Comparison of Stereo-inspired Optical Flow Estimation Techniques

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Abstract

The similarity of the correspondence problems in optical flow estimation and disparity estimation techniques enables methods to adopt knowledge from the stereo vision literature to enhance optical flow estimation. This knowledge is used in the three key-problems of optical flow estimation: the motion representation, the estimation criteria and the optimization. Two different methods are described and compared, which borrow from the Stereo Vision literature to respectively address one of these key problems. The first method uses a discrete optimization algorithm, which is also applied by top-performing stereo approaches, to fuse candidate solutions. The second method includes color-segmentation or more precisely a segment-wise representation into the estimation process, what has proven to be useful to stereo approaches. In this paper the respective energy functions, motion models and optimization methods are examined. The performance of the described methods on various benchmark datasets which are offered by the Middlebury optical flow website are validated. In this context, it is shown that the described methods go beyond traditional techniques and are able to cope with common problems in optical flow estimation, like textureless regions, occlusions and the preservation of motion discontinuities. Finally, strengths and weaknesses of both techniques are highlighted.

Keywords

Optical flow, Motion, Stereo vision, Optimization, Computational perception, Evaluation