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MS60

A Finite Element Based Method for Quantification of Self-diffusion Process in White Matter Environment

Diffusion MRI (DMRI) is a biomedical imaging modality for non-invasive assessment of anatomy of white matter tracts in human brains. It offers local sensitivity of white matter tracts to orientations of water molecules diffusive motions. To simulate the DMRI process, we develop a higher-order finite element method for solving the diffusion PDE in a multi-compartment environment in this work, which provides more flexibility for geometry and material of different white tracts compartments than existing techniques.

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MS60

Shore in Action: Estimation of Microstructural Features from Magnetic Resonance (MR) Data

Analysis of diffusion-weighted MR data characterizes the microstructural features of materials or tissues. The Simple Harmonic Oscillator based Reconstruction and Estimation (SHORE) technique, which successfully represents a wide range of MR signal profiles, will be described. We will discuss how the SHORE framework can be utilized to quantify several characteristics of the specimen including its structural anisotropy, pore size distributions, and an apparent fractal dimension.

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MS61

A General Framework for a Class of First Order Primal-Dual Algorithms for TV Minimization

We generalize the primal-dual hybrid gradient (PDHG) algorithm proposed by Zhu and Chan, draw connections to similar methods and discuss convergence of several special cases and modifications. In particular, we point out a convergence result for a modified version of PDHG that has a similarly good empirical convergence rate for total variation (TV) minimization problems. Its convergence follows from interpreting it as an inexact Uzawa method discussed. We also prove a convergence result for PDHG applied to TV denoising with some restrictions on the PDHG step size parameters. It is shown how to interpret this special case as a projected averaged gradient method applied to the dual functional. We discuss the range of parameters for which the inexact Uzawa method and the projected averaged gradient method can be shown to converge. We also present some numerical comparisons of these algorithms applied to TV denoising, TV deblurring and constrained l1 minimization problems.

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MS61

Dynamic Network Flows and Nonlinear Discrete Total Variation Evolutions

We consider combinatorial minimization algorithms for solving some variational image processing problems. In particular, we consider energies involving Discrete Total Variations. Their minimizations yield a differential inclusion problem that can be efficiently solved via parametric maximum-flow. A maximum-principle follows. Links with first-order methods, Hamilton-Jacobi equations and conservations are described.

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MS61

Non-local Regularization of Inverse Problems

This article proposes a new framework to regularize linear inverse problems using a total variation prior on an adapted non-local graph. The non-local graph is optimized to match the structures of the image to recover. This allows a better reconstruction of geometric edges and textures present in natural images. A fast algorithm computes iteratively both the solution of the regularization process and the non-local graph adapted to this solution. The graph adaptation is particularly efficient to solve inverse problems with randomized measurements such as inpainting random pixels or compressive sensing recovery. Our non-local regularization gives state of the art results for this class of inverse problems. On more challenging problems such as image super-resolution, our method gives results comparable to translation invariant wavelet-based methods.

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