current approach compares well with manual ground truth, it still requires improvements in sensitivity to achieve the robustness of manual methods, especially in predicting successful outcome of RF ablation (the Utah AF scoring scheme). We also plan to release additional patient data to supplement the existing public database. Specifically, we will include not only more subjects but also additional time points (6-month and 1-year follow-up scans) and anatomical landmarks (pulmonary vein, mitral valve, and appendage attachment locations).

Over the next year we will increase our engineering activities to disseminate algorithms from the CARMA─NA-MIC DBP through Slicer4. Specifically, we will release (1) a registration module for cardiac LGE-MRI that includes preset parameters for specific use-cases, (2) an intensity inhomogeneity correction module, (3) a parameter-free automatic scar segmentation module, and (4) a landmark-based registration module for pre/post pulmonary vein antrum evaluation. We will also work closely with our algorithms partners to test and develop their Slicer4 automatic segmentation modules.

D. References cited in 4.1

Peer-reviewed conference proceedings

Perry D., Morris A., Burgon N., McGann C., MacLeod R., Cates J. Automatic classification of scar tissue in late gadolinium enhancement cardiac MRI for the assessment of left-atrial wall injury after radiofrequency ablation, SPIE Medical Imaging February 2-9, 2012.

4.2 Huntington's Disease

Key Investigators
Hans Johnson, PI, University of Iowa, Iowa City IA
Martin Styner, UNC, NA-MIC Algorithms and Engineering
Host Institution: University of Iowa

A. Introduction

PREDICT-HD (Neurobiological Predictors of Huntington's Disease) is an NIH-funded project designed to quantify the neurologic and morphologic changes in pre-symptomatic Huntington's gene-positive carriers so that drug-therapy trials can be performed in patients before symptomatic onset. The aims of this work are to: (1) create longitudinal neurological morphometric analysis on individual subjects from multimodal data, (2) perform full brain diffusion tensor imaging (DTI) tractography analysis on individual subjects, and (3) create rigorous and reproducible results through the deployment of extensible tools for sharing source data, derived results, algorithms, and methods with external multi-site analysis groups (Figure 1).

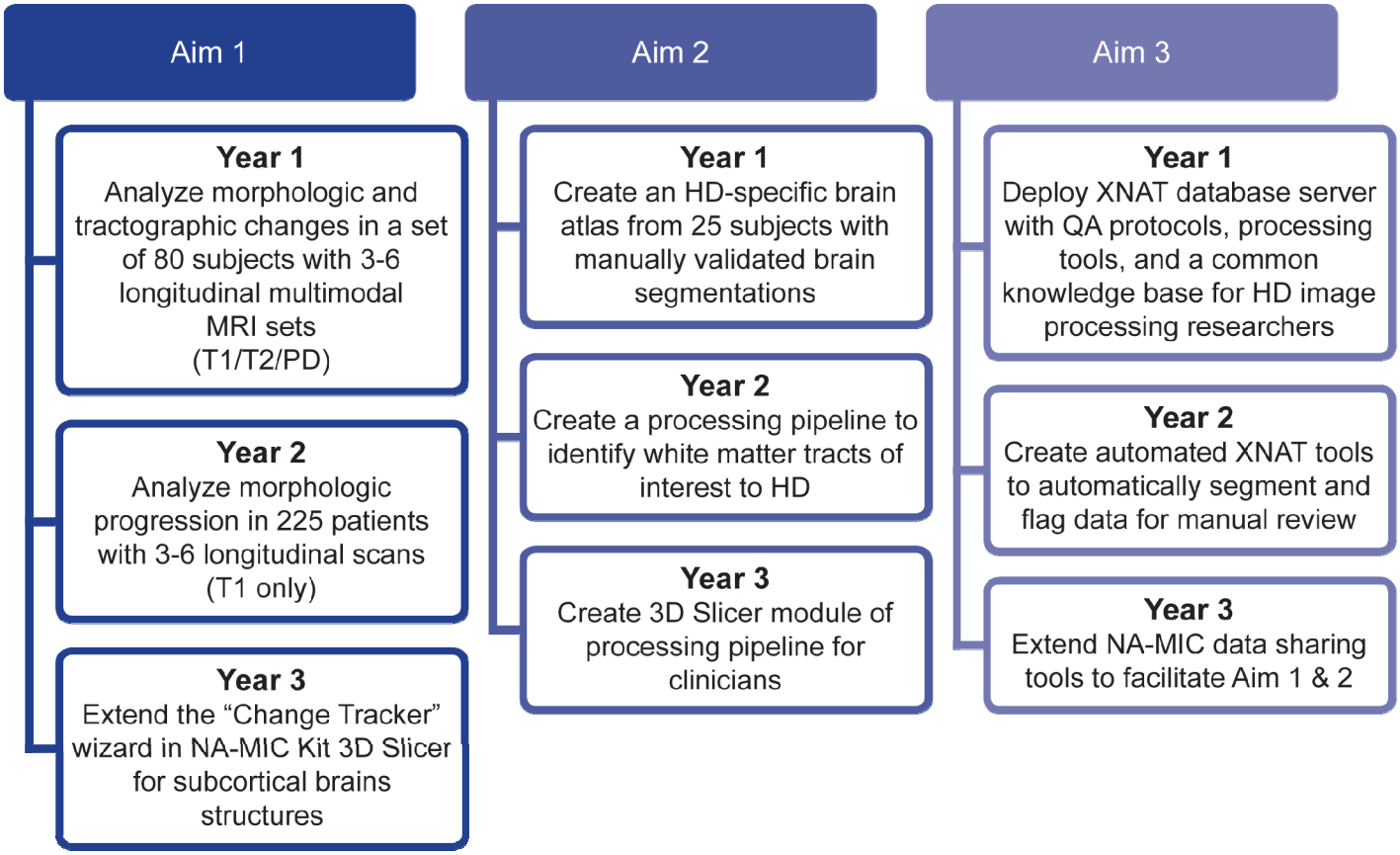

Figure 1. Specific aims of the Huntington's Disease DBP.

B. Research Progress

During 2011-2012, we were able to accomplish many important advancements in the analysis of HD. In addition, we were able to contribute many new tools to the NA-MIC community as well as provide training and exposure to researchers both within and outside the NA-MIC community.

B.1 Year 2 Achievements: Aim 1

Our goal for this year was to progress from the preliminary longitudinal shape analysis tools developed in Year 1 to more robust and mature versions appropriate for large cohort studies with increased automation and reliability. The tool DTIPrep [DTIPrep] developed collaboratively with Martin Styner's lab at UNC-Chapel Hill, has been improved to correct for motion/eddy current artifacts, estimate and filter noise in DTI, achieve better

DTI estimation, and generate a property map to provide comprehensive information about specific scan quality failures, thus allowing for meta-analysis of failures across site, scanner, and protocol. In addition, DTI-Reg has been created by the UNC group to pipeline pair-wise DTI registration using scalar FA maps. Individual steps of the pair-wise registration pipeline are performed via external applications - some of which are Slicer modules. Registration is performed between these FA maps via BRAINSDemonWarp or Advanced Normalization Toolkit (ANTS), which provide different registration schemes: rigid, affine, BSpline, diffeomorphic, and logDemons.

We contributed a 3D Slicer compatible build system for the ANTS package, modularized the registration framework, and created a 3D Slicer compatible utility called CompositeTransformUtil. This program can create a composite transform from a list of individual transform files in the ITKv4 compatible format, and save it to a single transform file. It can also read a composite transform and save each of its constituent transforms to a separate file. This will allow us to bridge the ITKv3 based tools and the performance enhanced ITKv4 tools to create cross-sectional or longitudinal atlases from large cohort studies and measure subjects against a statistically valid mean anatomy.

B.2 Year 2 Achievements: Aim 2

Joy Matsui and Mark Scully have integrated GTRACT [GTRACT] and DTIPrep into our longitudinal white matter analysis pipeline. Additionally, Joy is working with Demian Wasserman (BWH) on developing appropriate data analysis for the pipeline results. We currently have several papers in revision on her work with DTI analysis applied to subjects with apparent pathological changes from disease onset.

GTRACT has been integrated as an optional component in both the ITKv3 and the ITKv4 versions of Slicer.

B.3 Year 2 Achievements: Aim 3

XNAT pipeline development has continued on schedule with the implementation of our BRAINSImageEval tool. This application notifies our QA personnel when new scans have been uploaded to our server from our PREDICT-HD clinical sites, allows them to verify and score the usability of the data, and loads the image reviews onto our XNAT server. The quality reports of the data are then used to identify the best processing strategies.

In addition, Hans has worked closely with Satra Ghosh (BWH) on integrating Slicer modules with Nipype [Nipype] a neuroimaging pipeline Python package, and improving the Nipype cluster processing for use on the University of Iowa's High-Performance Computing (HPC) cluster.

B.4 Year 2 Achievements: Additional

Hans has been working closely with the ITK community to integrate the newest version of ITK (version 4) with Slicer, as well as to integrate additional support for Python scripting functionality within Slicer (SimpleITK). A bridging mechanism that allows convenient integration of SimpleITK and Slicer (sitkUtils) has been contributed. At MICCAI 2011, the 2011 Winter Project Week, the March 21-22 Iowa Training conference, and during a 7 part lecture series at the University of Iowa he gave a tutorial presentation on Slicer, NA-MIC, ITKv4 and SimpleITK.

Hans, Joy, Regina, Mark, and Dave Welch participated in the 2011 Winter Project Meeting. During the meeting, Dave began work with Ron Kikinis and Nicole Aucoin (BWH) on a fast registration module for the AMIGO [AMIGO] surgery suite (to be completed by June 2012), Regina and Mark implemented a prototype SPHARM [SPHARM] pipeline, Joy investigated fiber tracking methods in Slicer, and Hans met with Nipype's lead developer.

Iowa hosted a NA-MIC training session [Slicer Workshop] in March 2012 that was a huge success, with an attendance of over 35 individuals from 6 departments during the two-day conference. Later in April, Hans presented a seven-part lecture on 3D Slicer to the Iowa Institute of Biomedical Imaging (IIBI) with guest speakers from Nipype and Iowa's HPC.

Additionally, data-sharing through XNAT has become a benchmark success for open-data methods in neuroimaging, with many researchers and institutions accessing our database this year (Table 1).

Table 1: XNAT HD Data Collaborators

Requester	Institution	Project Description
Ramesh Sridharan Adrian Dalca	Polina Golland's Group, CSAIL, MIT	Learn image manifolds and the underlying structure of brain images by incorporating external constraints such as longitudinal data.
Archana Venkataraman	Polina Golland's Group, CSAIL, MIT	Model the structural-functional relationship in the brain and how it breaks down in clinical populations.
Manasi Datar Ross Whitaker	SCI Institue, School of Computing, University of Utah	Include longitudinal shape regression into the ShapeWorks framework
Martin Styner	University of North Carolina	Novel longitudinal shape analysis methodology applied to the nucleus caudate in Huntington's disease patients. Novel longitudinal DTI assessment methods applied to white matter fiber tracts of interest Huntington's disease patients.
Yi Gao	Georgia Tech	Segmentation and registration research.
Guido Gerig	University of Utah	Develop analysis methodologies for 4D MR images, specifically quantifying longitudinal anatomical changes and comparing such changes between different populations.
Carl-Fredrik Westin	Brigham and Women's Hospital / Harvard Medical School	Develop novel analysis methods.
Thomas Shultz	Max Plank Institute	Develop reliable and reproducible methods for in vivo segmentation of thalamic subnuclei.
William Wells	Brigham and Women's Hospital / Harvard Medical School	Evaluate quantitative susceptibility mapping.
Hans Johnson	University of Iowa	Developing new and refined existing tools to achieve the specific aims of the NA-MIC HD-DBP.
Casey Goodlett	Kitware	Develop registration algorithms for distribution in Slicer 3D.
Dan Marcus	Washington University in St. Louis School of Medicine	Improve data distribution and modeling methods for the XNAT imaging informatics platform.
Anuj Srivastava Sentibaleng Ncube	Florida State University	Development of novel Riemannian metrics for HARDI data analysis.
Stefan Klöppel Volkmar Glauche	Universitäts Freiburg	Study white matter changes in different stages of HD and compare data variability between diffusion directions for sequences with many directions but a single repetition.
Jessica Turner	University of California, Irvine	Develop the use of automated reasoning systems to represent the connectivity of white matter tracts.
Xiaodong Tao	GE Global Research Center	Improve the DicomToNrrd diffusion tensor conversion tool, and improve 3D Slicer (www.slicer.org) DTI analysis processing
Zhexing Liu	The University of North Carolina at Chapel Hill	Improve the DTIPrep diffusion tensor quality control tool.

Kent Williams updated and refactored the Dicom2Nrrd conversion module in Slicer and is waiting upon integration by the Slicer community. This represents a major improvement to Slicer's support for the DICOM file format, in particular for DTI and DWI data. The previous version of Dicom2Nrrd was difficult to maintain and incompatible with ITKv4's version of GDCM (Grassroots Dicom). The current version is much better structured, easier to maintain and expand, compatible with ITKv4, and handles a wider variety of DICOM formats.

BRAINSTools multithreading currently depends on ITKv3 implementation of Mattes Mutual Information metric. Significant effort was spent to debug and fix the multithreading issues in ITK. Where appropriate, those changes were included in ITKv3, otherwise the improvements are all available once the transition to ITKv4 occurs.

C. Plans

Our lab has several papers in progress (Magnotta, submitted to Brain Connectivity; and Matsui, submitted to Human Brain Mapping) that will be published during the next year. We also have begun work on our longitudinal, large cohort study that will be completed within the year. In addition, we continue with our efforts to integrate SPHARM with Slicer.

In year 3, David will create normative healthy and diseased models of subjects with the use of ANTS and SPHARM for Aim 1. Aim 2 will be fulfilled with a Nipype-based workflow running our BRAINSStandAlone utilities in concert with the white matter tractography tools Joy has been developing.

Documentation and sharing of workflows will be done through the NA-MIC wiki to complete Aim 3. In addition, the use of Nipype will make it possible to describe our methods in publications to such a degree that the effort needed for reproduction will be minimized.

D. References cited in 4.2

1. DTIprep [http://www.nitrc.org/projects/dtiprep/]
2. GTRACT [http://www.nitrc.org/projects/vmagnotta/]
3. Nipype, Gorgolewski K., Burns C.D., Madison C., Clark D., Halchenko Y.O., Waskom M.L., Ghosh S.S.,"Nipype: a flexible, lightweight and extensible neuroimaging data processing framework in Python," Front. Neuroinform. 5:13, 2011.
4. AMIGO [http://www.ncigt.org/pages/AMIGO]
5. SPHARM [http://www.nitrc.org/projects/spharm-pdm]
6. Slicer Workshop at Iowa [http://wiki.na-mic.org/Wiki/index.php/Iowa-March-20-2012-Slicer-Workshop]

4.3 Roadmap Project: Adaptive Radiotherapy for Head and Neck Cancer

Key Investigators
Gregory C. Sharp, PI, Massachusetts General Hospital
Polina Golland, MIT, NA-MIC Algorithms
Allen Tannenbaum, BU, NA-MIC Algorithms
Steve Pieper, Isomics, NA-MIC Engineering
Host Institution: Massachusetts General Hospital

A. Introduction

Head and neck cancers account for about 60,000 new cancer cases per year and represent 4-6% of all cancers in the United States. Sixty percent of patients present with advanced disease. The five-year survival is approximately 50%. These cancers are treated by a combination of chemotherapy, radiotherapy, and surgery. During a six-week regimen of radiotherapy, head and neck cancer patients often exhibit anatomic changes that affect their treatment. These changes include tumor regression or growth, changes in lymph node size, and changes in air cavities. Uncorrected, these changes can increase the risk of treatment complications or reduce treatment efficacy.

