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Variational Methods, Implicit Representations & Visual Grouping

Segmentation and extraction of structures of interest refers to a core component of Imaging and Vision with a variety of applications. One can think that this task is equivalent with the separation of a bounded domain (image/volume) into regions with consistent properties. Such properties can be defined on an arbitrary space, like intensity properties, texture properties, motion properties, stereo properties, etc.

An elegant tool to perform such grouping is by the propagation of curves aiming at separating regions with consistent characteristics. Such propagation is either derived from the minimization of an objective function, or defined according to the application objectives (geometric flows). Implicit representations and level set methods is an emerging technique to perform this task. In this talk, we will describe variants of this technique to perform visual grouping. First, a connection between curve/surface propagation and level set methods will be established. Then, we will propose a general formulation to address grouping using implicit representations. Such formulation can account for various information cues. Boundary, Regional (intensity, motion, stereo, texture), prior knowledge (shape of the structure of interest) and user interaction will be the major components of our approach. Examples of such framework (if time permits), to perform unconstrained and constrained segmentation, tracking, motion estimation, computer aided boundary delineation in medical image analysis and shape/image registration will be presented.

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