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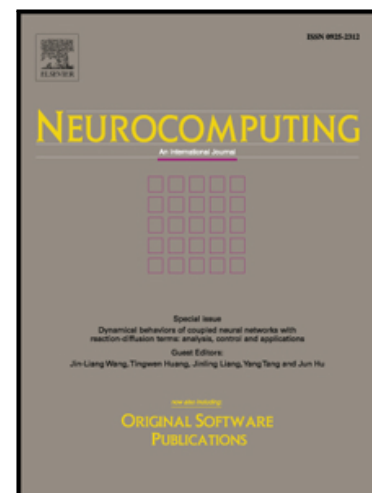
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A Novel Low-rank Model for MRI Using the Redundant Wavelet Tight Frame

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Abstract

The low-rank matrix reconstruction has been attracted significant interest in Compressed Sensing Magnetic Resonance Imaging (CS-MRI). To the end of computability, rank is often modeled by nuclear norm. The singular value thresholding (SVT) algorithm is taken as a solver of this model, usually. However, this model with the solver may be insufficient to obtain a high quality magnetic resonance (MR) image at high speed. Still inspired by the low-rank matrix reconstruction idea, we proposes a novel low-rank model with a new scheme of the weight selection to reconstruct the MR image under the redundant wavelet tight frame. A fast and accurate solver is given for the proposed model. Further, a new scheme is presented to accelerate the proposed solver. Numerical experiments demonstrate that the proposed solver and its accelerated version can converge stably. The proposed method is faster than some existing methods with the comparable quality.

Keywords: Low-rank Matrix Reconstruction, MR Image Reconstruction, Compressed Sensing, Tight Frame, Alternative Optimization Algorithm.

1. Introduction

Magnetic Resonance Imaging (MRI) plays an important role in medical diagnostic imaging due to its high soft-tissue contrast and its non-invasive acquisition, however, fundamentally limited by physical (gradient amplitude and slew-rate) and physiological (nerve stimulation) to reconstruct a high quality image from a small number of samples. In fact, the quality of the imaging may directly influent the therapy, and the imaging speed may affect the applications of MRI [1][2].

The conventional Compressed Sensing MRI (CS-MRI) was represented as ℓ_1 norm based model and resulted in a convex optimization that can be efficiently

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