Adaptive radiotherapy addresses the problem of anatomic change by incrementally adjusting the radiotherapy plan. It is a prime example of personalized medicine. A mid-treatment adjustment is complex, requiring a new CT image, image segmentation, deformable registration, and mapping of the previously delivered dose onto the new image. This project proposes to use the NA-MIC Kit to develop a simple, practical workflow for achieving adaptive radiotherapy which can be applied on a case-by-case basis.

B. Research Progress

B.1 Clinical

Analysis was performed to determine if adaptive replanning is needed to compensate for anatomic change during proton-beam radiotherapy. CT images of eight patients treated with proton therapy in the base of the skull were acquired prior to radiotherapy and mid-treatment. The physician delineated the tumor volumes and critical structure volumes on the pre-treatment scan. The CT scan acquired at mid-course was registered rigidly to the bony structures of the skull to remove the setup error. A deformable B-spline based registration was then performed to transfer structure contours from the planning CT to the mid-treatment CT. The original treatment plan was then applied to the mid-course CT, and proton dose was recalculated. Anatomic differences between the two CT scans were analyzed interactively, and dose distributions were evaluated by comparing isodose lines and distance-to-agreement analysis. Dose-volume histograms were compared using transferred contours on the mid-course CT and original contours on the pre-treatment CT.

Anatomic change was noted in all eight cases. The most prominent patient response to the treatment was tumor shrinkage in the nasal cavity and the paranasal sinuses. Three examples of dramatic anatomic change are shown in Figure 1. In the first case (left), the tumor volume (outlined in green) has become calcified as a result of therapy. The calcified tissue is of higher density, which affects the range of a proton beam. The beam loses energy more rapidly in the dense region, which might lead to underdosing at the most distal edge of the beam. In the other two cases (center, right), the tumor has shown a good response to therapy, and the tumor has shrunk. Areas within the volume which were tissue density are now replaced with air. In contrast to the calcified tissue, which absorbs more energy per unit length than tissue, the air absorbs little energy, but does scatter the proton beam. The expected effect of this change is to produce overdosing at the distal edge of the beam.

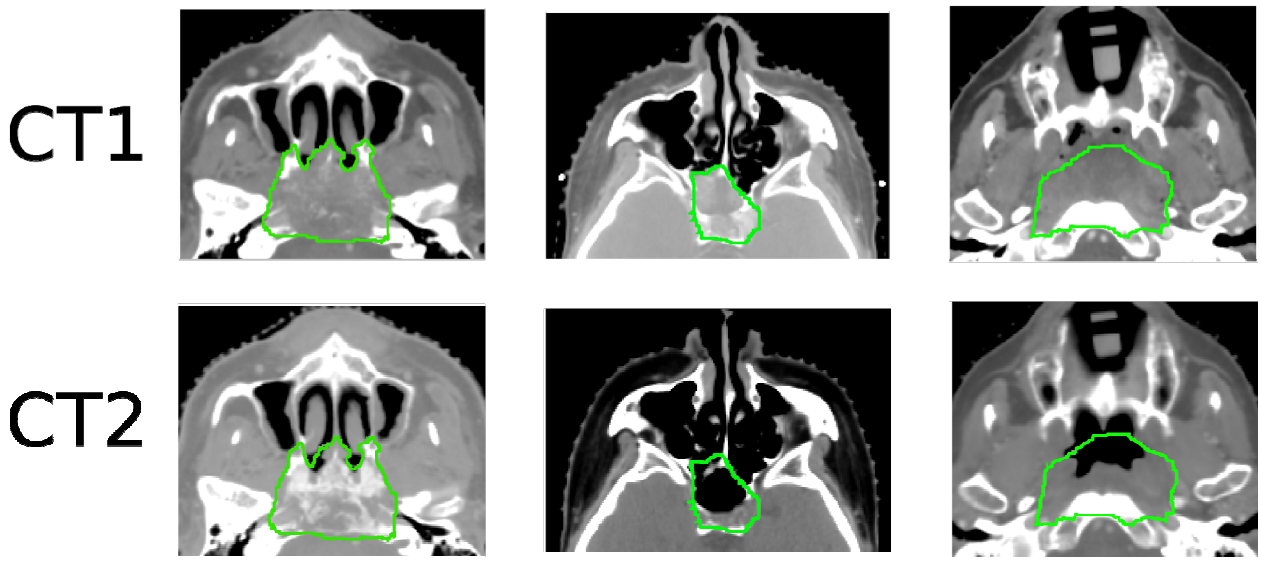

Figure 1. Anatomic change was identified inside gross tumor volume on eight patients with head and neck cancer. The top row shows pre-treatment anatomy, while the bottom row shows mid-treatment anatomy.

The effect of anatomic change on dose distribution was computed and assessed. Our analysis of the dosimetry concentrated on changes in dose to the tumor volume, and changes in dose to the normal tissues. An example of changes in the dose to the tumor volume is shown in Figure 2, which demonstrates hot spots (left) and cold spots (right) in the planned dose distribution. We are still investigating the origin of these findings, but the most likely cause is anatomic change. From pre-treatment to mid-treatment CT, we identified a change in the average gross tumor volume of -12% (range 0%-36%). In most cases, the lost tumor volume is replaced with air. This is verified by noting a median decrease in tumor density of 43 Hounsfield Units (=4.3% of the density of water). In addition to tumor volume, we analyzed normal tissues and found a median increase of mean dose to the brainstem of 1.5%, and median increase of maximum dose to the brainstem of 8%. The details of the study will be presented at the AAPM annual meeting.

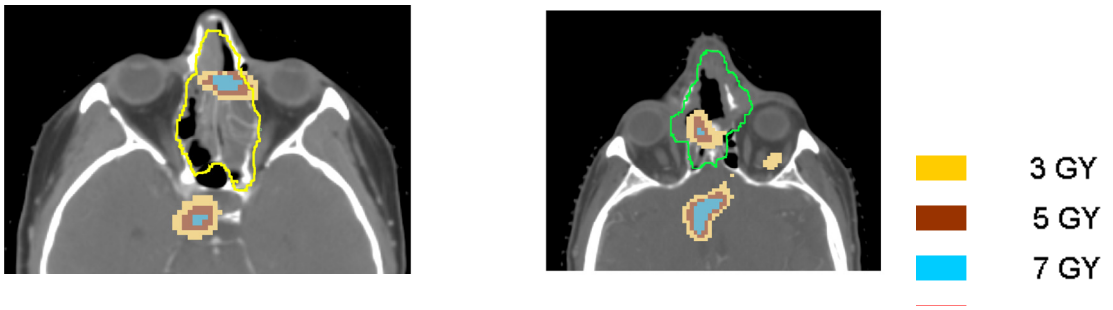

Figure 2. In some cases, hot spots (left) and cold spots (right) of greater than 5% were identified in the planned dose distribution. These effects are likely caused by anatomic change.

B.2 Algorithms

Image segmentation is a key technology needed to make adaptive radiotherapy a practical option for head and neck cancer patients. Through our collaboration with MIT, we have performed a thorough evaluation of a non-parametric approach to image segmentation. This method is a multi-atlas based approach in which multiple labeled images are registered to the unlabeled target image, and then a weighted voting method is applied to transfer the labels. Analysis was performed on the left and right parotids and the brainstem, as these structures are particularly challenging to contour because of inter-patient variability. The algorithm compensates for patient variability by emphasizing contributions from training images that are more locally similar to the target

image. With a database of sixteen images, we achieved mean Hausdorff distances of 2.8 mm for the brainstem, and between 3.4 and 4.4 mm for the parotid glands. The details of this study will be presented at the American Association of Physicists in Medicine (AAPM) annual meeting.

Deformable image registration is another key component of adaptive radiotherapy. In this year, we have addressed the problem of interactive registration, which is needed for cases where automatic registration fails. The method used is an analytically regularized landmark spline, which takes point landmarks from the user and interpolates a vector field as a sum of Gaussian kernels. Unlike previous approaches, this method is both local and regularized. The locality property is essential for making fine corrections to a deformation without disturbing distant areas, and the regularization is needed to preserve invertibility. This work has been statistically validated and was recently published in Physics in Medicine and Biology as a featured article.

Interactive segmentation methods based on control theory introduced at Boston University will also be tested as part of our research program. Initial results were evaluated at the winter project week meeting and the results have been very encouraging. Stochastic based elastic registration methodologies developed at Boston University should also be very relevant to this part of the project.

B.3 Engineering

The engineering plan for the DBP is proceeding according to schedule, and we have achieved all project milestones. The DICOM-RT import/export modules were available early in 2011, and we released the first version of the adaptive dose warping module at the project week in June 2011. These modules are fully documented, and include end-user tutorials. In the third quarter of 2011, we upgraded the B-spline registration module to include analytic regularization. Finally, a working prototype of a dose review tool was introduced at the winter project week in January 2012. A screenshot for this module is shown Figure 3, which demonstrates the use of the 3D gamma method for dose comparison. The gamma method is well established in the medical physics community for comparing two spatial distributions of radiation, because it lets the user define action thresholds on both the absolute dose difference and the spatial similarity.

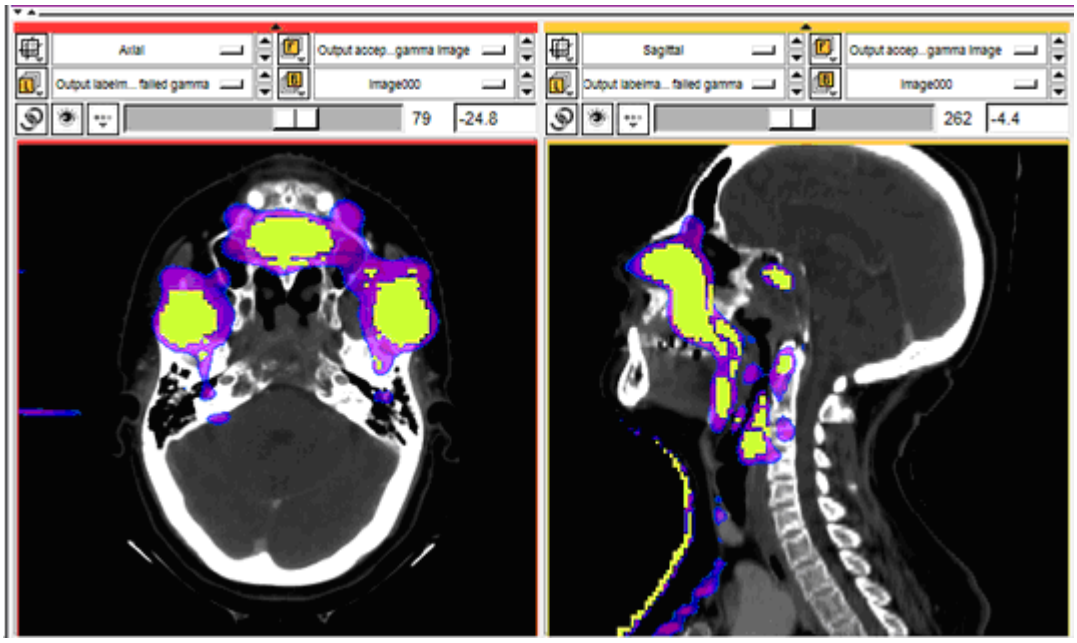

Figure 3. A new dose comparison tool developed for Slicer uses the 3D Gamma index to compared two different doses and highlight changes.

C. Plans

In the coming year, we plan to address the following goals: (1) A 3D Slicer module for atlas-based segmentation of head and neck cancer; (2) Improved support for radiotherapy structure sets in 3D Slicer (3) Improve and document dose review tools; (4) Review and improve interactive segmentation tools.

D. References cited in 4.3

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Peroni M., Golland P., Sharp G.C., Baroni G. *Ranking of Stopping Criteria for Log Domain Diffeomorphic Demons Application in Clinical Radiation Therapy*. Conf Proc IEEE Eng Med Biol Soc. 2011;2011:4884-7. PMID: 22255433.

4.4. Traumatic Brain Injury

Key Investigators
Jack Van Horn, PI, UCLA
Andrei Irimia, UCLA DBP Engineer
Guido Gerig, Utah and SCI Institute, NA-MIC Algorithms
Stephen Aylward, Kitware, NA-MIC Engineering
Host Institution: UCLA

A. Introduction

Traumatic brain injury (TBI) continues to be major health care and research challenge. Each year there are 1.7 million new cases of TBI, fully half are considered mild. Severe, or long-term brain injury, results in 650,000 hospitalizations each year. Known as the 'silent epidemic,' these cases are associated with unresponsiveness, coma, brain death, and eventually death. The cost to society is enormous. The estimated cost is $48 billion in case management and loss to the US workforce. Many of these injuries occur during motor vehicle accidents and incidents at the workplace. Returning war veterans are also particularly affected. This report summarizes progress made by the TBI Driving Biological Project (DB) during the second year of the 3-year DBP cycle.

B. Research Progress

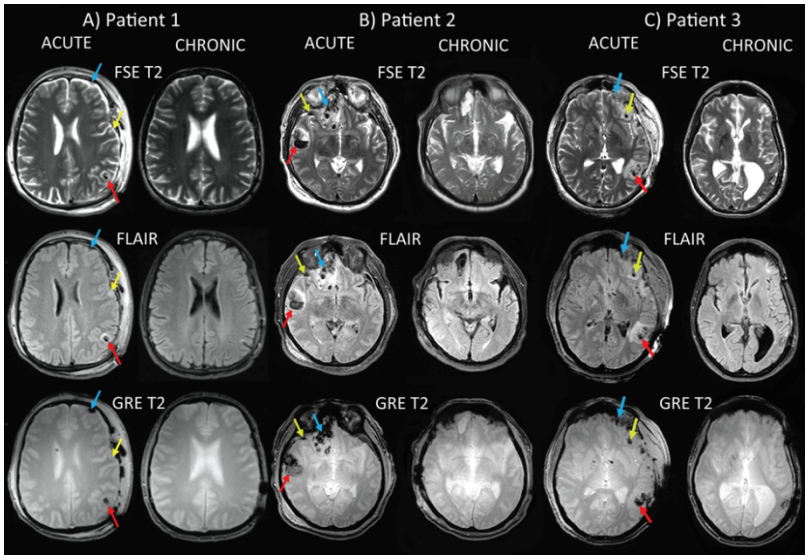

Figure 1. Sample MR images for three TBI cases labeled as Patient 1 (Part A), Patient 2 (Part B), and Patient 3 (Part C). Images are displayed in radiological convention. The sequence types shown include T_2, GRE T_2, and FLAIR. Red, green and blue arrows identify the locations of three different insults.

B.1 3D Slicer as a Tool for Longitudinal Neuroimaging of TBI

Throughout the past year, progress on this grant has been excellent. One of our important achievements is that we have developed a patient-tailored framework which makes use of 3D Slicer methodologies to allow mapping and characterization of TBI-related structural damage to the brain via multimodal neuroimaging and personalized connectomics. Specifically, we have introduced 3D Slicer workflows for the assessment of trauma-related atrophy of white matter (WM) connections between cortical structures, with relevance to the quantification of TBI chronic case evolution. Our workflows allow one to use 3D Slicer to inform the formulation of graphical neurophysiological and neuropsychological TBI profiles based on the particular structural deficits of the affected patient. In addition, they allow us to relate the findings supplied by our workflow to the existing body of research that focuses on the functional roles of the cortical structures being targeted. Our work is relevant for the purpose of using 3D Slicer to

investigate TBI patient status, which makes the 3D Slicer platform appreciably more appealing to TBI clinicians.

