

## Mbirn: B0 and eddy current correction code for diffusion MRI

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### Introduction:

The goal of this program is to implement the EPI distortion correction in such a way that it can be inserted into a reconstruction pipeline. The detailed description of the phase step EPI sequence and distortion correction procedures can be found in the reference paper below.

### Reference Paper:

Chen, B., Guo, H., and Song, A. W., Correction for direction-dependent distortion in DTI using match magnetic field maps (NeuroImage, in press).

### Installation:

The program and necessary files are saved in a .zip format. Unzip the package into your chosen directory, where the following files and directories will be extracted.

```
DTIC.cmd      -- wrapped executable file
\source       -- source files
\lib          -- run time libraries
\demo         -- demonstration data
\doc          -- documentation
demo.bat      -- run demonstration
cepi.exe      -- binary file
readme.txt    -- this file
readme.pdf    -- readme file and screenshot
```

### Usage:

```
DTIC PI DWI d1 d2 d3 dt dw FOV TE SW H1 H2
(Run DTIC without arguments for instructions)
```

### Input:

PI: raw data file collected by phase step EPI sequences during the calibration stage. Pass the file name as the parameter. The file should be saved as big endian 16-bit integer. The data is interleaved real and imaginary channels. The raw data should be saved in the order of d1,dt,d2,d3,dw (see below).

DWI: diffusion weighted images acquired by single shot EPI images. The base image and the diffusion weighted images are saved in one directory. Pass the directory name as the parameter. Each diffusion weighted image is saved in a separate file as intensity values in big endian 16-bit integer format. The file extension should be from 1 to dw corresponding to the order of diffusion weighted files, e.g. I.001, I.002, I.003, etc. The file order should match the order of dw in PI file.

d1,d2,d3: resolution in frequency, phase and slice directions respectively

dt: number of echoes in phase step EPI sequence.

dw: number of total diffusion weighting image volumes. For a typical DTI scheme with 1 base image and 6 diffusion weighting directions, dw = 7.

FOV: field of view. Unit: centimeter.

TE: time of echo. Unit: millisecond.

SW: sweep frequency. Unit kHz. Default value = 125kHz.

H1: header size of PI file in bytes. Default = 39984 (Based on the GE Horizon standard file format)

H2: header size of DWI in bytes. Default = 7904 (Based on the GE Horizon standard file format)

**Output:**

cDWI:Corrected DW images saved as little endian 16-bit integer in one file in the order of d1,d2,d3,dw.

**Screenshot:**

```
H:\bchen\EPI_Geo_Corr\EPI_C>demo
Diffusion MRI distortion correction demonstration
Brain Imaging and Analysis Center, Duke University
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==== Reading and reconstructing phase EPI images ..... Done.
==== Computing field variation maps ..... Done.
      File saved. Filename=c_dBmap; DataType=double; Endian=little endian.
==== Reading and reconstructing EPI images ..... Done.
      File saved. Filename=c_epiDWI; DataType=int16; Endian=little endian.
==== Correcting the image distortions ..... Done.
      File saved. Filename=cDWI; DataType=int16; Endian=little endian.
H:\bchen\EPI_Geo_Corr\EPI_C>
```