光学精密工程 » 2015, Vol. 23 » Issue (7): 2086-2092 DOI: 10.3788/OPE.20152307.2086

应用半二次罚函数的图像盲去模糊

廖永忠[1,2], 蔡自兴[1], 何湘华[2]

1. 中南大学 信息科学与工程学院, 湖南 长沙 410081;
2. 湖南第一师范学院 信息科学与工程学院, 湖南 长沙 410205

Image blind deblurring with half-quadratic penalty method

LIAO Yong-zhong[1,2], CAI Zi-xing[1], HE Xiang-hua[2]

1. School of Information Science and Engineering, Central South University, Changsha 410081, China;
2. Department of Information Science and Engineering, Hunan First Normal University, Changsha 410205, China

摘要 由于现有的模糊图像盲恢复算法计算复杂度高,计算量大,本文提出了一种基于半二次罚函数的图像盲去模糊算法,并进行了实验验证。应用图像噪声的多阶偏导数的高斯分布特性和图像梯度值服从hyper-Laplacian分布特性建立方程,使用高效交替迭代的算法对方程求解。由于迭代过程中采用快速傅里叶变换一次求解,故大大降低了运算时间,同时获得了很好的恢复效果,为实现实时视频图像去模糊奠定了基础。对一个百万像素级的图像进行了去模糊实验, 结果显示,本文算法比当前流行的算法有更快的计算速度和更好的鲁棒性,计算时间缩短了60% 。提出的算法为视频图像的实时盲恢复提供了新的工具。

关键词 : 图像处理, 半二次罚函数, 盲去模糊, 迭代算法, 模糊核函数(点扩散函数)

Abstract : As existing image blind deblurring algorithms have larger and more complex computing, this paper proposes a new image blind deblurring algorithm based on half-quadratic penalty method, and verifies the feasibility of the algorithm by experiments. It formulates the optimization function by using the higher-order partial derivatives of image noise and the hyper-Laplacian priors of image gradients, then uses an efficient optimization scheme that alternates between PSF and latent image estimation to solve the proposed formula. As the fast Fourier transform has been used in iterative processing, the computing time is reduced greatly, and the restoration effects are improved. An debluring experimental is performed on an image with pixel levels of 1×10^6 and the results demonstrate that the proposed method is more robust and more computationally efficiency than that of current blind deblurring algorithm and its computing time has been reduced by about 60%. The algorithm provides a new way for blind deblurring of video images in real time.

Key words : image processing half-quadratic penalty blind deblurring iteration method Point Spread Function(PSF)

收稿日期: 2015-01-09

中图分类号: TP391.4

基金资助:国家自然科学基金资助项目(No. 61175064);湖南省教育厅科学研究计划资助项目(No.14C0244)

作者简介: 廖永忠(1976-),男,湖南常德人,博士研究生,副教授,2006年于湖南师范大学获得工学硕士学位,主要从事信号处理方面的研究。E-mail:lyz031608@126.com

引用本文:

廖永忠, 蔡自兴, 何湘华. 应用半二次罚函数的图像盲去模糊[J]. 光学精密工程, 2015, 23(7): 2086-2092. LIAO Yong-zhong, CAI Zi-xing, HE Xiang-hua. Image blind deblurring with half-quadratic penalty method. Editorial Office of Optics and Precision Engineering, 2015, 23(7): 2086-2092.

链接本文:

http://www.eope.net/CN/10.3788/OPE.20152307.2086 或 http://www.eope.net/CN/Y2015/V23/I7/2086