Our patient-tailored approaches to the graphical representation of WM change over time offer the ability to use 3D Slicer to produce detailed noninvasive characterization of TBI-related GM/WM abnormality and atrophy in vivo. This allows the visualization of brain connections affected by pathology as obviated by MRI and to relate patient injury profiles to the existing body of scientific and clinical knowledge on affected cortical structure function. These methods, which make use of VTK/ITK functionality, provide the ability to quantify the neural atrophy of WM tracts for personalized connectomics. Consequently, they allow one to integrate neuroimaging knowledge with other clinical case information so as to inform clinicians on specific neuroplasticity and neurodegeneration patterns that occur in the TBI brain. Using this approach, we hope to contribute to the clinical care of TBI patients, maximizing the utility of modern neuroimaging technologies, and having possible implications for the improvement of outcome in this important clinical population.

B.2 VTK/ITK methods for DTI-based structural connectivity in TBI

One of our notable efforts as part of our collaboration within the NA-MIC consortium has involved the development and implementation of DTI-based workflows for the analysis of structural connectivity. Specifically, we have developed ITK/VTK modules for computing inter-region brain connectivity in both TBI and healthy adults. To accomplish this, we have developed methods that allow the location of fiber tract extremities to be identified and then associated with appropriately parcellated gyral and sulcal structures in the brain. This has allowed us to generate brain connectivity matrices of the brain in both health and TBI. Because they make use of VTK/ITK functionality, these workflows are integrated with 3D Slicer tools and, consequently, they can significantly aid the investigation of connectivity using this environment.

In our approach, appropriate connectivity matrix entries can be updated as necessary to reflect fiber count increments. To validate the accuracy of algorithm results, connectivity results as produced using our VTK/ITK software can be reproduced by individually counting all fibers in 3D Slicer that connect any two brain regions. For each pair of cortical regions, our VTK/ITK modules allow the change Δ in the fiber density D between times t1 and t2 to be computed as a percentage of the fiber count at acute baseline based on the multimodal imaging data acquired at the two time points. Fibers can also be thresholded by the user, who can specify either more conservative or more liberal values for the purpose of data exploration or for reasons related to statistical significance criteria.

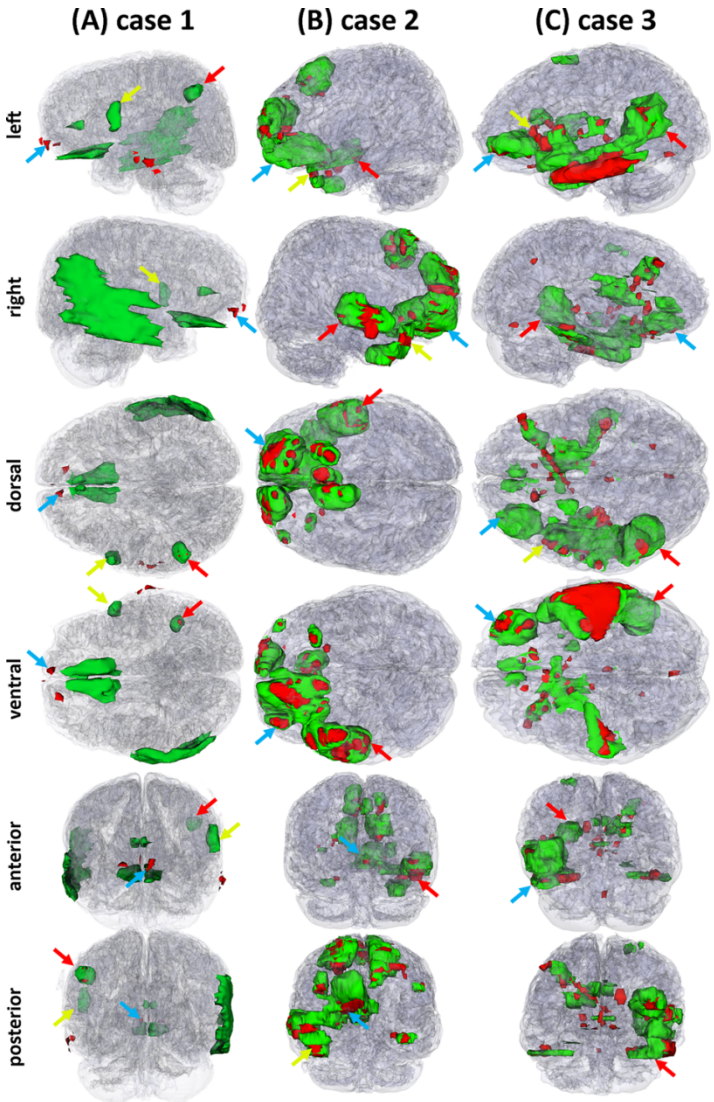

Figure 2. Three-dimensional models of automatically segmented TBI pathology superposed on transparent models of the brain for each patient. Edema and hemorrhage are shown in green and red, respectively. To guide the eye in localizing three distinct lesions in the 3D models, color-coded (red, green and blue) arrows are provided to identify the locations of the insults indicated in Figure 1 using corresponding colors.

B.3 Development of 3D Slicer Workflows for TBI pathology identification

Throughout the past year, we have continued and expanded the collaboration with our clinical colleagues in the Neurointensive Care Unit of the UCLA Ronald Reagan Medical Center. Specifically, we have continued to acquire and process TBI MR data using a newly implemented, state-of-the-art neuroimaging protocol. This protocol includes T_1-weighted MP-RAGE imaging, fast spin echo (FSE) T_2–weighted imaging, gradient recalled echo (GRE) T_2, fluid attenuated inversion recovery (FLAIR) and 32-direction diffusion tensor imaging (DTI). Scanning sessions are held both one day (acute baseline) as well as 6 months (chronic follow-up) after TBI, and the same scanner and sequence parameters are used for both acute and chronic time in our patients.

In the past year, we have greatly extended and perfected our TBI image processing methodologies. Specifically, we have greatly advanced and streamlined the process whereby we perform pathology identification from MR images. The context of our perfected workflow is a desire to maximally utilize the multimodal information contained in the MR sequences used by our colleagues at the UCLA Neurointensive Care Unit, as well as our collaboration with the algorithm core members at the University of Utah.

In our approach, non-hemorrhagic lesions are coded as hyperintensities on FLAIR, and segmentation quality is confirmed using GRE imaging as well as TSE T2-weighted volumes. Non-hemorrhagic shearing lesions are defined as hyperintense lesions visible on T2-weighted or FLAIR images. Hemorrhagic lesions are defined as hypointense foci that are not compatible with vascular, bone, or artifactual structures on conventional GRE images. WM, GM and pathology are classified using 3D Slicer (slicer.org), and Atlas Based Classification (ABC), the latter having been developed by our colleagues at the University of Utah. Our use of 3D Slicer to provide TBI processing solutions for neurointensivists includes multimodal MR volume registration followed by tissue classification, lesion segmentation using outlier detection and by physical model estimation. Co-registration of MR volumes, intensity normalization within and between scans are applied in 3D Slicer. Our segmentation results in Slicer have been favorably compared to manual segmentations by a human expert. Another area of progress involves the integration of DTI data with structural imaging in 3D Slicer for the purpose of TBI neuroimaging. In this approach, diffusion tensors are computed from DWI images and rotationally re-oriented at each voxel. Tensor-valued images were linearly realigned based on trilinear interpolation of log-transformed tensors and resampled to isotropic voxel resolution.

B.4 3D Slicer Solutions for Clinically Driven TBI Rehabilitation Strategies

Rehabilitation of TBI is an exceedingly important public health goal not only because neurotrauma-related activity limitations can have significant impact upon life roles, but also because it affects interpersonal communication, as well as social participation in personal activities of daily living. In this context, our results and methodology hold implications for the systematic mapping of human neural impairment caused by this condition. Firstly, our 3D Slicer and VTK/ITK work is of potential clinical relevance to the study of neural atrophy changes. Aside from identifying and describing connectomic patient profiles, our methodologies can be used to generate suggestions for informing and guiding clinical interventions designed to ameliorate recuperation. Rapidly visualizing the longitudinal evolution of individual TBI cases using our 3D Slicer tools can reveal how deficit patterns are influenced by lesion site, by relative sparing and redundancy within the distributed cortical system under scrutiny, as well as by the neural plastic changes that can occur with recovery.

Because of the high level of TBI neuroanatomic information that is made available through the use of 3D Slicer, our visualization workflows can be exploited to quickly delineate the function of specific WM fibers or cortical (sub-)regions. Thus, in addition to their relevance to the clinical field, our methods have potential applications to the formulation, validation or information of basic science theories concerning perceptual learning and neural plasticity. They could also complement and extend information already gained from previous animal and human lesion studies. The detailed level of structural impairment description afforded by our techniques can be used to construct more effective patient interventions. Such strategies can be used to explain occupational performance difficulties as well as to shed light upon existing or emerging compensatory rehabilitation techniques.

The potential for recovery from TBI depends on the patient's ability for regeneration of structures and on his/her capacity for neural plasticity. Consequently, the ability to provide TBI researchers and rehabilitation professionals with information regarding the longitudinal atrophy/regeneration profile of patients using VTK/ITK

and 3D Slicer is an important advantage of our work throughout the past year. Firstly, our techniques for rapidly visualizing structural WM connectivity in 3D Slicer may allow clinicians to compare changes in cortical regions and in connectivity with metrics of patient case evolution. Secondly, these tools can be applied to individual patients as well as used to visualize brain morphometric and connectomics on a population level, as well. Thirdly, the use of our framework to the study of atrophy profiles may be useful in the context of personalized rehabilitation treatments by informing qualified personnel on recovery prospects and by providing guidance in the process of evaluating the need for long-term care.

B.5 Outreach and Dissemination Events

Our TBI research was honored with the Mazziotta Prize of the Department of Neurology at UCLA for best postdoctoral research in the field of neurology. In addition, it received the First Prize and the Fine Science Award from the Brain Research Institute at UCLA, and the first Prize in the Annual Tutorial Contest of NA-MIC in Boston, MA. Our work was also acknowledged with several postdoctoral travel awards to various conferences, including Dynamics Days 2012 in Baltimore, MD and the Annual Meeting of the Society for Neuroscience in Washington, DC. Our research was selected for a postdoctoral travel award as well as a plenary session presentation that was made at the Keystone Symposium on Chronic Traumatic Encephalopathies. A member of our team was also selected to the Faculty of the Keystone Symposium Continuing Medical Education Program on account of our emerging expertise in the field.

C. References cited in 4.4

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Peer-reviewed conference proceedings

Wang B., Prastawa M.W., Awate S.P., Irimia A., Chambers M.C., Vespa P.M., Van Horn J.D., Gerig G. (2012) Segmentation of serial MRI of TBI patients using personalized atlas construction and topological change estimation *Proceedings of the Tenth International Symposium on Biomedical Imaging (ISBI 2012), May 2-5, 2012, Barcelona, Catalonia, Spain*

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5. COMPUTER SCIENCE CORE

The Computer Science Core is comprised of two complementary teams of scientists: Algorithms (Core 1a) and Engineering (Core 1b). NA-MIC drives the development of platforms and algorithms through the needs and research of its DBPs. Each DBP has selected specific workflows and roadmaps as focal points for development, with a goal of providing the community with complete end-to-end solutions using NA-MIC tools. Each DBP is assigned to one member from each team. They orchestrate the provision of NA-MIC resources to support the specific aims of the DBP.

5.1 ALGORITHMS

Key Investigators
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Ross Whitaker, Utah

The Algorithms team provides computational methods that support patient-specific analysis of medical images. The clinical data presented by the DBPs involve sequences of images of individuals with distinct anatomy, pathology, and function. This requires analysis of images that vary significantly from one patient to another, or from one time point to another, in ways that present distinct challenges to existing state-of-art image analysis algorithms. These technical challenges are addressed by using four computational approaches: (1) Statistical models of anatomy and pathology; (2) Geometric correspondence; (3) User interactive tools for segmentation; and (4) Longitudinal and time-series analysis.

5.1.1 Statistical Models of Anatomy and Pathology

A. Introduction

Statistical models play an important role in virtually all types of advanced algorithms in medical image analysis. Recently, a great deal of progress has been made by using modeling approaches that systematically capture the statistics of a problem domain from a collection of examples and then use these statistics to interpret novel images. Examples include the use of probabilistic atlases in the Bayesian segmentation strategy of the EM-Segmenter and knowledge-based priors in a Bayesian context. Another class of methods uses statistical shape priors in the form of active shape and appearance models and shape-based descriptors such as spherical harmonics or spherical wavelets. Recently, in the computer vision literature, scenes or configurations of objects have been modeled with stochastic grammars. Many of the state-of-art methods in medical image analysis rely on relatively simple parametric distributions, such as multivariate Gaussians. Learning is therefore reduced to estimating a small number of parameters, e.g., the mean and the modes of variation of the Gaussian distribution.

Unfortunately, large inherently nonlinear anatomical variations in heterogeneous populations cannot be captured accurately by traditional parametric models. For instance, the changes in the surrounding anatomy induced by a tumor cannot be represented as small, continuous deviations from a mean. Likewise, the positions of organs in a highly deformable anatomy, such as abdomen, do not form small variations around a mean value. Thus, there is a need for more sophisticated models to adequately address problems in personalized medicine. The challenge of developing and using statistical models is the necessary balance between the expressiveness of the model and the ability to robustly learn the appropriate parameters from limited sets of examples and to apply these models.

The use of statistical models will address the needs of the DBPs in several ways. Our research in statistical modeling from images will lead to practical algorithms directly relevant to the clinical problems of the DBPs. Specifically, we will develop models that can handle the severe effects of brain injury (TBI) on intensity and

shape of brain structures, the differences in anatomical images induced by changes in the tumor and surrounding structures in the course of radiation treatment, the changes in heart images that result from fibrosis and remodeling (before and after ablation), the effects of lesions on white matter connectivity, and the longitudinal change due to brain tissue degeneration in brain disorders such as Alzheimer's and Huntington's disease.

B. Research Progress Report

B.1 Non-Parametric Priors for Segmentation: We demonstrated a nonparametric, probabilistic model for the automatic segmentation of medical images, given a training set of images and corresponding label maps. The resulting inference algorithms rely on pairwise registrations between the test image and individual training images. The training labels are then transferred to the test image and fused to compute the final segmentation of the test subject. Such label fusion methods have been shown to yield accurate segmentation, since the use of multiple registrations captures greater inter-subject anatomical variability and improves robustness against occasional registration failures. Previously, we developed the first comprehensive probabilistic framework that rigorously motivates label fusion as a segmentation approach.

