Morphometry BIRN: Milestones for 2005

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2004 All Hands Meeting

Next Meetings:

- Morphometry BIRN ~April 2005 (6 months)

- BIRN AHM ~ October 2005 (12 months)

Morphometry BIRN Cores:

- MRI Calibration (J. Jovicich)

- Analysis, Visualization, Tools (S.Pieper)

- Computational Informatics (D. Kennedy)

Software release applications ~Dec 04

- **MRI Calibration**
  - Reminder of delivery goals
  - Overview of work plan
  - Milestones for year 2004-2005

By the end of 2006 we will provide:

- <u>Protocol recommendations</u> for multi-site, multi-fields
    - T1-based structural multi-spectral protocol
    - T2-based structural multi-spectral protocol
    - Diffusion protocol
- <u>Correction recommendations</u> that minimize variability
- <u>Software tools</u> that perform the recommended corrections
- De-identified human <u>calibration data</u>

Phase 1: Clean up + Preliminary evaluations on new methods/platforms

- Complete data analysis & publication of first MorphBIRN calibration cycle
- Selected test preliminary protocols and correction methods
- Obtain preliminary test-retest reproducibility measures (intensity, GM, WM, CSF, FA, ADC)

Phase 2: Implementation of test protocols at all Human BIRN sites

- Multi-spectral T1, T2, DTI 1.5h protocol

Phase 3: Test-retest data acquisition with common protocols

Phase 4: Data Analysis and Evaluation of reproducibility

Phase 5: Preparation for dissemination (protocols & correction tools)

Oct 04 – Apr 05 (6 months timeline)

Reproducibility of T_1-based multi-spectral data & derived morphometry

- Multi-site calibration manuscript *(J. Jovicich)*

- Preliminary reproducibility evaluation of MR signal and GM/WM/CSF segmentations as function of B_0, B_1, unwarping *(A. Dale)*

- Distortion phantom scanned at new sites, unwarping evaluated *(J. Jovicich)*

Reproducibility of T_2-based multi-spectral data & derived morphometry

- Multi-spectral acquisitions (1.5T/3T) at Duke (first test-retest round) *(J. MacFall)*

- Preliminary multi-spectral GM/WM/CSF segmentations (unwarping) *(J. MacFall)*

Diffusion: reproducibility of FA and ADC

- Acquisition/analysis of test-retest DTI (3-4 subjects, 1.5T, 4T, SNR effect) *(S. Mori)*

- Preliminary evaluation of B_0 correction with field maps *(A. Song)*

- Preliminary evaluation of number/orientation of gradient-encoding directions *(L. Frank)*

BIRN
BIOMEDICAL INFORMATICS RESEARCH NETWORK

Apr 05 – Oct 05 (12 months timeline)

Reproducibility of T_1-based multi-spectral data & derived morphometry

- Reproducibility evaluation of MR signal and full segmentations as function of B_0, B_1, unwarping *(A. Dale)*
- Unwarping code for all human BIRN sites *(J. Jovicich)*
- Protocol/correction recommendations for multiple platforms *(A. Dale)*

Reproducibility of T_2-based multi-spectral data & derived morphometry

- Complete test retest multi-spectral acquisitions (1.5T/3T) at Duke *(J. MacFall)*
- Complete multi-spectral GM/WM/CSF segmentations (unwarping) *(J. MacFall)*
- Protocol recommendation related to specific applications *(J. MacFall)*

Diffusion: reproducibility of FA and ADC

- Acquisition & analysis of test-retest DTI (1.5T, 4T, TE, b effects) *(S. Mori)*
- Protocol/correction recommendations that includes # averages, TE, b-value, number/directions of encoding gradients, MRI platforms *(S. Mori, A. Song, L. Frank)*

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- **Analysis, Visualization and Integration Tools**
  - Segmentation Tools
  - Shape Analysis Tools
  - Diffusion Analysis Tools
  - Integrated Visualization Tools
  - Query Atlas Tool
  - Machine Learning Tools

- <u>Segmentation Tools</u>
  - A) Protocol Specific (Fischl, MGH)
    - 6: Develop Atlases for High Field Strength, New Protocol
    - 12: Deploy Segmentation Tools
  - B) Protocol Neutral (Pieper, BWH)
    - 6: Apply to MS Data
    - 12: Test on mBIRN AD / ADNI Data
  - C) Facial Masking for T2, DTI (Notestine, UCSD / Grimson, MIT / Pieper, BWH / Fischl, MGH)
    - 6: Behavioral Recognition Test; Machine Vision Analysis
    - 12: Masking T2, DTI (Either 2.1.A or 2.1.B)
  - D) QA for Protocol Specific (Fischl, MGH)
    - 6: Collect Statistics
    - 12: Deploy QA Tools

