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Sparse-View CT Reconstruction Based on Nonconvex L1 − L2 Regularizations

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Abstract : The reconstruction from sparse-view projections is one of important problems in computed tomography (CT) limited by the availability or feasibility of obtaining of a large number of projections. Traditionally, convex regularizers have been exploited to improve the reconstruction quality in sparse-view CT, and the convex constraint in those problems leads to an easy optimization process. However, convex regularizers often result in a biased approximation and inaccurate reconstruction in CT problems. Here, we present a nonconvex, Lipschitz continuous and non-smooth regularization model. The CT reconstruction is formulated as a nonconvex constrained L1 − L2 minimization problem and solved through a difference of convex algorithm and alternating direction of multiplier method which generates a better result than L0 or L1 regularizers in the CT reconstruction. We compare our method with previously reported high performance methods which use convex regularizers such as TV, wavelet, curvelet, and curvelet+TV (CTV) on the test phantom images. The results show that there are benefits in using the nonconvex regularizer in the sparse-view CT reconstruction.

Keywords : computed tomography, non-convex, sparse-view reconstruction, L1-L2 minimization, difference of convex functions
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