Non-uniform motion deblurring with Kernel grid regularization

Ziyi Shen, Tingfa Xu, Jinshan Pan, Jie Guo

PII: S0923-5965(17)30247-3
DOI: https://doi.org/10.1016/j.image.2017.12.002
Reference: IMAGE 15306

To appear in: *Signal Processing: Image Communication*

Received date : 27 January 2017
Revised date : 3 December 2017
Accepted date : 4 December 2017

Please cite this article as: Z. Shen, T. Xu, J. Pan, J. Guo, Non-uniform motion deblurring with Kernel grid regularization, *Signal Processing: Image Communication* (2017), https://doi.org/10.1016/j.image.2017.12.002

Non-Uniform Motion Deblurring with Kernel Grid Regularization

Ziyi Shen[a,1], Tingfa Xu[a,*], Jinshan Pan[b], Jie Guo[a]

[a]*School of Optical Engineering, Beijing Institute of Technology, Beijing, 100081*
[b]*School of Mathematical Sciences, Dalian University of Technology, Dalian, 11024*

Abstract

Camera shake during the exposure time often leads to spatially varying blurring effect on images. Existing work usually uses patch based methods that assume the blur in each patch is uniform to solve this problem. However, these kinds of methods do not consider the consistency between different patches and thus leading to inaccurate results with ringing artifacts. In this paper, we propose a kernel mapping regularized method to solve the non-uniform deblurring problem, where the consistency between image patches is considered to improve blur kernel estimation. We analyze the theoretical framework of blur kernels which can be described as a motion path transference, and propose a robust kernel estimation algorithm based on Earth mover's distance (Wasserstein metric) to preserve the properties of blur kernels. In addition, we develop a new kernel refinement method based on a proposed Ink Dot Diffusion that uses 8 directions of kernel mapping flow where the erroneous kernels are identified and corrected. Experimental results demonstrate that the proposed algorithm performs favorably against the state-of-the-art image deblurring methods.

Keywords: Non-uniform deblurring, blind deconvolution, total variation regularization, kernel mapping

*Corresponding author
Email addresses: joanshen0508@gmail.com (Ziyi Shen), tf_xubit@126.com (Tingfa Xu), jspan@mail.dlut.edu.cn (Jinshan Pan), jieguo_2013@163.com (Jie Guo)