Invited Talk
Sparse versus Dense Approaches in Computer Vision

Joachim Weickert

Mathematical Image Analysis Group,Saarland University

Abstract

Methods that estimate the epipolar geometry from a pair of uncalibrated stereo images traditionally rely on a sparse set of point correspondences that have been established by matching salient image features. Finding the most useful sparse correspondences is a highly nontrivial task.
Modern variational methods, on the other hand, have become the most accurate techniques for estimating the correspondence between two images. Thanks to the filling-in effect they produce dense displacement fields with many thousands of correspondences. The goal of this talk it to bridge the gap between these two methodologies.
In a first step we investigate the usefulness of dense optical flow for the estimation of the fundamental matrix. We compare our results with those of two widely-used feature-based methods and analyse cases in which optical flow has a clear advantage over sparse approaches.
Motivated by these promising results we propose in a second step a new variational model that recovers the fundamental matrix and the optical flow simultaneously as the minimisers of a single energy functional. We show that our coupled approach is able to produce excellent estimates for the fundamental matrix and that the optical flow computation is on par with the best spatial techniques to date.
An additional benefit of the joint recovery of image geometry and dense correspondence is that we can fuse in this way the two steps of dense projective reconstruction that are normally performed separately. We demonstrate this by applying our method to the task of 3D reconstruction from internally calibrated image pairs.
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