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# Investigations of multigrid algorithms for the estimation of optical flow fields in image sequences

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### Abstract

Optical flow fields are useful to describe the motion of objects relative to the observer of a scene. Smoothness requirements facilitate the estimation of optical flow fields even for areas with constant or only linearly sloping gray value distributions. Horn and Schunck (*Artif. Intell.***17**, 1981, 185–203) formulated the estimation of optical flow fields as a minimization problem. In order to avoid problems with the general smoothness constraint of Horn and Schunck (op. cit.), Nagel (in *Proceedings, IJCAI, Karlsruhe, Aug. 1983*, pp. 945–951) developed the  $\alpha$ -oriented smoothness constraint. Here, a modified formulation of this  $\alpha$ -oriented smoothness constraint will be compared to an earlier one. The differences between these formulations will be discussed analytically. Starting with an iterative solution approach for the system of nonlinear partial differential equations resulting from the  $\alpha$ -oriented smoothness constraint, the

iterative solution approach could be improved significantly using multigrid methods. Results obtained from experiments with real world image sequences will be presented.



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