MARGINALIZED MAXIMUM A POSTERIORI HYPER-PARAMETER ESTIMATION FOR GLOBAL OPTICAL FLOW TECHNIQUES

Kai Krajsek, Rudolf Mester
Institute for Computer Science,D-60054 Frankfurt, Germany
(e-mail: krajsek@vsi.cs.uni-frankfurt.de
http://www.vsi.cs.uni-frankfurt.de)

Abstract

Global optical flow estimation methods contain a regularization parameter (or prior and likelihood hyper-parameters if we consider the statistical point of view) which control the tradeoff between the different constraints on the optical flow field. Although experiments (see e.g. Ng et al. [2]) indicate the importance of the optimal choice of the hyper-parameters, only little attention has been focused on the optimal choice of these parameters in global motion estimation techniques in literature so far (the authors are only aware of one contribution [2] which attempts to estimate only the prior hyper-parameter whereas the likelihood hyper-parameter needs to be known). We adapted the marginalized maximum a posteriori (MMAP) estimator developed in [1] to simultaneously estimating hyper-parameters and optical flow for global motion estimation techniques. The optimal hyper-parameters are strongly determined by first order statistics in the image scene, i.e. the illumination distribution. Optimal values for the hyper-parameter of former image scenes could therefore be used to feed in the Bayesian hyper-parameter estimation framework. Furthermore, the resulting objective function is not convex with respect to the hyper-parameters, thus an appropriate starting point for the estimated parameters is essential for obtaining a reasonable estimate and not to stick into an unimportant local minimum. Experiments demonstrate the performance of this optimization technique and show that the choice of the regularization parameter/hyper-parameters is an essential key-point in order to obtain precise motion estimates.

References:

[1] A. Mohammad-Djafari, A full Bayesian approach for inverse problems, Presented at the 15th International Workshop on Maximum Entropy and Bayesian Methods (MaxEnt95), Santa Fe, New Mexico, USA (1995)

[2] Lydia Ng and Victor Solo, A Data-driven Method for Choosing Smoothing Parameters in Optical Flow Problems, Proc. International Conference on Image Processing, Washington, DC, USA (1997), pp. 360-363

Key Words: optical flow, marginalized MAP estimation