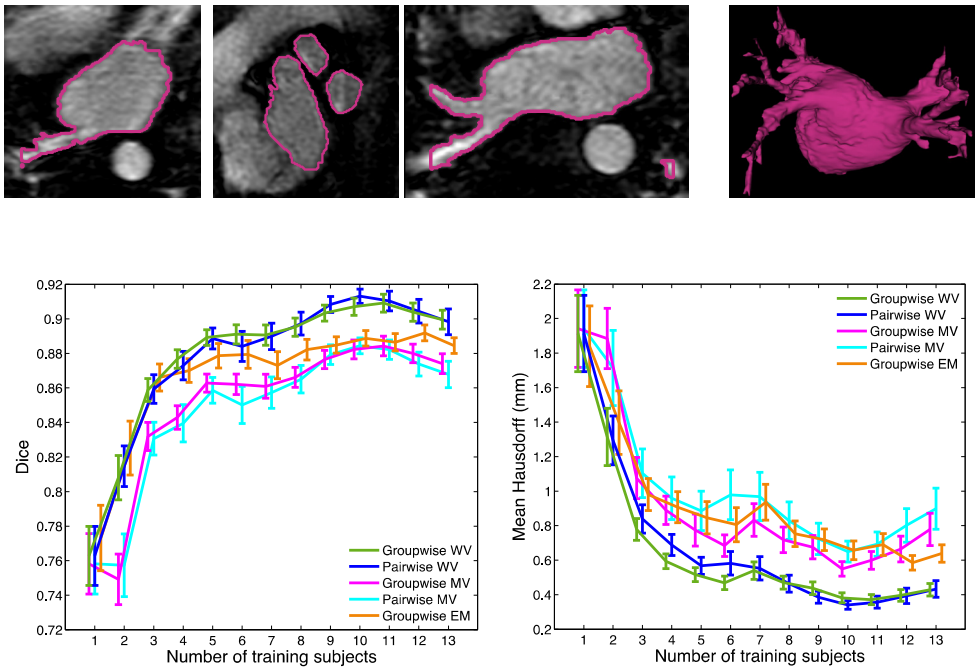


Figure 1. *Top:* example segmentations in cross-sectional slices and a 3D reconstruction of the left atrium segmentation from the blood pool images. *Bottom:* comparison of the segmentation accuracy as volume overlap (left) and distance between surface boundaries (right). The pre-aligned version of label fusion (green) performs similarly to the original pairwise variant (dark blue); similar results hold for pre-aligned majority voting (magenta) and pairwise majority voting (light blue). EM segmentation (orange) is shown for comparison.

During this year, we addressed the problem of computational efficiency for clinical application. The performance gain offered by label fusion typically comes at an increased computational cost owing to the many pairwise registrations between the novel image and training images. We developed a modified label fusion method that approximates these pairwise warps by first pre-registering the training images via a diffeomorphic groupwise registration algorithm. The novel image is then only registered once to the template image that represents the average training subject. The pairwise spatial correspondences between the novel image and training images are then computed via concatenation of appropriate transformations. Our experiments on cardiac MR data suggest that this strategy for nonparametric segmentation dramatically improves computational efficiency, while producing segmentation results that are statistically indistinguishable from those obtained with regular label fusion (Depa 2011).

In addition, we applied the algorithm to the CT scans provided by the Radiotherapy DBP. The preliminary results are promising; we are currently working closely with the DBP team to tailor the algorithm to the specific application.

We have developed an analytical framework for evaluating the effectiveness of a database for segmenting particular structures or pixels using a nonparametric approach. The analysis is derived from first principles but it gives excellent correspondence with data of a variety of different types from a variety of different anatomies. This analysis allows us to estimate the number of datasets in a database that would be required to get certain specified levels of segmentation accuracy. In this way we can plan the creation of such databases, analyzing the confidence of such segmentations pixel by pixel, and evaluate and compare different label-fusion segmentation strategies in a systematic way. This work (Figure 2) is under review for publication.

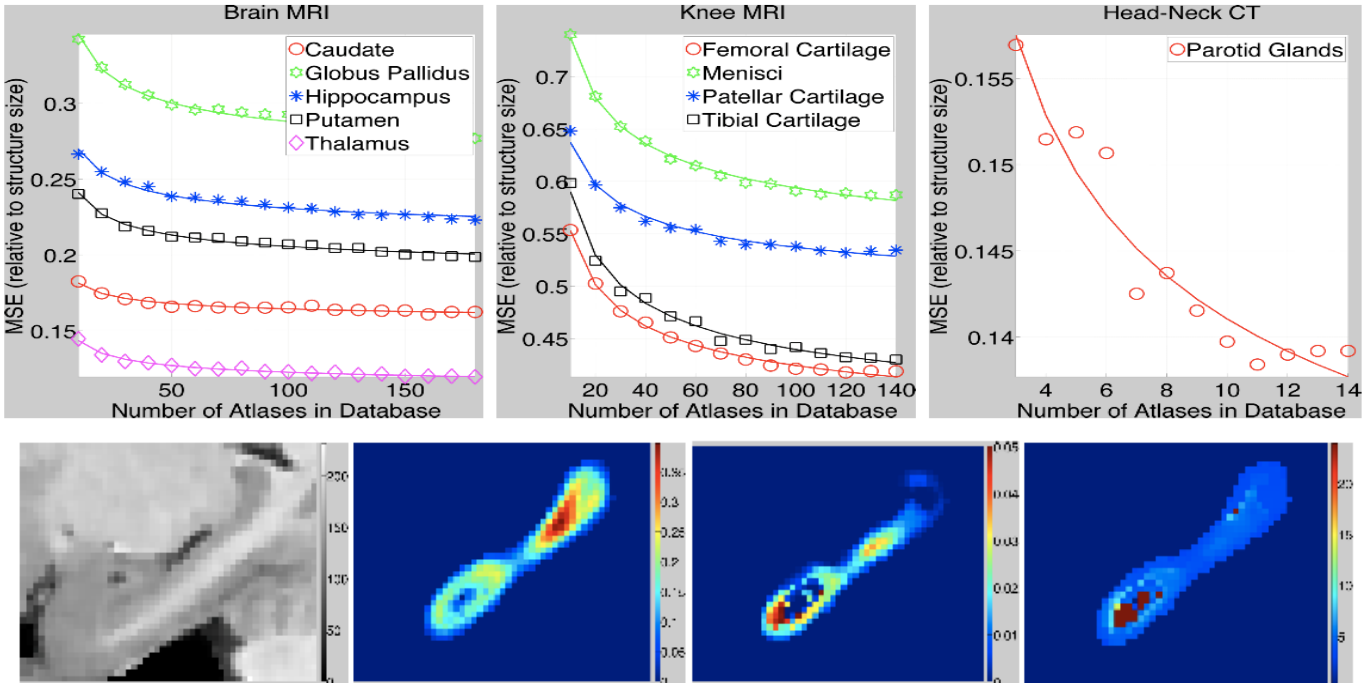


Figure 2. *Top:* Analytical models of label-fusion-based segmentation, predict segmentation error as a function of database size for a variety of different datasets and anatomical structures. *Bottom:* These models estimate for each pixel shown here for MRI data of (left to right) hippocampus (a), inherent variability of the problem (b), functional complexity (c), and average dimensionality (d).

B.2 Fast nearest-neighbor lookup in large image databases: Multi-atlases or nonparametric atlas-based techniques for image segmentation require registration of a test image with a small set of very similar images from a database. Using only similar images has been found to improve segmentation quality. Finding the best matching images typically requires one to estimate similarity with enough images in a database to find those that are similar. For this query to be shaped-based, a deformable registration, which can be prohibitively slow for large databases is typically required. To address this issue, we have developed a technology, based on results from the computer vision literature, for finding similar images in a database that relies on fast comparisons between sparse feature sets (e.g. edges). This method, as shown in Figure 3, reveals a great deal of correspondence with deformation-based matches with a small fraction of the computational cost.

***B.3 Atlases and Registration for DTI Processing*:** To create statistical models and perform analysis of Diffusion Tensor Imaging (DTI) data in cases of large brain pathology, such as observed in TBI or in symptomatic Huntington's Disease(HD), we have developed a set of novel methods that enhances the co-registration of the DTI data either to a prior image of the same subject or to an existing atlas with predefined fiber tracts or regional white matter parcellation. Our first method focuses on the raw diffusion data, where the

analysis of local diffusion directionality via spherical histogram-based entropies removes and potentially corrects datasets suffering from vibrational artifacts [Farzinfar 2012 in press, Wolff 2012].

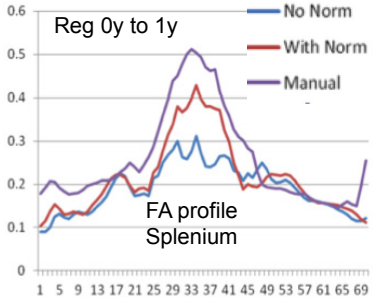


Figure 3. Improvement in DTI fiber tract profile sampling using atlas-based registration with and without normalization.

The second novel method targets the preprocessing phase of the DTI registration. We propose a tensor calibration that normalizes the appearance or shape of local DTI tensors of two images by calibrating both the cumulative distribution function of the three diffusion values as well as the fractional anisotropy (FA) histogram across the images [Gupta 2012 in press]. This enables the use of standard tensor based registration methods in images with widely disagreeing appearance. The method was tested by registering neonate DTI scans with 1 year old DTI scans (FA is expected to more than double between those ages, see Figure 4) or DTI scans with white matter pathology to a normal DTI atlas [Gupta 2012 in press].

Additionally, we also developed a landmark initialized DTI registration for cases with large deformations such as due to hydrocephalus, tumors or hematomas in TBI [MICCAI 2012 submission]. The method employs full brain two-tensor tractography to create maps of local fiber distributions (directional entropy, fiber density and fiber histogram differences), which are combined into a single feature map. In these maps, corresponding landmarks are determined via a 3D version of the scale-invariant feature transform (SIFT) algorithm. These landmarks form the basis for a deformation field from Gaussian radial basis functions (RBF), which is employed as an initialization to a standard deformable registration method. Using this approach, we were able to considerably improve the registration accuracy in sample DTI data with massively enlarged lateral ventricles due to white matter atrophy (see Figure 4).

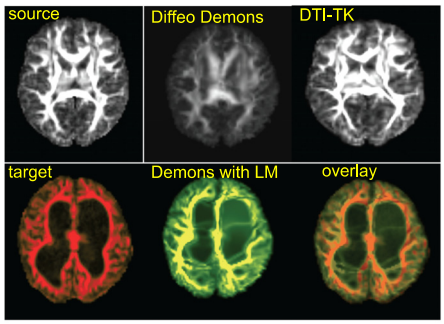


Figure 4. DTI Registration results of a normal subject to a subject with massively enlarged ventricles via Demons, DTI-TK and our proposed landmark initialized approach.

Our major activities in DTI registration of pathological data is towards enhancing our landmark based initialized registration method, by studying both the robustness of the proposed fiber feature maps, as well as develop a novel registration method that incorporates weighted landmark matching errors into the image match criterion. The proposed landmark weights will be based on the SIFT correspondence. Additional automatic brain surface landmarks from co-registered structural MRI data will further improve the landmark initialization.

C. Plans

- Application of shape- and examples-based models to CT data from the Radiotherapy DBP including analysis of existing DBP databases to characterize the efficacy of example-based (label-fusion, multi-atlas) segmentation for different anatomical structures, and more extensive validations of label-fusion approaches with data from atrial fibrillation and radiotherapy applications.
- Software infrastructure for analysis of label fusion techniques including tools for parameter and algorithm development, and fast GPU-based implementations for fast lookup nearest neighbors.
- Applications to DTI, including Monte-Carlo-based estimates of tensor property bias to enable consistent, quantitative analysis of DTI data bias following DTI quality control-based rejection of raw diffusion data.

5.1.2 Geometric Correspondence

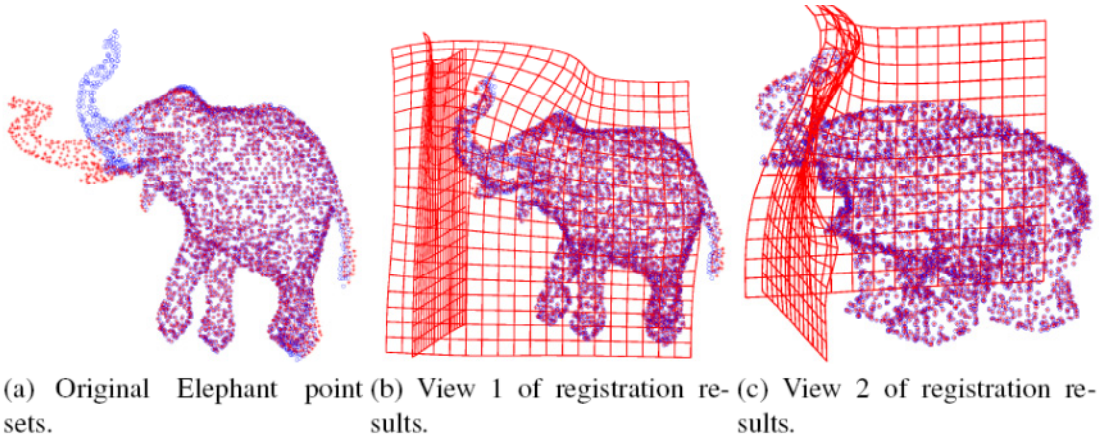
A. Introduction

Establishing anatomical correspondences between pairs of patients, groups of patients, patients and templates, and individual patients over time is important for automatic and user-assisted image analysis. Typically, we consider geometric correspondence problems to be one of two types: image registration, which estimates dense correspondences and coordinate transformations between images; and set-correspondence,

which determines geometric mappings between sparse or lower dimensional sets of data such as points, curves, surfaces, etc. As with statistical models, state-of-art approaches typically rely on assumptions about geometric mappings or transformations, such as smoothness or inevitability, which make the analysis and computation more tractable. However, in applications that entail pathologies and thus more deformable anatomies, collections of anatomical objects can have very different shapes, topologies, and intensity boundary profiles. The ability to establish geometric correspondences, with and without expert guidance, in challenging clinical circumstances is essential for the DBPs. For example, to evaluate a patient with traumatic brain injury relative to a model (statistical or otherwise), we will need to identify anatomy in the presence of large displacements and missing parts of organs and tissues, as well as dramatic discrepancies in intensity or signal. In the case of radiation treatment planning for head and neck cancer, the patient's pose can dramatically affect the relative positions of tissues and organs. Likewise, the physicians who manage cardiac fibrillation have requested comparisons of heart images taken before and after treatment and remodeling.

B. Research Progress Report

B.1 Stochastic Point Set Registration: This project proposes a non-rigid point set registration algorithm that seeks an optimal set of radial basis functions to describe the registration. The need for such registration was motivated in particular by our DBP collaborators. A global optimization approach is introduced composed of simulated annealing with a particle filter based generator function to perform the registration. The registration process is implicitly regularized by limiting the number of bases making up the deformation. Further, a constraint on the deformation is enforced whose role is to ensure physically meaningful fields (i.e., invertible). Preliminary results on 2D and 3D data demonstrate the algorithm's robustness to datasets with noise and with missing information as shown in Figure 5.



(a) Original Elephant point sets. (b) View 1 of registration results. (c) View 2 of registration results.

Figure 5. Example of registration of 3D point cloud data. The Elephant data set is composed of 3,093 points.

B.2 Automatic Correspondences For Shape Ensembles: *We* built upon the continued success of our NA-MIC shape analysis pipeline in several ways. First, we have several new clinical papers in a variety of fields [Looi 2011, Lindberg 2012 in press, Maltbie 2011]. We also have some novel statistical developments [Li 2012 in press, Shi 2011 in press]. The major development focus was on integrating the UNC and Utah shape approaches into a coherent pipeline [Paniagua 2012 in press].

