Variational Models for Magnetic Resonance Imaging Denoising

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Magnetic Resonance Imaging (MRI) is a flexible and non-invasive clinical imaging technique that does not use ionizing radiation and provides essential diagnosis information from tissues and structures of the body. This technique suffers from the main limitation of being inherently slow, which provokes patient discomfort so increasing the possibility of motion during the scan. Noise strength in MRI directly depend on acquisition time, so accurate denoising methods can mitigate the effect of scan time reduction.

The consideration of noise removal in a bayesian framework leads to the study of non-convex likelihood functions derived from the rician and non-central-χ distributions that govern noise in MRI for different acquisition techniques. Based on these likelihood terms we formulate variational models for image denoising using Total Variation (TV) or Total Generalized Variation (TGV) regularization. The resulting non-smooth and non-convex problems are numerically solved using efficient proximal point algorithms. Theoretical results for the case of TV-based rician denoising are presented here proving the existence of at least one positive global minimizer of the functional (in collaboration with Prof. **S. Segura de Leon** from Universitat de Valencia). Finally, the performance of the proposed methods is shown for synthetic and in-vivo MRI denoising cases.