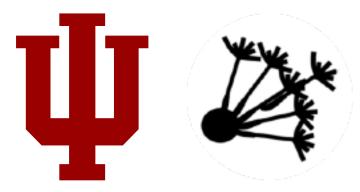
THY COMPUTE

- So is this solved?
- Far from it

$$\mathbf{B}^{T}\mathbf{B} = \mathbf{B}_{z}^{T}\mathbf{B}_{z} \otimes \mathbf{B}_{y}^{T}\mathbf{B}_{y} \otimes \mathbf{B}_{x}^{T}\mathbf{B}_{x}$$

$$(\mathbf{B}_{z} \otimes \mathbf{B}_{y} \otimes \mathbf{B}_{x})^{T} \mathbf{D}\mathbf{D}(\mathbf{B}_{z} \otimes \mathbf{B}_{y} \otimes \mathbf{B}_{x})$$



REGISTRATION TIME



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DR-BUDDI (Diffeomorphic Registration for Blip-Up blip-Down Diffusion Imaging) Method for Correcting Echo Planar Imaging Distortions

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Abstract

We propose an echo planar imaging (EPI) distortion correction method (*DR-BUDDI*), specialized for diffusion MRI, which uses data acquired twice with reversed phase encoding directions, often referred to as blip-up blip-down acquisitions. *DR-BUDDI* can incorporate information from an undistorted structural MRI and also use diffusion-weighted images (DWI) to guide the registration, improving the quality of the registration in the presence of large deformations and in white matter regions. *DR-BUDDI* does not require the transformations for correcting blip-up and blip-down images to be the exact inverse of each other. Imposing the theoretical "blip-up blip-down distortion symmetry" may not be appropriate in the presence of common clinical scanning artifacts such as motion, ghosting, Gibbs ringing, vibrations, and low signal-to-noise. The performance of *DR-BUDDI* is evaluated with several data sets and compared to other existing

$$\xi = \int_{\Omega} CC \left(I_{up}(\phi(\mathbf{x})) \mathcal{J}(\phi), I_{down} \left(\phi^{-1}(\mathbf{x}) \right) \mathcal{J}(\phi^{-1}) \right) d\Omega$$

$$\xi_1 = \int_{\Omega} CC(I'_{up}, I'_{down}, \mathbf{x}) d\Omega$$

$$\xi_2 = \int_{\Omega} \left(CC \left(I_{up}(\phi_1(\mathbf{x}, 0.5)), \mathcal{S} \right) + CC \left(\mathcal{S}, I_{down}(\phi_2(\mathbf{x}, 0.5)) \right) \right) d\Omega$$

$$\mathcal{K}(\phi_1, \phi_2) = 2 \frac{I'_{up} \cdot I'_{down}}{I'_{up} + I'_{down}}$$

$$\xi_3 = \int_{\Omega} CC(\mathcal{K}, \mathcal{S}, \mathbf{x}) d\Omega$$

$$I_{up}^{"}=I_{up}(\phi_1(\mathbf{x},0.5))\times |\mathscr{J}(\phi_1(\mathbf{x},0.5))|,$$

$$I''_{down} = I_{down}(\phi_2(\mathbf{x}, 0.5)) \times | \mathscr{J}(\phi_2(\mathbf{x}, 0.5)) |$$

$$\xi_4 = \int_{\Omega} CC(I_{up}^{"}, I_{down}^{"}, \mathbf{x}) d\Omega$$