We have improved the robustness of our entropy-based correspondence system, ShapeWorks, in several ways. First, we have developed a method for particles to interact on surfaces using geodesic distances [Datar 2011]. This improves the behavior of the system on sharp features or convoluted shapes. Conventionally, geodesic distances are computationally expensive and therefore prohibitive in an optimization context. However, a recently developed fast, GPU-based eikonal solver for unstructured meshes allows us to precompute distances on a dense set of mesh vertices and interpolate these distances on the fly as particles move and interact. We have also extended the system to incorporate surface normals into the comparisons across shapes. Thus, particles should have compact distributions in not only their positions but also their orientations. This is especially important in structures with strongly curved, thin surfaces that are not

appropriately handled with the current approach. For this we have studied two approaches. With the first approach we do the statistics of normals on the manifold formed by the collections of the collections of normals on the unit sphere. We use the method of principle geodesic analysis (PGA) to find the Frechet mean and then we compute variance on the tangent space at that mean. We have also developed a similar approach with a statistical analysis based on principal nested spheres (PNS) to compute the entropy of surface normal across a population. Evaluation of these methods is ongoing.

C. Plans

- Thorough evaluation of the proposed PNS approach (e.g., compare with the PGA approach) with integration into the existing shape pipeline software
- Incorporation of user-defined landmarks into automatic, entropy-based scheme
- Application of shape analysis to data from the HD DBP.
- Extend the clinical application of shape analysis to left atrium for the Afib DBP.
- Development and testing of registration methods that allow for nonsmooth deformations and localized abnormal/pathological intensity profiles, with applications to images of patients with tumors and traumatic brain injury

5.1.3 User Interactive Segmentation

A. Introduction

Despite many important advances in medical image processing, most projects on the cutting edge of clinical research still rely on the time-consuming process of segmenting objects of interest in a three-dimensional dataset one slice at a time. Thus, advanced image analysis technologies that better leverage expert user interaction are imperative in patient-specific image analysis. Our goal is to develop methodologies for image segmentation that can be used in settings where the heterogeneity and variability of anatomy and pathology impedes the immediate construction of conventional high level statistical models, but where users can see the structures of interest by observing contrast, lines, shapes, textures, etc.

The field of computer vision has addressed the issue of user-assisted segmentation mostly in terms of image partitioning or contours. Examples of such general purpose techniques include parameter-based active contours or snakes, curvature flows implemented via level-sets, variational formulations, the live-wire method, label spaces, and diffusion and graph-cut methods. Virtually all of these methods are formulated as either geometric or statistical optimizations. Despite all of these developments, the typical segmentation problem in medical imaging is still largely solved by hand contouring, although new tools with intuitive user-guidance for 3D level-set segmentation are increasingly used as an alternative.

Several algorithmic challenges are important to these methods. First, there is the necessity of posing the formulation to capture the relevant image properties, particularly the more subtle features that do not always coincide with sharp intensity contrast. Second, there is the challenge of finding the optimal configuration for the nonconvex energies that result from these formulations. Third, input must be incorporated into the definition of the objective function and the optimization procedure. Our work will address these important aspects of user-interactive segmentation.

We expect that the patient-specific analysis suggested by the DBPs will present images of patients with pathologies and/or injuries that sometimes defy automated approaches. Moreover, as informed by our own experience, we know there is a critical need for a set of reliable, light-weight, easy-to-use tools to account for the broad and diverse range of medical and biological applications. Furthermore, even when more automated analyses are feasible, they usually require some level of training or bootstrapping, which requires examples from segmentations that are driven by user interaction and low-level image features.

B. Research Progress Report

B.1 Control-Based Interactive Segmentation: Interactive segmentation is motivated by experience with existing software tools, such as 3D Slicer. Typically, a user's first attempt to use automatic segmentation is met with only partial success. Eventually, he or she finds a combination of manual editing and re-processing,

focusing on one small subdomain at a time, that yields a satisfactory result. The novel contribution of our control-based interactive approach is a model that represents interactive segmentation as a feedback system, thus enabling a principled merging of automated methods and user input. Having this framework in place allows the tools of control theory to be invoked for systems analysis and design. This differs from existing schemes, which are all open loop, and thus stability cannot be verified. On the other hand, using Lyapunov theory from dynamical systems, we can rigorously proof for stability and convergence, which allows us to design and improve the necessary algorithms. Code has already been written in C++ to implement the basic procedures. Figure 6 illustrates the overall scheme.

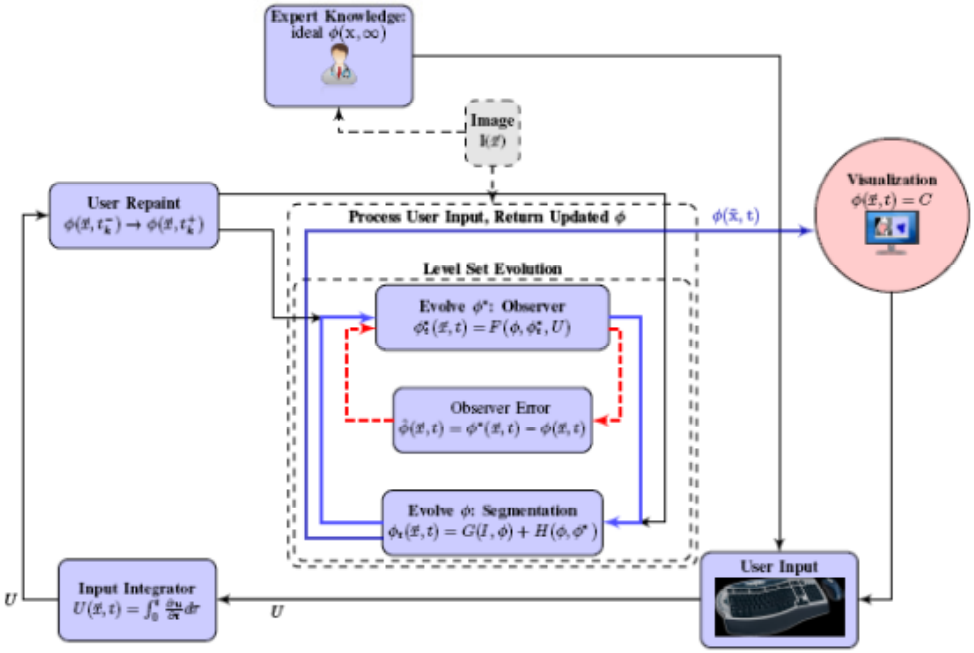


Figure 6. Explicitly modeling the visualization feedback to the user as a source of expert input provides insight into how to design both the automated portion of segmentation and the user interaction structure. Feedback compensates for deficiencies in automatic segmentation by exploiting the human expert's interpretation of complex imagery.

Since this methodology may be used to close the loop under any gradient-based segmentation scheme (this includes all active contour methods), we have been testing various energy functions, in particular, a localized version of Chan-Vese. We have used both from problems in bone and brain segmentation. An MRI bone example is shown in Figure 7.

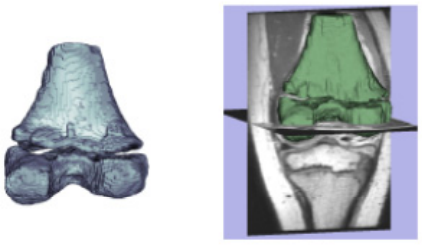


Figure 7. Moving into 3D, a user's time to segment high quality surfaces is cut dramatically over manual segmentation. Accuracy follows that of an underlying automatic method, except where user input as a correction has been applied.

This project impacts the work of several DBPs, including left atrial fibrillation (Utah), traumatic brain injury (UCLA), and adaptive radiotherapy (MGH). The code already was successfully tested on imagery from these groups at the NA-MIC project work in January.

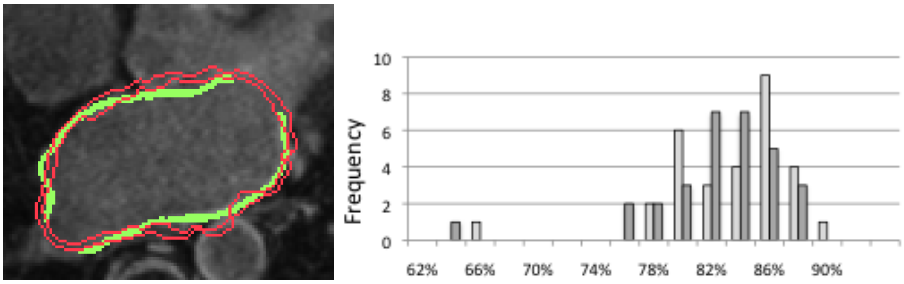


Figure 8. A 2D slice of an optimal graph cut (left, red) shows atrial heart segmentation compared to a manual contour (left, green). A histogram of Dice scores (right) shows good agreement between experts and the optimal method for endo- (light grey) and epicardium (dark grey).

B.2 Globally Optimal Segmentation: Some of the DBPs, such as the atrial fibrillation project (Utah), have difficult segmentation problems that entail diffusion and inconsistent and noisy boundaries with objects that have irregular shapes. In this case, methods that rely on local optimizations (e.g., variational methods with PDEs) tend to get stuck on local structures, since the actual boundaries are only visible when considered in a global context. Because the shapes are irregular, shape priors (e.g., from a database) have difficulty accounting for the individual variability. Thus, we have been developing a set of methods that rely on global optimization of energy functions via graph cuts. The challenge is to build graphs that properly represent the space of possible shapes. For this, we use a database of segmented images to form a set of shape templates (Figure 8), which in turn form the graphs, and then choose from among these templates the one that produces the best segmentation as measured by correlation with a learned model. User input is minimal, with no parameter tuning. All that is required is a simple click to specify the center of the object. Results on delayed contrast MRI from the atrial fibrillation project are quite promising, and this work is currently under review for publication.

B.3 Patient-Specific Segmentation Framework for Longitudinal MR Images of Traumatic Brain Injury: Robust, reproducible segmentations of MR images with TBI are crucial for quantitative analysis of recovery and treatment efficacy. This is a significant challenge as a result of the severe anatomic changes caused by edema (swelling), bleeding, tissue deformation, skull fracture, and other effects related to head injury. Our early NA-MIC segmentation package ABC (atlas-based classification) had been applied to a selection of clinical cases [Irimia 2011, Irimia 2012], where the segmentation of pathology required a user-assisted post-segmentation step. Our current research aims at developing an automated multi-modal image segmentation framework for longitudinal TBI images taken from chronic to acute stages. The method is initialized through manual input of primary lesion sites at each time point, which are then refined by a joint approach composed of Bayesian segmentation and construction of a personalized atlas. The personalized atlas construction estimates the average of the posteriors of the Bayesian segmentation from each time point and warps this average back to each time point to provide the updated priors for Bayesian segmentation [Wang 2012]. In addition, we detect and model topological changes caused by disappearing and newly appearing lesions and large deformations by estimating the probability for topology changes jointly with the personalized atlas. Validation of the new automatic segmentation compared to expert segmentations of acute and chronic images was provided on 3 longitudinal TBI datasets and demonstrated that joint segmentation of 4D multi-time point data is superior than individual segmentations. The results provide not only segmentations at the time points of study, but also a quantitative change map to be used for measuring effect of therapeutic intervention and recovery. The method, implemented in C++/ITK, can handle different sets of modalities at each time point, which provides flexibility in analyzing scans from a clinical setting.

C. Plans

- Incorporate various energy functionals into the interactive segmentation framework (e.g., Bhattacharyya distance to separate distributions), to allow one to use all of the statistical information in the data in an interactive manner.
- Incorporate atlases as priors for interactive segmentation.
- Improve visualization to allow the user to view multiple slices simultaneously during segmentation (e.g., to see how the results of a segmentation of a given slice propagates to all the neighboring slices)
- Extend the global optimization framework (graph based): better templates based on larger training data of left atrium, better penalty terms that quantify surface smoothness, and better feature detectors that capture context in a robust manner.

5.1.4 Longitudinal and Time Series Analysis

A. Introduction

An important component of patient-specific data analysis is the ability to analyze multiple images from the same patient over time, as a disease or injury progresses or responds to treatment, or to assess neurodevelopment or neurodegeneration. Standard cross-sectional analysis of longitudinal data does not provide a model of growth or change that considers the inherent correlation of repeated images of individuals. Nor does it tell us how individual patients change relative to normal trajectories of a population. Two aspects are of particular importance for this project. First, when the progression or time behavior of a condition is an important component of the differences between groups, the statistical power of comparisons benefit from subject-specific analysis and allow one to apply time-series analysis. Second, the availability of longitudinal data presents an opportunity to leverage images at multiple time points for segmentation and evaluations of shape and function, and thus adds a dynamic aspect to the process that can be useful in recognition. Longitudinal image analysis is important for all four DBPs in this project. The TBI DBP, for instance, will monitor the progress of patients during recovery, and tools for systematically analyzing these changes will be essential. Likewise, the Head and Neck Cancer DBP, the Atrial Fibrillation DBP, and the Huntington's Disease DBP all will require comparisons of patients across multiple time points, and the ability to consolidate these longitudinal models across collections of patients in comparison to healthy controls.

B. Research Progress Report

B.1 Connectivity Changes in Disease: This approach uses a novel probabilistic framework to merge information from diffusion weighted imaging tractography and resting-state functional magnetic resonance imaging correlations to identify connectivity patterns in the brain. In particular, we model the interaction between latent anatomical and functional connectivity and present an intuitive extension to population studies. We use the EM algorithm to estimate the model parameters by maximizing the data likelihood. The method simultaneously infers the templates of latent connectivity for each population and the differences in connectivity between the groups.

We demonstrated our method in a schizophrenia study. Our model identifies significant increases in functional connectivity between the parietal/posterior cingulate region and the frontal lobe and reduced functional connectivity between the parietal/posterior cingulate region and the temporal lobe in schizophrenia. We further established that our model learns predictive differences between the control and clinical populations, and that combining the two modalities yields better results compared with considering each one in isolation (Venkataraman 2012). We have submitted a paper to MICCAI 2012 that describes a variant of the model. The new method effectively transforms the connectivity differences detected along pairwise connections between regions to information on which regions are most affected by the disease. We have also identified a joint project with the Predict-HD DBP to apply these methods to connectivity data in the HD population.

B.2 Modeling Pathology Evolution: Extensive imaging is routinely used in brain tumor patients to monitor the state of the disease and to evaluate therapeutic options. A large number of multi-modal and multi-temporal image volumes is acquired in standard clinical cases, requiring new approaches for comprehensive integration of information from different image sources and different time points. In this work we propose a joint generative model of tumor growth and of image observation that naturally handles multimodal and longitudinal data. We use the model for analyzing imaging data in patients with glioma. The tumor growth model is based on a reaction-diffusion framework. Model personalization relies only on a forward model for the growth process and on image likelihood. We take advantage of an adaptive sparse grid approximation for efficient inference via Markov Chain Monte Carlo sampling. The approach can be used for integrating information from different multi-modal imaging protocols and can easily be adapted to other tumor growth models (Menze 2011). We believe the underlying model will be useful in characterizing processes due to traumatic brain injury and plan to explore it during the next year of the project.

