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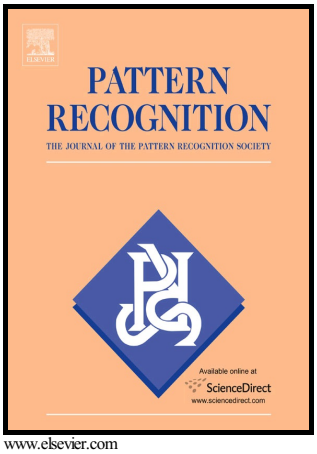

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Regularized Motion Blur-kernel Estimation with Adaptive Sparse Image Prior Learning

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Abstract. This paper proposes a regularized negative log-marginal-likelihood minimization method for motion blur-kernel estimation, which is the core problem of blind motion deblurring. In contrast to existing approaches, the proposed method treats the blur-kernel as a deterministic parameter in a directed graphical model wherein, the sharp image is sparsely modeled by using a three-layer hierarchical Bayesian prior and the inverse noise variance is supposed distributed to the Gamma hyper-prior. By borrowing the ideas of mean filed approximation and iteratively reweighted least squares, the posterior distributions of the sharp image, the inverse noise variance and the hyper-parameters involved in the image prior, as well as the deterministic model parameters including the motion blur-kernel and those involved in the hyper-priors, are all estimated automatically for each blind motion deblurring problem. It is worthy to note that, the new approach relies on a strict minimization objective function, and learns a more adaptive sparse image prior while with considerably less implementation heuristics compared with existing motion blur-kernel estimation approaches. Experimental results on both benchmark and real-world motion blurred images demonstrate that the proposed method has achieved state-of-the-art or even better performance than the current blind motion deblurring approaches in terms of the image deblurring quality. The results also show that the proposed approach is robust to the size of the motion blur-kernel to a great extent.

Keywords. Blind deconvolution, motion deblurring, hierarchical prior, Jeffreys, variational Bayes, iteratively reweighted least squares

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