Image registration based on normalized gradient fields

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Abstract

Image registration (also called *fusion* or *warping*) is one of today's challenging image processing problems. The objective is to find a geometrical transformation that aligns points in one view of an object with corresponding points in another view of the same object or a similar one. Registration is of particular interest for data analysis, interpretation, and fusion. Hence, registration is central for many applications arising in biology or medicine imaging.

The main ingredients of a registration approach are an appropriate distance measure, a regularizer, and some additional constraints, if necessary. The goal of the distance measure is to mimic the eye of an expert and to focus on application relevant features within the images. As registration is an ill-posed problem, regularization becomes inevitable. Constraints might be used to provide additional information about particularities of the problem and to guide the registration towards optimal solutions.

In this talk, we focus on a particular distance measure which is based on a regularized normalized gradient field. The aim is to extract image contents from intensity values and to focus on structures which are characterized by intensity changes. It is explained how this new distance measure relates to mutual information, which can be considered as the state-of-the-art approach to multi-modal registration. Moreover, it is illustrated, why the new approach outperforms mutual information in a variety of applications.

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