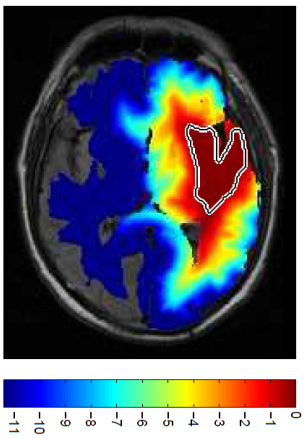


Figure 9. In addition to the detected tumor outline (white line), our method estimates tumor cell density (colormap), which can be used to improve the precision of radiation planning.

B.3 Longitudinal Analysis of DTI Change Trajectories: A population growth model that represents the growth trajectories of individual subjects is critical to study and understand white matter changes in neurodevelopment, neurodegeneration and disease progress. Data reduction by sparse sampling (as in [Durrleman 2011] for group comparison of brain deformations) or the use of parametric functions is key for effective statistical analysis. We are developing a new framework for spatiotemporal analysis of parameterized functions attributed by properties of 4D longitudinal image data. This computational framework follows earlier NA-MIC developments by Casey Goodlett on tract-based statistical analysis of DTI which introduced a population-based unbiased atlas building for group-wise mapping of DTI into a common coordinate space with subsequent functional data analysis of tract profiles. Application of this methodology to study early brain development in a longitudinal neuroimaging study is shown in [Geng 2012], and validation of reproducibility is shown in [Gouttard 2012].

We are jointly estimating and modeling individual and population growth trajectories, and determining significant regional differences in growth pattern characteristics applied to longitudinal neuroimaging data. We use non-linear mixed effect modeling where temporal change is modeled by the Gompertz function, a growth function which uses intuitive parameters related to delay, rate of change, and expected asymptotic value; all descriptive measures which can answer clinical questions related to growth. Our proposed framework combines nonlinear modeling of individual trajectories, population analysis, and testing for regional differences. Extending this modeling to tract functions, we obtain a smooth temporal modeling of change from a discrete-time set of functions with applying the parametric growth model to time-dependent spline functions, solved via energy minimization. Multiple subjects will be modeled and compared for assessment of normative trends and changes from normal. A prototype software written in Matlab and using the R statistics package has been applied to small sample datasets from the Huntington Disease DBP partner and from an early brain development study.

B.4 Analysis of Longitudinal Shape Variability via Subject Specific Growth Modeling: Statistical analysis of longitudinal imaging data is crucial for understanding normal anatomical development as well as disease progression, as demonstrated in [Lyall 2011] by studying brain ventricle structures in mild ventriculomegaly (MVM). This fundamental task is challenging due to the difficulty in modeling longitudinal changes, such as growth, and comparing changes across different populations. Longitudinal shape analysis often relies on the estimation of a realistic continuous growth scenario from data sparsely distributed in time. We have developed a new type of growth model parameterized by acceleration, whereas standard methods typically control the velocity. This mimics the behavior of biological tissue as a mechanical system driven by external forces. The growth trajectories are estimated as smooth flows of deformations, which are twice differentiable. This differs from piecewise geodesic regression, for which the velocity may be discontinuous. Cross validation experiments show that our method is robust to missing observations, as well as being less sensitive to noise, and is therefore more likely to capture the underlying biological growth [Fishbaugh 2011].

Current developments aim at quantifying spatiotemporal population differences. Our approach estimates 4D anatomical growth models for a reference population (an average model) and for individuals in different groups. We define a reference 4D space for our analysis as the average population model and measure shape variability through diffeomorphisms that map the reference to the individuals. Conducting our analysis on this 4D space enables straightforward statistical analysis of deformations as they are parameterized by momenta vectors that are located at homologous locations in space and time [Fishbaugh 2012]. So far, we evaluate our method on a synthetic shape database, clinical data from a study that seeks to quantify growth differences in subjects at risk for autism, and on 10 longitudinal sample datasets of longitudinal image data of Huntington disease from our NA-MIC DBP partner Iowa. The prototype code is written in C++/ITK and will be developed into a plug-in for the NA-MIC Kit.

B.5 Longitudinal and Time Series Analysis: In this year, two novel methods for longitudinal registration and time series regression were developed. The first focuses on the use of geodesic regression, which generalizes linear regression to general Riemannian manifolds. Applied to images, it allows for a compact approximation of an image time-series through an initial image and an initial momentum. Specifically we developed a simplified geodesic regression method, which approximates the residual to the regressed geodesic with respect to a fixed initial image. This results in dramatically simplified computations, as the method becomes straightforward to implement using large displacement diffeomorphic metric mapping (LDDMM) shooting algorithms and decouples the problem into pairwise image registrations allowing parallel computations [Hong 2012 in press]. The same approach further allows incorporating time-dependent intensity changes via the initial momentum (article, currently under review). We successfully demonstrated and evaluated the approach on human and primate longitudinal data of brain changes, such as postnatal brain development or prodromal HD.

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5.2 ENGINEERING

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The Engineering component of the Computer Science Core (Core 1b) has been focusing on the infrastructure needed for the Algorithms component to implement their methods, and has been working closely with them so that the functionality we provide can serve to inspire new methods as well. Herein we provide more details regarding our accomplishments in those directions.

5.2.1 End-user Platform: 3D Slicer

Release of 3D Slicer version 4.0 and 4.0.1

As shown in Figure 1, 3D Slicer version 4.0 (commonly called Slicer4) is having an immediate world-wide impact. Version 4.0, released at the Radiology Society of North America (RSNA) meeting in late November 2011, is the result of a major effort by the NA-MIC Engineering Team, in collaboration with the wider Slicer community, to re-implement and streamline the software in response to feedback from NA-MIC DBPs and algorithm developers. A new 3D Slicer version 4..1 release, being finalized at the time of this writing, adds back many of the advanced features of Slicer3, notably the Extension system by which new functionality can be downloaded and installed independently of the main executable. As described more fully below, these sweeping changes require touching not only most of the code in Slicer, but also feeding important feature and bug fix changes back into the rest of the NA-MIC Kit and upstream libraries. As a result of these efforts, 3D Slicer is now an improved reference implementation of a modern medical image computing package and a strong foundation for research.

A. Major Developments and New Functionality in Slicer4

Modern Cross-Platform Design Patterns: As a byproduct of the port of the user interface from KWWidgets to Qt, a comprehensive suite of non-GUI OS abstractions and utility functions from Qt became available to support core application functions such as preference settings, multi-processing, and application resource data. This was a direct benefit from the GUI port supported by an ARRA supplement to the Neuroimage Analysis Center, a NA-MIC collaborating P41 grant. Slicer4 supports native windows 64 bit environments and can be bundled into a standard Mac OS X application bundle.

Efficiency and Robustness: Careful review of core data management and processing pipeline steps allowed us to remove much redundant processing. The result is that Slicer is easier for developers to understand and debug, and end users experience faster startup and more responsive behavior.

DICOM Networking: Slicer4 includes DICOM listener and DICOM Query/Retrieve capabilities for integration with standard clinical image management environments and workflows. For example, intraprocedural imaging obtained during image-guided procedures can now be auto-routed to Slicer for analysis and navigation.

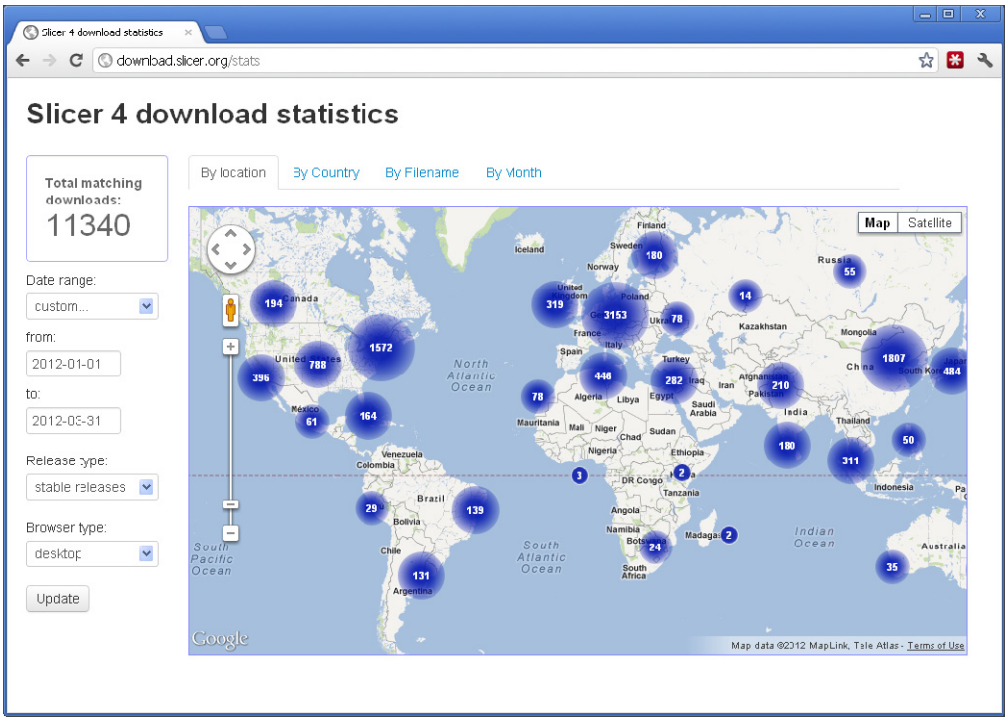

Figure 1. 3D Slicer version 4.0 end-user downloads during the first 3 months of 2012, a rate of 45,360 per year (over 100 downloads per day). Interactive geolocated download statistics are available at http://download.slicer.org/stats

Additional Features: Slicer4 includes: an improved flexible view layout system; a revised implementation of the Expectation Maximization (EM) Segmenter; faster hardware accelerated volume-rendering; improved markups and annotations; improved atlas and model hierarchy support; a streamlined and revised diffusion MRI implementation.

B. Plans

With the introduction of the Slicer4 Extension system we plan to stabilize the core Slicer distribution and move to less frequent releases with more of the algorithm innovation becoming available as Extensions. This will allow further stabilization and streamlining of the core while speeding up the delivery of new technologies to end users for testing.

5.2.2 Computational Platform

Efforts in the Computational Platform have focused on developing a general and flexible computing architecture and analysis platform to meet the needs of NA-MIC scientists and engineers as well as the larger medical imaging community.

A. Major Developments

Interactive Methods: The Editor module has supported interactive segmentation techniques that were deeply integrated with the Editor codebase. We have broadened the Slicer Extension mechanisms to support Editor Extensions, allowing interactive segmentation techniques to be developed separately from the Slicer codebase. We have also refined the interaction patterns for interactive segmentation within the Editor and are starting to develop interactive registration techniques.

Multivolume Analysis: The infrastructure for Diffusion Weighted MRI (DWI) IO and visualization has been generalized to be used for other time varying acquisitions like Dynamic Contrast Enhanced MRI (DCE) and Gated Cardiac CT. Massively univariate processing of DCE to produce parametric maps is being developed as a Slicer Extension.

Distributed Computing: Slicer Execution Model modules (also known as Command Line Modules) are now available as Nipype tools, enabling local and distributed scripted execution of processing pipelines.

Exploratory Image Analysis: Infrastructure for the interactive exploration of images and the relationships of features calculated over regions of images was developed, including: feature libraries for Gabor, Haralick, entropy, polynomial, and histograms; and charting capabilities to display line, bar, and scatter plots within Slicer.

Compatibility with ITK Version 4: Compatibility with ITK version 4 was developed and continuously maintained over the past year as ITKv4 matured. Slicer will officially switch to ITKv4 in the coming months.

B. Plans

At the time of this writing, 3D Slicer 4.1 is being finalized. After the release of Slicer 4.1, the Slicer development codebase will migrate to using ITK version 4. This migration will enable new image registration methods, introduce SimpleITK APIs, and introduce GPU support for image analysis algorithms. Other plans for the Computational Platform include further developments for interactive analysis methods, infrastructure for private cloud computing, and interfaces for statistical analysis.

5.2.3 Data Management Platform

Efforts in the Data Management Platform have focused on (1) developing an ergonomic user interface and internal networking logical to efficiently exchange data between Slicer and XNAT and (2) expanding Slicer's support for importing from and exporting to local DICOM Objects and networked DICOM PACS.

A. Major Developments

User Interface: The XNAT development team is working with a web usability firm (Integrity St. Louis) to design and implement a web interface that can be deployed in Slicer4's Qt framework for exploring data hosted in a remote XNAT data repository. Prototypes have been implemented and are currently being reviewed by stakeholders with the goal of having a functioning interface by June, 2012.

Networking Logic: An alpha implementation of the infrastructure for actually exchanging data between XNAT and Slicer has been developed and revealed that significant additional work is required to handle parsing of MRML files within Slicer in the context of remotely hosted data. This work is now under way and will require several months to complete.

Use cases: Several use cases have been identified, including projects within the Quantitative Imaging Network (QIN), to drive the development of the Slicer/XNAT integration.

DICOM-RT and QIN support: Via DCMTK and custom classes, Slicer is being extended to support RT Plans, Images, Annotations, etc. Much of the support is being driven by the adaptive radiotherapy for head-and-neck cancer DBP. Additional developments are being driven by an ongoing effort to integrate Slicer as an annotation module in the Quantitative Imaging Network (QIN).

DICOM database and networking: Slicer DICOM support is approaching clinical quality in terms of speed of searching and IO by maintaining a database that indexes previously loaded DICOM objects. Via this database, it is no longer necessary to parse each object to search and/or load an entire series, study, or patient into Slicer.

B. Plans

The bulk of the effort in the coming year will continue to focus on (1) the user interface and networking logic for remote data management in XNAT and (2) import and export of Slicer results (i.e., entire MRML scenes) as DICOM objects. Regarding XNAT, as the initial development completes, we will turn to developing more efficient mechanisms for caching data locally and synchronizing local caches with remote repositories. Regarding importing and exporting Slicer data as DICOM objects, we are pursuing the concept of a **DICOM Lollipop.** In a DICOM Lollipop, a complete Slicer (MRML) Scene, with annotations, segmentations, viewing conditions, etc., can be saved as a binary payload in a standard DICOM object. In this manner, Slicer's data can be pushed/pulled from PACS for integration with and sharing across hospital workflows.

5.2.4 Community Software Process

The goal of the Community Software Process effort is to provide tools and processes that make it easy for algorithms developers to contribute methods to the NA-MIC Kit, while maintaining the NA-MIC Kit's high-quality software standards.

A. Major Developments

This year, we have seen massive expansion and significant stabilization of the NA-MIC Kit. While these two accomplishments may seem at odds, they actually represent the planned progression of our community software processes. The specific aims and approaches we pursued to achieve these accomplishments are:

Provide a modern, stable platform: Slicer 4.0 has been released. This is a major milestone in the NA-MIC community. Slicer 4.0 represents a re-write of the majority of the Slicer core to achieve stability, remove redundancy, refactor inefficiencies, and provide new pathways for growth. The most noticeable change is the conversion of the user interface to Qt, which provided speed, stability, and support from the well established Qt community.

Provide a simple interface for algorithm developers to extend Slicer:

- Python has been adopted as the preferred scripting language, and it has been tightly integrated into Slicer 4.0. Python is a powerful scripting language with strong scientific computing support via add-on libraries such as SciPy, NumPy, and NiPy. We have tightly integrated it with Slicer so that Python scripts can modify and extend the Slicer GUI, manipulate Slicer's data representations (i.e., the MRML Scene), and call other extensions in Slicer to specify novel workflows.
- Slicer Extension Manager is now the "Slicer Catalog." It is a new web-based system that builds upon the "App Store" concept that is familiar to Android and Apple users. Users can easily install, uninstall, rate, and comment on extensions. Developers can easily add new extensions, upload revisions, add screenshots, and respond to feedback from users.