- **Shape Analysis**
  - A) Standardized Representation (Kolasny, JHU)
    - 6: BIRN Data Grid Segmentation Format (Subcortical)
    - 12: Portal Launching Studies
  - B) Large Scale Computation (Kolasny, JHU)
    - 6: Port to Multiple Target Architectures (Intel, AMD…)
    - 12: Local Cluster / Grid Deployment
  - C) Statistical Metrics (Kolasny, JHU)
    - 6: Develop Metrics
    - 12: Apply to Subject Populations
  - D) Visualization Integration (Kolasny, JHU / Pieper, BWH)
    - 6: Improved Visualization Modes (Integrated with MRML Scenes)
    - 12: DTI LDDMM Visualization

- **DTI Aims**
  - A) Software Interoperability (Pieper, BHW / Gerig, UNC)
    - 6: Collect Sample Datasets
    - 12: Standardized File Formats (BXH, MRML)
  - B) Forebrain White Matter Atlas (Fallon, UCI)
    - 6: Control Populations (Version 1)
    - 12: Depression, MCI, AD Populations (Version 1)
  - C) WM Atlases for Automated Tractography (BWH, UCI, UNC)
    - 6: Discuss
    - 12: Experiment with Initial Atlases
  - D) Expert Review of Automated Atlases (UCI)
    - Minimal work in first year

- ## <u>Visualization</u> (Pieper, BHW)

  - A) High Performance Interaction with BIRN Data Grid
    - 6: Flexible Portal Launch
    - 12: Images Re-Uploaded to Data Grid

  - B) Integrated Display
    - 6: DTI Visualization from Multiple Sites
    - 12: LDDMM Deformations in Anatomical Context

- **Query Atlas** (Pieper, Plesniak, BWH / Brown, UCSD)
  - A) Ontology Labeling of Analysis Results
    - 6: Determine Gray Matter Ontology
    - 12: Multi-Tool Query Interface
  - B) Integrate Metadata and Target Multiple Sites
    - 6: Publication of Concept and Status
    - 12: Re-Architect for Version 2
  - C) Integrate Query Results in 3D Context
    - No direct milestones in year 1

- **<u>Machine Learning</u>** (Golland, Jaakkola, MIT)
  - A) Automatic Hypothesis Generation
    - 6: Apply Existing Tools to BIRN Data (MIRIAD)
    - 12: Evaluate Results and Publish
  - B) Incorporate *a priori* knowledge
    - Initial Discussions and Plans this Year for Work to be Done Next Year
  - C) Integration with Visualization (with Pieper, BWH)
    - 12: Experiments to Display Hypotheses in Anatomical Context
  - D) Integration to BIRN Portal (with Grethe, BIRN-CC)
    - 6: Define Architecture
    - 12: First Version Implemented for Use with MIRIAD and other BIRN Statistics Interfaces

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Informatics Work Plan: Phase 1 Milestones

Database Technologies		
Beta test XNAT deployment to selected BIRN sites	**Dan Marcus**	4/1/2005
Controlled release cycles of databases and tools	**Jeff Grethe**	4/1/2005
Postgres implementation of the HID	**Burak/Karen P.**	4/1/2005
Workflow		
End-to-end uploading improvements (BIRNDUP)	**Jonathan Sacks**	4/1/2005
CALM / GAME Assessment incorporation	**Burak**	4/1/2005
Access and query of data		
Improve Statistics Interface	**David Kennedy**	4/1/2005
Knowledge Management		
Expand Data Mediation capabilities	**Burak/Amarnath**	4/1/2005
Data Provenace		
Integrate Provenance with XML Upload	**Nicole Aucoin**	4/1/2005
Store the Data Provenance in HID	**Nicole Aucoin**	4/1/2005
Data Curation		
Create project registration and data checkout tool	**Jonathan Sacks**	4/1/2005
Create Quality Assurance tools	**Dan Marcus**	4/1/2005
Public Data		
Survey of anticipated BIRN data	**David Kennedy**	4/1/2005
Public release of WashU AD data	**Dan Marcus**	4/1/2005

Database Technologies		
Integration of XNAT with the HID via XML	**Dan Marcus**	10/1/2005
Access and query of data		
Improve Semantic Web (Haystack) general data viewer	**David Karger**	10/1/2005
mBIRN service delivery to RPDR	**Shawn Murphy**	10/1/2005
Standalone Stats Browser	**David Kennedy**	10/1/2005
Knowledge Management		
Create a Neuropsycholocial Ontology prototype	**Christine F-Notestine**	10/1/2005
Data Provenace		
Query by Provenance	**Nicole Aucoin**	10/1/2005
Continuing support of Clinical Projects		
Longitudnal functions for Multi-site Alzheimer Disease		10/1/2005