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FAKULTÄT FÜR MATHEMATIK
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Einladung zur öffentlichen Defensio von

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Thema der Dissertation:

Shape and Image Matching with Nonconvex Regularization

Abstract:

In different imaging scenarios, such as medical and biological applications, the matching of two or more images of similar objects is of crucial importance. We present variational models for two such problems. A common feature is the use of nonconvex regularization, in addition to the natural nonconvexity of registration problems.

The first is surface matching, in which the data is given as two different surfaces. In this framework, we consider surfaces embedded in some computational domain and represented by their signed distance functions. Our approach is to consider shell energies penalizing expansion, compression and bending of the first surface, which are simplified using the level set scenario and the geometry of the second surface. We obtain a first order formulation which effectively encodes the geometry of the situation and allows to prove weak lower semicontinuity and existence of minimizers. Additionally, discretization on adaptive grids is used for efficient numerical computations.

The second is the estimation of optical flow along a full sequence of images. For it, a novel time regularization along the trajectories of the flow is proposed. It penalizes the convective acceleration of the resulting vector field, instead of the naive time derivative of the Eulerian velocity field. The resulting problem can then be approximated in a semi-implicit fashion by a sequence of linear ones. Numerical results show a marked improvement with respect to just using the time derivative.

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