Provide access to the best algorithms: ITKv4 has been released by the Insight Software Consortium, and we have begun integrating this new version of ITK and its associated wrapping for Python (i.e., SimpleITK) into Slicer 4.0.

Provide easy access to clinical data: We upgraded the version of the DICOM library (DCMTK) used by Slicer and provided improved DICOM RT support. We also have begun supporting ultrasound (e.g., video) and 4D (e.g., gated CT) data in Slicer.

Provide easy-to-create and easy-to-access documentation: We have integrated the extension writing and the documentation generation processes. The documentation created when an extension is written is now automatically ported to a web host for easier access from within and outside of Slicer.

B. Plans

The planned efforts of the Community Software Processes are continuations of ongoing work:

Provide a modern, stable platform: Slicer quality will continue to be improved via refactoring and via expanded emphasis on testing. Refactoring of the core is nearly complete and new efforts will be directed by the Algorithms team to support their evolving needs and to inspire future research directions. Testing will evolve from code unit testing to GUI testing. Kitware's ParaView team has developed a semi-automated GUI testing system. It can record and then play-back user interactions. It can also verify that the user interface and Slicer output matches a pre-defined state. In this way, algorithm developers can more easily implement regression tests to ensure the continued operation of their modules.

Provide a simple interface for algorithm developers to extend Slicer:

- *Python:* We will continue to promote Python as the preferred language for scripting in Slicer. It will be used for algorithm prototyping, parameter exploration, and workflow development and delivery. In particular, we expect future development to facilitate scripts that feature interactive algorithms running within Slicer's 2D and 3D visualizations.

- *Slicer Catalog:* Future work will focus on extending the foundation introduced in Slicer 4.1. New developments will address hosting "extension packages" (e.g., the microscopy package for the DTI package of extensions) as well as hosting data, tutorials, videos, and other adjunct material.

Provide access to the best algorithms: We will complete integration of ITKv4 and its associated SimpleITK (for Python) into Slicer4. Special attention will be given to ensuring that the upgrade will not disrupt the operation of existing modules.

Provide easy access to clinical data: The OFFIS and CTK developers anticipate further updating to DCMTK and other clinical data systems used by Slicer. We will continue, in particular, to broaden and stabilize Slicer's support of DICOM, DICOM RT, ultrasound, video, and 4D data.

5.3 NA-MIC KIT

The NA-MIC Kit is designed to accelerate the pace of research and facilitate clinical evaluation. It provides (a) a flexible yet stable execution and visualization engine with strong support for clinical data (Slicer), (b) methods for extending that platform and sharing those extensions with others, and (c) tools for community software development. The major components of the NA-MIC Kit are illustrated in Figure 2.

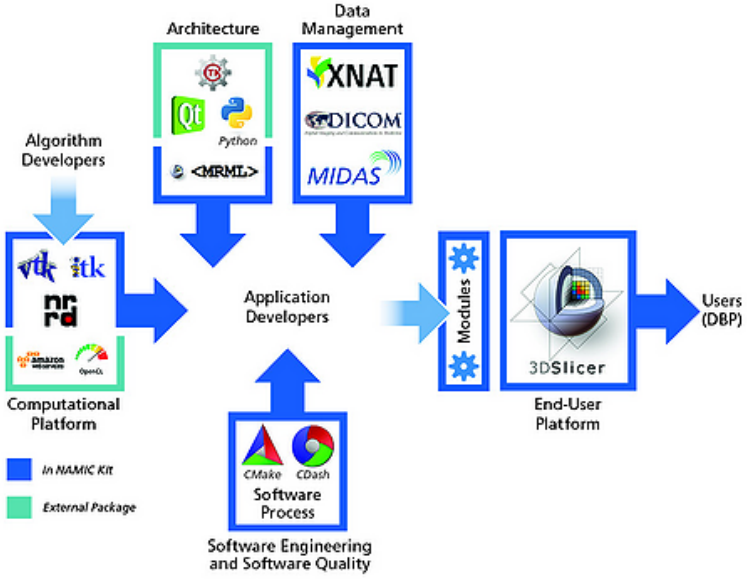

Figure 2. The NA-MIC Kit is a collection of applications, libraries, and processes for bridging algorithm developers, engineers, and clinical researchers. Slicer is the primary vehicle for deploying algorithms. The other components of the NA-MIC Kit address the critical yet often overlooked elements of data-sharing, integration into clinical workflows, code quality assurance, cross-platform development, and much more.

5.3.1 Maturation

As mentioned in Section 5.2., Slicer has undergone massive expansion while also achieving improved stability. The same is true for the NA-MIC Kit as a whole. This evolution represents a maturation of our tools as well as the community. Open-source software, good software practices, and our tools are becoming the leading standards in our fields. Large communities of users and developers are forming around many of the components that we have chosen to use and that we have created for the NA-MIC Kit. The many improvements and new features of Slicer are discussed in Section 5.2. Below we highlight the evolution of the other tools in NA-MIC Kit:

- CMake 2.8.7 was released with support from NA-MIC. CMake is the foundation of the Slicer build process. It greatly facilitates building Slicer on multiple platforms, using a wide range of support libraries within Slicer, and packaging Slicer for redistribution. CMake is downloaded over 2,000 times per day. It has become the industry standard for cross-platform development, and NA-MIC has played a key role in driving and funding its development.

- CDash 2.0.2 (with CTest) was released with support from NA-MIC. CDash and CTest are responsible for the nightly regression testing of the core code and extensions of Slicer. NA-MIC has driven more of the evolution of this project than nearly any other end-user application. In the CDash releases during this past project cycle, one of the most significant contributions to CDash from NA-MIC was the package upload process. This process allows the many machines that are used to test Slicer every night to upload the executables and packages they create during testing to the main CDash server. This, in turn, allows users to download those testing packages and run additional tests or use them in their research. This complete automation of the test-release cycle is a massive time-saver for the Service core and has greatly reduced the time to discover and resolve bugs and to improve the stability of Slicer. More details on this process are available in a blog at: http://www.kitware.com/blog/home/post/249
- DCMTK 3.6 was released with support from NA-MIC. DCMTK is the DICOM toolkit used in Slicer for local object IO and for networking Slicer with DICOM PACS. This release offers improved support for jpeg compressed DICOM images, for structured reports, for large file support, and for RT objects. Further details are available at http://www.kitware.com/blog/home/post/88
- XNAT 1.5.4 was released with support from NA-MIC. XNAT is an open source imaging informatics platform, developed by the Neuroinformatics Research Group at Washington University. It facilitates common management, productivity, and quality assurance tasks for imaging and associated data. Thanks to its extensibility, XNAT can be used to support a wide range of imaging-based projects. The 1.5.4 release addressed security and DICOM handling as well as improved the overall stability of the system.
- BRAINSFit updated with NA-MIC support. BRAINSFIT is a collection of programs for registering images with mutual information based metric. Several registration options are given for 3, 6, 9, 12, 16 parameter- (i.e., translate, rigid, scale, scale/skew, full affine) based constraints for the registration. The program uses the Slicer execution model framework to define the command line arguments and can be fully integrated with Slicer using the module discovery capabilities of Slicer.

5.3.2 Expansion

The maturation of the foundation of the NA-MIC Kit (discussed in Section 5.3.1) has allowed NA-MIC to pursue new opportunities with less effort and greater confidence. Highlights regarding the expansion of the NA-MIC Kit into new areas include:

- *Slicer Catalog:* The NA-MIC community will be introduced to the Slicer Catalog in Slicer 4.1. This system allows users to install, uninstall, search, browse, and rank Slicer extensions. This user experience is available from within Slicer and over the web ─ much like the Android and Apple App Stores. Developers can contribute, update, document, and post screenshots on their modules and receive community feedback. We see this work as a launchpad for new levels and avenues for community involvement in Slicer.
- *CDash Package Manager:* We have automated the nightly release of pre-compiled packages for Slicer on multiple platforms. This new process is built on CDash and allows executables and packages created during nightly regression testing to be submitted to a Midas system for download: http://slicer.kitware.com
- *CTK* is the toolkit NA-MIC created in collaboration with other open-source toolkits (e.g., MITK from the German Cancer Research Center in Heidelberg, XIP from Siemens, GIMIAS from UPF in Spain, and OpenMAF from U of Bologna) to host custom Qt and DCMTK modules for crafting medical applications. CTK now provides several innovative GUI and DICOM elements that specifically save GUI space, user-time, and developer effort in medical applications. Examples of the widgets provided by CTK are discussed in the blog: http://www.kitware.com/blog/home/post/169
- *GUI Testing* is being offered in a maintenance release to follow Slicer 4.1 in May/June 2012. This work will allow user interactions with Slicer to be recorded on one machine and played back on another, and the results of those interactions can be compared. This GUI testing will be integrated into Slicer's

nightly regression testing process. We propose to base the tests on the features demonstrated in the Slicer tutorials.

- DICOM Lollipops are a novel method for embedding entire Slicer (MRML) scenes into a DICOM object. Via this embedding, Slicer data can be read to/from PACS, thus enabling better integration of Slicer with clinical workflows.

5.3.3 Roadmap

We are proposing to offer quarterly releases of the NA-MIC Kit and Slicer. Highlights from the recent releases and plans for future releases are given next.

Slicer 4.0: Major Changes (November, 2011)

Slicer 4.0 includes a major overhaul of the user interface, improved and simplified workflows for major tasks, simplified procedures for developers, and improved Python support. http://www.slicer.org/slicerWiki/index.php/Documentation/4.0/Announcements

Slicer 4.0.1: Major Changes (January, 2011)

Notable changes in Slicer 4.0.1 include new support for Ubuntu 11.04 and Fedora FC 13, and for DWI tractrography modules on Mac OS X. VTK GPU raycast method support of ATI GPU cards for Mac OS X is also included in this release, as well as major improvements to restoring scenes, which now provides significantly faster speeds. Additionally, in Slicer 4.0.1, users can now drag-and-drop files, including volumes, meshes, annotations, etc., into Slicer from Window Explorer, Mac Finder, and Linux Nautilus. http://www.slicer.org/slicerWiki/index.php/Slicer4:QtPort/Releases#Slicer_4.0.1

Slicer 4.1: Major Changes (April, 2012)

Charting support has been added with a new chart view in the 4.1 release, which is used by the MultiVolumeExplorer module. This new module introduces multi-volume (e.g. time series) support in Slicer. The Cache Settings panel has been ported from Slicer3, to provide users with controls to display or clear the available cache space used when downloading sample data, and to store temporary filter outputs. Further support for importing VTK unstructured grids is also a new addition.

Several other modules have been updated or added, including the OpenIGTLinks, Welcome, and DICOM modules. The CompareViews and View Controller GUI have been revised and improved. The Modules settings panel has also been enhanced, enabling users to set Prefer Executable CLI loading option to decrease memory consumption by modules and select which module(s) to skip at startup, as well as to customize their Favorite modules toolbar. Many of the icons for the Core Modules have also been updated.http://www.kitware.com/news/home/browse/401

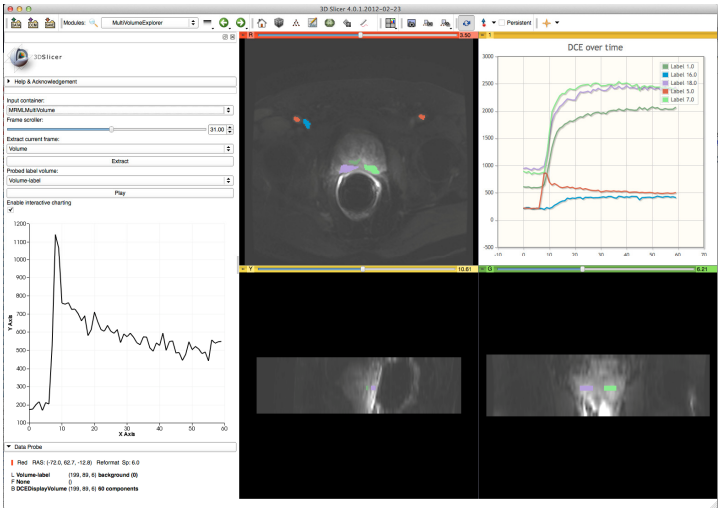

Figure 3. Slicer 4.1 introduces support for 4D images and charting

Slicer 4.2: Plans (August, 2012)

The next major release, Slicer4.2, is still in the planning phase, but certain features are likely to be present. In particular, we anticipate the following will be released in Beta/1.0 format in Slicer 4.2:

- QtTesting
- DICOM Lollipops
- ITKv4
- SimpleITK

Additionally, Slicer 4.2 will feature the maturation of two leading technologies:

- Improved and stabilized Multi-Volume support, e.g., dynamic objects (4D surfaces/ meshes)
- Improved and stabilized Slicer Catalog integration

As with prior releases, community involvement is key to determining and providing the final set of features to be included.

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6. ARRA SUPPLEMENT

A small subcontract was given to Kitware (from 9/2011 to 3/2012) to continue the development, support, and maintenance of the conversion of Slicer to Qt. This funding specifically contributed to the enhancement of Slicer4's interface in conjunction with the Slicer4 release (version 4.0.1) generated for the NA-MIC All Hands Meeting in Salt Lake City. Over 100 people attended that meeting, and we saw a massive spike in downloads during and just after the meeting. The 64 bit Windows version alone now has been downloaded over 12,000 times. That release represents a new level of functionality and stability for Slicer. Developers now are able to use it to create their own extensions and user interfaces. Users are able to process their data using a more responsive and capable user interface. New algorithms and interfaces have been developed and shared to address new pre-clinical and clinical problems.

[http://wiki.na-mic.org/Wiki/index.php/2012_Progress_Report_ARRA_Supplement].

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7. OUTREACH

Sonia Pujol, PI

The Training Core's efforts are two-fold: a teaching effort to accelerate the transfer of NA-MIC technology to clinicians and scientists, and a validation effort to investigate the comparative performances of diffusion tensor image analysis algorithms.

A. Training Events

NA-MIC training activities over the period July 1, 2011-June 30, 2012 consisted of a series of 15 workshops and courses at national universities and international venues. These outreach events have been undertaken as part of on-going NA-MIC initiatives or in response to requests made by host institutions at both national and international venues.

We have organized outreach events tailored toward specific groups of users, such as the "*3DSlicer Workshop for Image-guided Therapy Research"* at the University of British Columbia, which gathered 20

clinical researchers and scientists, and the "*Cranio-Maxillo Facial Workshop"* at Case Western Reserve University School of Dental Medicine, which gathered 20 participants from the cephalometric community. Finally, we delivered a series of hands-on demonstrations of *"NA-MIC Technology for Neurosurgical Planning and Image-guided Prostate Interventions"* at the Brigham and Women's Hospital 2011 Radiology Resident Fair.

We designed a two-day workshop geared toward both user and developer communities. For example, we delivered a two-day "Slicer4 Training Workshop" that gathered 36 scientists and clinical researchers at the University of Iowa, and we have been invited to deliver a two-day hands-on seminar on "*Diffusion Tensor Imaging and Programming in Slicer4"* at the Universidad Rey Juan Carlos in Madrid, in collaboration with the Madrid-MIT+Vision Consortium.

In addition, we have organized a series of seminars and demonstrations at four international conferences in Radiotherapy, Neuroscience, Biomedical Imaging, and Radiology.

