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A fast minimization method for blur and multiplicative noise removal. (English)

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Summary: Multiplicative noise and blur removal problems have attracted much attention in recent years. In this paper, we propose an efficient minimization method to recover images from input blurred and multiplicative noisy images. In the proposed algorithm, we make use of the logarithm to transform blurring and multiplicative noise problems into additive image degradation problems, and then employ l_1 -norm to measure in the data-fitting term and the total variation to measure the regularization term. The alternating direction method of multipliers (ADMM) is used to solve the corresponding minimization problem. In order to guarantee the convergence of the ADMM algorithm, we approximate the associated nonconvex domain of the minimization problem by a convex domain. Experimental results are given to demonstrate that the proposed algorithm performs better than the other existing methods in terms of speed and peak signal noise ratio.

MSC:

94A08 Image processing (compression, reconstruction, etc.) in information and communication theory

Cited in 6 Documents

65F22 Ill-posedness and regularization problems in numerical linear algebra

65K10 Numerical optimization and variational techniques

65J22 Numerical solution to inverse problems in abstract spaces

65J20 Numerical solutions of ill-posed problems in abstract spaces; regularization

68U10 Computing methodologies for image processing

Keywords:

image restoration; multiplicative noise; blur; iterative method; minimization

Full Text: DOI

References:

- [1] Aubert G., SIAM J. Appl. Math. 68 (4) pp 925– (2008) · Zbl 1151.68713 · doi:10.1137/060671814
- [2] Bertsekas D., Computer Science and Applied Mathematics (1982)
- [3] Bioucas-Dias , J. and Figueiredo , M. Total variation restoration of speckled images using a split-Bregman algorithm . 16th IEEE International Conference on IEEE . Cairo , Egypt. Image Processing (ICIP) , pp. 3717 – 3720 .
- [4] Boyd S., Convex Optimization (2004) · doi:10.1017/CBO9780511804441
- [5] Cole E., The Removal of Unknown Image Blurs by Homomorphic Filtering (1973)
- [6] Douglas J., Trans. Am. Math. Soc. 82 (2) pp 421– (1956) · doi:10.1090/S0002-9947-1956-0084194-4
- [7] Durand S., J. Math. Imaging Vis. 36 (3) pp 201– (2010) · Zbl 05788120 · doi:10.1007/s10851-009-0180-z
- [8] Esser E., CAM Rep (2009)
- [9] Fan , A. 2003 . ” A variational approach to MR bias correction ” . Ph.D. thesis, Massachusetts Institute of Technology
- [10] Gabay D., Stud. Math. Appl. 15 pp 299– (1983) · doi:10.1016/S0168-2024(08)70034-1
- [11] Gabay D., Comp. Math. Appl. 2 (1) pp 17– (1976) · Zbl 0352.65034 · doi:10.1016/0898-1221(76)90003-1
- [12] Glowinski R., Numerical Methods for Nonlinear Variational Problems (1984) · Zbl 0536.65054 · doi:10.1007/978-3-662-12613-4
- [13] Goldstein T., SIAM J. Imaging Sci. 2 pp 323– (2009) · Zbl 1177.65088 · doi:10.1137/080725891
- [14] Huang Y., SIAM J. Imaging Sci. 2 (1) pp 20– (2009) · Zbl 1187.68655 · doi:10.1137/080712593
- [15] Li F., SIAM J. Imaging Sci. 3 pp 1– (2010) · Zbl 1185.65067 · doi:10.1137/090748421
- [16] Martinet B., Recherche Opérationnelle 4 pp 154– (1970)
- [17] Montillo A., Proc. SPIE 5032 pp 1025– (2003) · doi:10.1117/12.483555
- [18] Ng M., SIAM J. Sci. Comp. 33 pp 1643– (2011) · Zbl 1234.94013 · doi:10.1137/100807697
- [19] Ng M., SIAM J. Sci. Comp. 32 pp 2710– (2010) · Zbl 1217.65071 · doi:10.1137/090774823

- [20] Nocedal J., Numerical Optimization (1999) · Zbl 0930.65067 · doi:10.1007/b98874
- [21] Rockafellar R., Math. Oper. Res. 1 (2) pp 97– (1976) · Zbl 0402.90076 · doi:10.1287/moor.1.2.97
- [22] Rudin L., Geometric Level Sets in Imaging, Vision and Graphics pp 103– (2003) · doi:10.1007/0-387-21810-6_6
- [23] Rudin L., Phys. D Nonlinear Phenom. 60 (1) pp 259– (1992) · Zbl 0780.49028 · doi:10.1016/0167-2789(92)90242-F
- [24] Shi J., SIAM J. Imaging Sci. 1 (3) pp 294– (2008) · Zbl 1185.94018 · doi:10.1137/070689954
- [25] Tur M., Appl. Opt. 21 (7) pp 1157– (1982) · doi:10.1364/AO.21.001157
- [26] Wagner R., IEEE Trans. Son. Ultrason. 30 (3) pp 156– (1983) · doi:10.1109/T-SU.1983.31404
- [27] Weiss P., SIAM J. Sci. Comp. 31 pp 2047– (2009) · Zbl 1191.94029 · doi:10.1137/070696143
- [28] Yin W., SIAM J. Imaging Sci. 1 (1) pp 143– (2008) · Zbl 1203.90153 · doi:10.1137/070703983

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