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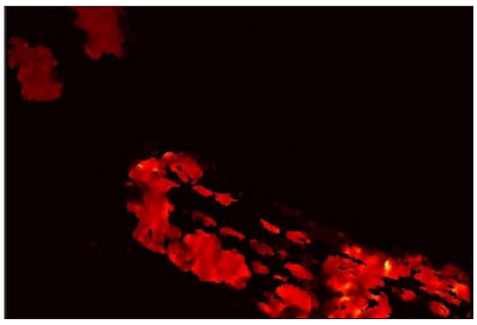
Efficient Implementation and Evaluation of Methods for Estimating Optical Flow in Video

9 Fast and Accurate Lucas-Kanade Extended Optical Flow Algorithm using CUDA GPU Computing

Optical flow field of a traffic sequence

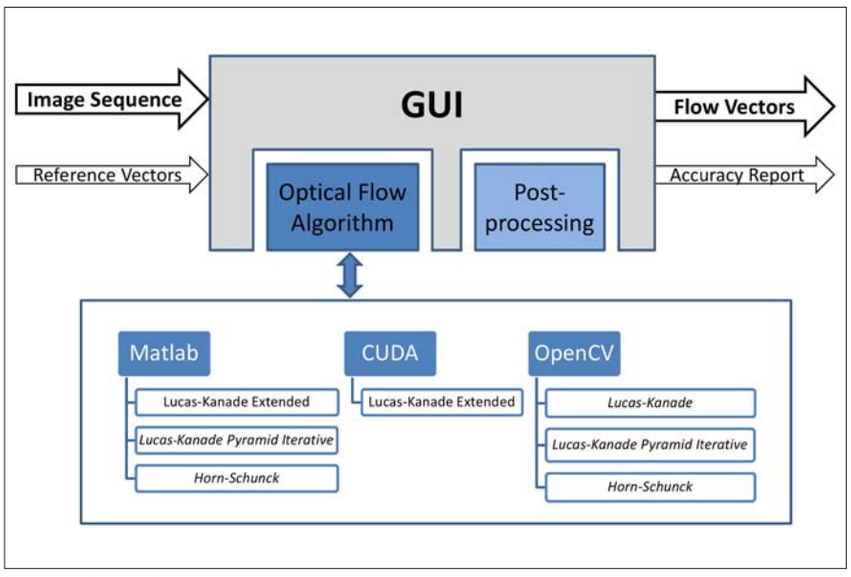


Magnitude of optical flow field

Introduction: In this bachelor thesis, an efficient and accurate optical flow estimation algorithm is presented. The problem of optical flow estimation, a sub-area of computer vision, is to calculate the two-dimensional movement in an image sequence (video) by computational methods. The main goal of this thesis was to implement an accurate and efficient optical flow algorithm, and to compare it with other available implementations.

Proceeding: Therefore an extended version of the Lucas-Kanade algorithm is presented as the core implementation in the software toolbox provided. As a new approach, using CUDA for parallel computing on the graphics card, a very efficient implementation is introduced. A weighted vector median filter is used in a postprocessing stage to refine the optical flow field. To make a clear statement about the accuracy of the estimated optical flow, several error measurement methods, such as Fleets angular error, were used. Besides various third-party implementations, the software toolbox provides an extensive Matlab GUI for optical flow research.

Result: Based on CUDA, a very efficient algorithm with a speedup of several thousand was reached. As the results show, its accuracy is satisfying and comparable with the OpenCV implementation of the pyramidal iterative Lucas-Kanade algorithm. By applying the weighted vector median filter in a postprocessing step, the accuracy can be improved even more.



Structure of the software toolbox