Variational Image Segmentation Using Multilayer Implicit Curve Evolution Approach

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Abstract

Variational image processing has been extensively studied due to its strong mathematical theory and existence of state-of-the-art numerical methods for solving PDEs. In this talk, we present a piecewise constant image segmentation model based on a new implicit curve evolution technique in the context of variational approach. In our approach we use multiple level sets of the evolving level set function to represent the boundaries among objects. Our proposed model can be viewed as an extension of the piecewise constant Chan-Vese segmentation model by combining their model with multilayer level set approach. This new approach can be applied for images with known topology and nested structure, e.g. MR brain images. By construction our approach is more efficient way of partitioning images. We show how we can apply the multilayer segmentation model to 3D MR brain data sets. In addition we present ways of incorporating brain atlas into our variational multilayer image segmentation model and show numerical results and comparison with existing semi-automatic segmentation algorithm. We also discuss different choices of regularization in order to keep the level set function regular.

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