Radiotherapy: The 3DSlicer workshop on the use of Slicer for radiotherapy research led by Gregory Sharp at the Joint meeting of the American Association of Physicists in Medicine (AAPM) and the Canadian Organization of Medical Physics (COMP) (2011 AAPM/COMP, July 31-Aug. 1, Vancouver, Canada) gathered 20 clinical researchers from the radiotherapy community.

Neuroscience: We have organized a one-day satellite workshop at the Annual Meeting of the Society for Neuroscience (SfN 2011, Nov. 12-16, Washington DC): the event combined a series of lectures on the fundamentals of diffusion tensor imaging with hands-on training sessions using NA-MIC technology, and gathered 23 neuroscientists.

Biomedical Imaging: We have delivered a half-day course that guided participants through an integrated workflow for exploring the brain white matter at the SPIE Medical Imaging conference (SPIE 2012, Feb. 5-8, San Diego, CA).

Radiology: NA-MIC presence at the Annual Meeting of the Radiological Society of North America (RSNA 2011, Nov. 27-Dec. 2, Chicago, Il) consisted of a full week of training courses and hands-on demonstrations.

Our outreach activities at RSNA 2011 included a paper presentation on *"Publicly available RadLex-linked Anatomy Atlas for image Analysis, Informatics and Education*", as well as two 1.5 hour hands-on educational courses *"3D Visualization of DICOM Images for Radiological Applications"* in collaboration with Dr. Kitt Shaffer, Vice-Chairman for Education in Radiology at Boston University School of Medicine, and *"Quantitative Imaging for Clinical Research and Practice"* in collaboration with Dr. Katarzyna J. Macura M.D., Ph.D., Associate Professor of Radiology at the Johns Hopkins School of Medicine. Each of our courses gathered between 100 and 125 international radiologists and clinical researchers.

We delivered more than 50 hours of hands-on demonstrations at the *"3D Slicer Open Source Software Platform for Segmentation, Registration, Quantitative Analysis and 3D Visualization of Biomedical Image Data"* exhibit, which was part of the RSNA 2011 Quantitative Imaging Reading Room. The 3DSlicer exhibit introduced translational clinical researchers to the capabilities of the new 3DSlicer software version 4.0 through a series of 13 hands-on demonstrations on a diverse set of topics, including MRI-based topographic parcellation of human brain, PET/CT quantitative assessment of tumor response, white matter exploration for neurosurgical planning using Diffusion Tensor Imaging tractography, and registration and segmentation strategies for follow-up of cases of Traumatic Brain Injuries.

Our outreach activities have also included the dissemination of NA-MIC technology in Australia and Europe. In Australia, Dr. Kikinis was invited to deliver 3DSlicer seminars at St. Vincent's Hospital in both Sydney and Melbourne. In Europe, Dr. Kikinis presented a lecture on 3DSlicer application at the *"Eurobioimaging Workshop on Open-source Medical Image Analysis Software,"* which was part of the International Symposium on Biomedical Imaging (ISBI 2012, Apr. 30-May1, Barcelona, Spain), and he attended the one-day *"NA-MIC Satellite Workshop on Image-Guided Therapy"* at the 26th International Congress on Computer Assisted Radiology and Surgery (CARS 2012, June 27-30, Pisa, Italy).

Since its release at RSNA in November, 2011, all of our hands-on training workshops have incorporated the new Slicer version 4.0, for which we have been developing a new compendium of topics, including 3D visualization, diffusion tensor imaging, neurosurgical planning, and Python programming.

Since 2005, the Training Core has given instruction in NA-MIC technology to a total of 2,056 scientists and clinicians.

B. Validation Effort

We extended our exploratory research on the validation of DTI tractography algorithms, which we have been conducting since 2007, to the arena of neurosurgical planning. While tractography has demonstrated the potential to deliver valuable information about the spatial relationship of intricate pathways that lie adjacent to tumor, neurosurgeons still face the challenge of choosing the appropriate tractography method and tract selection strategy in the absence of ground truth. The first step toward validation is to compare the efficacy of DTI tractography algorithms against a common set of data. To that end, we organized the first "*DTI Tractography Challenge for Neurosurgical Planning"* at the 14th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2011) conference in Toronto, Canada. The 10-hour long workshop gathered 25 participants. Eight international teams took part in the challenge. The workshop datasets consisted of four neurosurgical cases and two series of repeat volunteer scans from two healthy subjects. Participants were invited to process two neurosurgical cases, along with the healthy subject datasets, prior to the event, and then on the day of the workshop they analyzed two neurosurgical cases. We used a set of qualitative and quantitative metrics for comparing tractography results across teams. Qualitative evaluation of the tractography results was provided by three clinicians and two DTI experts and focused on the assessment of the anatomical correctness of the tract reconstruction and the spatial relation between the tracts and the tumor. By giving clinicians an overview of the cutting-edge DTI tractography algorithms developed in research, and providing algorithm developers with feedback from leading neurosurgeons on a common set of data, this workshop forged a bridge between the scientists who create the tractography tools and the clinicians who use the tools in neurosurgical settings.

The tractography results obtained on the challenge datasets demonstrated a large variability among tractography methods and motivated the organization of a second edition of the NA-MIC DTI Tractography Challenge at MICCAI 2012.

C. Summary of NA-MIC Outreach events (July, 2011-June 2012)

1. 3DSlicer workshop for radiotherapy research, 2011 AAPM/COMP meeting, Aug. 2, Vancouver, Canada. http://www.na-mic.org/Wiki/index.php/Events:2011-08-02-AAPM-Slicer-Users-Group-Meeting

2. 3DSlicer workshop on image-guided therapy research, Aug. 4, 2011, University of British Columbia, Vancouver, Canada. http://www.na-mic.org/Wiki/index.php/Events:UBC_3D_Slicer_workshop_August_2011

3. MICCAI 2011, DTI Tractography Challenge for Neurosurgical Planning, Sept. 18, Toronto, Canada. http://www.na-mic.org/Wiki/index.php/Events:_DTI_Tractography_Challenge_MICCAI_2011

4. Brigham and Women's Hospital Resident Fair, Nov. 2, 2011 Boston, MA. http://www.na-mic.org/Wiki/index.php/BWH_Resident_Fair

5. Joint Cephalometric Expert Group Workshop, Nov. 9, 2011, Cleveland, OH. http://www.na-mic.org/Wiki/index.php/CMF_Workshop_Cleveland

6. SFN 2011, Nov. 11, Washington D.C. "White Matter Exploration with Diffusion Tensor Imaging: Fundamentals and Perspectives." http://www.na-mic.org/Wiki/index.php/__SFN2011_Diffusion_Tensor_Imaging_Analysis_Workshop

7. "Quantitative Medical Imaging for Clinical Research and Practice", RSNA 2011 Refresher course, Nov. 27, 2011, Chicago, Il. http://www.na-mic.org/Wiki/index.php/RSNA_2011_#Quantitative_Medical_Imaging_for_Clinical_Research_and_Practice

8. "3D Interactive Visualization of DICOM images", RSNA 2011 Refresher course, Nov. 29, 2011, Chicago, Il. http://www.na-mic.org/Wiki/index.php/RSNA_2011#3D_Interactive_Visualization_of_DICOM_images

9. “The 3D Slicer open source software platform for segmentation, registration, quantitative analysis and 3D visualization of biomedical image data”, RSNA Quantitative Imaging Reading Room, Nov. 27-Dec. 2, 2011. http://www.na-mic.org/Wiki/index.php/RSNA_2011#RSNA_2011_Quantitative_Imaging_Reading_Room

10. “Exploring Brain Connectivity in-vivo: from Theory to Practice”, NA-MIC course at SPIE Medical Imaging 2012, Feb. 5, San Diego, CA. http://www.na-mic.org/Wiki/index.php/SPIE_2012_DTI_Workshop

11. “Creating Tools for Medical Image Computing”, 3DSlicer workshop at St. Vincent’s Hospital, Apr. 26, 2012, Sydney, Australia. http://www.hisa.org.au/events/event_details.asp?id=224111

12. “3DSlicer: an open-source platform for Medical Image Computing,” ISBI 2011, Apr. 30- May 1, 2012, Barcelona, Spain. http://www.cs.ucl.ac.uk/opensource_mia_ws_2012/

13. “Creating Tools for Medical Image Computing,” 3DSlicer workshop at St. Vincent’s Hospital, Fitzroy, May 2, 2012, Australia. http://www.hisa.org.au/events/event_details.asp?id=224112

14. NA-MIC Training Workshop at the Universidad Rey Juan Carlos, May 21-22, 2012, Madrid, Spain. http://www.na-mic.org/Wiki/index.php/Madrid-May-21-2012-Slicer-Workshop

15. NA-MIC satellite workshop on Image-Guided Therapy, June 30, 2012, Pisa, Italy. http://www.na-mic.org/Wiki/index.php/CARS_2012

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8. NA-MIC PUBLICATIONS

Peer-reviewed journal articles

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12. Irimia A., Chambers M.C., Torgerson C.M., Horn J.D.V. Circular Representation of Human Cortical Networks for Subject and Population-level Connectomic Visualization. Neuroimage. 2012 Apr 2;60(2):1340-51. PMID: 22305988.

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9. EXTERNAL ADVISORY BOARD RECOMMENDATIONS

To: Dr. Ron Kikinis, National Alliance for Medical Image Computing

From: NA-MIC External Advisory Board

Date: 4/26/2012

Re: 2012 EAB Meeting: NA-MIC Progress

The External Advisory Board (EAB) for the National Alliance for Medical Image Computing (NA-MIC), one of seven National Centers for Biomedical Computing funded by NIH, met in Salt Lake City, Utah on January 12, 2012. Dr. Ron Kikinis hosted the meeting. Bill Lorensen (GE Retired, Chair), Chris Johnson (Utah), Morry Blumenfeld (Meditech Advisors), Sandy Napel (Stanford), Fred Pryor (WUSTL), and Carlo Pierpaoli (NIH NICHD) represented the EAB. Terry Yoo (NIH NLM), Michael Ackerman (NIH NLM) and Vinay Pai, the NIH Program Officer, also participated. The EAB Meeting was part of the NA-MIC 2012 All Hands Meeting (AHM).

EAB members attended the morning and afternoon sessions of the AHM along with the rest of the NA-MIC community. The EAB Chair also attended the Tuesday and Wednesday Project Week. This combination format was started after the first year and the EAB favors this format over one that has separate presentations for the EAB. After the AHM, the EAB met with NA-MIC leadership and PIs. In a round table discussion, each EAB member provided comments to the NA-MIC team. This report highlights the ensuing discussions.

EAB Impressions

- *The EAB is impressed with the diversity and progress of the DBPs.* The current portfolio of DBPs shows breadth in imaging modalities as well as clinical applications. Each DBP presented excellent progress toward their aims as well as good progress toward integrating NA-MIC tools into their work-flows. The Algorithms groups have frequent interactions with the DBPs and appear to look forward to the new challenges each one DBP brings. Often new technology must be adapted or invented. In the early years of NA-MIC, the algorithm groups were pushing technology to the DBPs. In recent years, the DBPs are defining and pulling technology from the Algorithms Core.

- *The EAB is impressed with the current state of Slicer4.* The bulk of software development in the past year has been on the new Slicer4 platform. The first release was rolled out at RSNA 2011. This been a major development effort and the EAB commends the distributed software engineering team for creating a quality software product. This Slicer4 effort was not just a conversion to a new Qt-based

GUI, but also included extensive refactoring and reorganization of all of Slicer4. Slicer4 includes 36 external packages as well as a large Slicer4 code base. All of the software builds and runs on Linux, Windows and Mac platforms. NA-MIC engineers contribute to many of the external projects, e.g. VTK, ITK, CTK, teem, OpenIGTLink and others. And NA-MIC benefits from the development of these external projects by international communities. The coordination of these multiple software packages is accomplished through the NA-MIC funded Superbuild capabilities of CMake. Slicer4 represents the culmination of years of effort towards the NA-MIC Kit that not only includes Slicer, but also the external projects and software engineering tools.

- *The EAB is impressed with the level of research content in the Algorithms Core.* The technical output of the Algorithm Cores through research papers is impressive. There is excellent synergy between the geographically separated groups and little if any duplication of effort. The different groups have a number of joint publications and the mutual respect they show for each other is evident in their formal presentations as well as personal interactions. Consistent, long-term vision and funding has resulted in a collegial, productive technical team.

- *The EAB recognizes the strength and value of the Center's training and education program.* The Training program continues to accelerate the transfer of NA-MIC technology to scientific and clinical customers. Twelve workshops at eleven different venues were presented. These included a mixture of engineering and clinical audiences. The largest effort was at RSNA 2011 where NA-MIC presented two courses, 54 hours of demos, and a paper. The courses are hands-on and the NA-MIC training team is well-organized and efficient in presenting these courses. The entire NA-MIC team focused on providing a high quality roll-out and presentation of Slicer4 at RSNA. Well done!

- *The EAB is impressed with the validation effort.* This year, the validation effort was moved into the Training Core. The purpose of the validation effort is to assess the performance of various algorithms in a variety of clinical areas. This year NA-MIC hosted the first *DTI Tractography Challenge for Neurosurgical Planning* at MICCAI 2011. Eight international teams participated in the Challenge. The faculty consisted of eight NA-MIC members plus additional international experts. Six patient datasets were investigated by the Challenge participants. Validation was both qualitative and quantitative. The qualitative assessment was done by neurosurgeons and DTI experts. This was truly an outstanding effort, unique in the field of medical image processing.

- *The EAB continues to recognize the biannual Project Week as a jewel of the Center.* Project Week brings together software engineers with a diverse group of NA-MIC customers. In 2012 over 100 people registered for the Project Week or AHM. This year's effort focused on Slicer4 and many of the 57 projects involved Slicer4. Thirty-five of the projects were DBP-related. This year's project variety shows that the bulk of the effort is directly related to DBPs. The EAB sees this as a positive trend.

Recommendations

- *NA-MIC should continue its leadership in validation.* The 2011 Neurosurgical validation was a huge success. The NA-MIC effort is unique in the field and further challenge workshops will be valuable for the field. This does not mean that NA-MIC must organize all validation workshops. The EAB thinks that NA-MIC's past success will motivate other groups to organize similar events.

- *Future of NA-MIC*. NA-MIC was formed by the NIH to be a national resource. As the NCBC funding winds down, the EAB is concerned about future funding mechanisms for NA-MIC's resources. NIH seems to be focusing on translational medicine. The EAB feels strongly that NA-MIC's **track record for transitioning technology and software** fits into the NIH translational future direction. The EAB urges NIH to look closely at NA-MIC's accomplishments and find a home for NA-MIC's unique mixture of technology development, high quality software, and transition successes.

Summary

A report is a difficult place to communicate the EAB's enthusiasm for NA-MIC. During our round table discussions, each member had glowing remarks about the presentations earlier at the AHM.

Each of the NA-MIC cores and DBPs has made excellent progress in the past year. NA-MIC continues to deliver its output through research publications, high quality and open software, as well as clinical applications through its DBPs. Although the major beneficiaries of NA-MIC's products are in the US, NA-MIC has a large international presence and impact. Dr. Kikinis and his leadership team continue to leverage multiple funding sources that consistently transition sophisticated research results and quality software to the broad biomedical imaging community. The EAB is confident that NA-MIC's proven transition record will help it survive under future NIH funding mechanisms.

Sincerely,

Bill Lorensen, EAB Chair, GE Research (retired)