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CP5

Atlas Based Mri Segmentation Using Both Magnitude and Phase Information

We present a new framework for MR image segmentation based on deformable template using both the magnitude and phase information. In VASO MRI, the phase depends on tissue type, provides extra information about object boundaries. Hence using phase information will improve the segmentation and analysis of MR images. Finding the optimal mapping is formulated as a variational problem over a vector field.

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CP5

Physics-Based Image Segmentation for Endoscopic Images

We propose a new mathematical model for analyzing endoscopic images, which are obtained in vivo by chromoscopic colonoscopy. The model is based on a PDE-constrained optimization problem, in which the state equation represents the chromoscopy process and the objective function uses the Chan and Vese segmentation model.

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CP5

Probabilistic Identification and Estimation of Noise (piesno): Mathematical Features and Challenges

PIESNO is a recent technique of noise assessment for magnetic resonance imaging that has provided new approach to identifying noise-only pixels and to estimating noise level in magnitude images. This technique embodies common features from different fields such as probability and dynamical system. Here, we will outline these interesting features and discuss key mathematical challenges associated with this framework that are currently not tractable through analytical means.

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CP5

Detecting Jump Discontinuities Given Noisy Fourier Data

The detection of jump discontinuities in physical space using frequency (Fourier) data is an essential aspect of Medical Resonance Image processing. The difficulty of the task lies in extracting local information from the global Fourier data, and is further complicated by noise. In this talk, we discuss a recently developed algorithm that uses frequency data to recover the jump discontinuities. The expected accuracy of the detector has been modeled using statistical hypothesis testing.

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CP5

A Study of Chiari Malformations Using Magnetic Resonance Elastography

Magnetic Resonance Elastography (MRE), also called palpation by imaging, is a non-invasive, in vivo imaging technique used to measure the elasticity of a biological tissue subject to dynamic or static mechanical stress. The resulting strains are measured using magnetic resonance imaging (MRI) and the related elastic modulus is computed from models of tissue mechanics. Such a technique can be used not only as a non-invasive diagnostic tool for tumor detection, but also for gaining fundamental knowledge about the in vivo mechanical properties of normal biological tissues. In particular, brain MRE using the natural pulsations of the brain will help us better understand the brain mechanics. The present proposal will involve using magnetic resonance images from Hershey College of Medicine of brains of patients with chiari malformations. We plan to analyze how the presence of this malformation changes the stiffness of the brain tissue in the vicinity of the malformation. The design aim of the proposal is to develop a computational tool in Matlab capable to study the mechanical properties of the brain tissue with chiari malformations before and after the surgery using medical images and appropriate mechanical models for the brain.

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