International Journal of Biomedical Imaging
Volume 2007 (2007), Article ID 27432, 11 pages
doi:10.1155/2007/27432

Research Article

Total Variation Regularization of Matrix-Valued Images

Oddvar Christiansen,[1] Tin-Man Lee,[2] Johan Lie,[1] Usha Sinha,[2] and Tony F. Chan[3]

[1]Department of Mathematics, Faculty of Mathematics and Natural Sciences, University of Bergen, Bergen 5008, Norway

[2]Medical Imaging Informatics Group, Department of Radiological Sciences, University of California, Los Angeles, 90024, CA, USA

[3]Division of Physical Sciences, College of letters science, University of California, Los Angeles, 90095, CA, USA

Received 30 October 2006; Accepted 13 March 2007

Academic Editor: Hongkai Zhao

Abstract

We generalize the total variation restoration model, introduced by Rudin, Osher, and Fatemi in 1992, to matrix-valued data, in particular, to diffusion tensor images (DTIs). Our model is a natural extension of the color total variation model proposed by Blomgren and Chan in 1998. We treat the diffusion matrix D implicitly as the product D=LLT, and work with the elements of L as variables, instead of working directly on the elements of D. This ensures positive definiteness of the tensor during the regularization flow, which is essential when regularizing DTI. We perform numerical experiments on both synthetical data and 3D human brain DTI, and measure the quantitative behavior of the proposed model.