STRUCTURE TENSOR TOTAL VARIATION AND ITS EXTENSION

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ABSTRACT

Structure tensor total variation regularizer (STV) [1] is a generalization of the total variation regularizer (TV) [2]. STV is different from TV in that at each point of image, STV adaptively takes the directions of highest and smallest intensity variation of neighborhood of a point while TV always considers vertical and horizontal directions. Thus, STV shows better ability to detect edge and smooth region than TV. Nevertheless, STV still produces staircasing artifacts because it is a TV based regularization. To remove staircasing artifacts, we first introduce the second-order extension of the structure tensor total variation regularizer. For second-order STV, we use the eigenvalues of weighted averaged matrix whose column is a vectorial form of Hessian of each channel of image. However, the valuable edges of an image can be attenuated when using only second order STV. In this article, we propose the hybrid STV which is a convex combination of STV and second order STV. It improves restoration results by sufficiently smoothing homogeneous regions while preserving edge parts. We prove that hybrid STV is convex. Discrete version of hybrid STV functional is introduced by patch-based Jacobian and patch-based Hessian operator. Based on dual formulation of hybrid STV, we utilize the proximal algorithm. Numerical experiments demonstrate that the proposed model is superior to methods with local regularization in terms of PSNR, SSIM values and visual quality.

REFERENCES

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