Shape Prior Segmentation with Intensity Inhomogeneity

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In the field of imaging sciences, segmentation in the variational framework is the task of partitioning a given image function into subregions. Shape matching is a fundamental problem, and incorporating priors of this form into existing segmentation formulations is not straightforward. The two-phase piecewise-constant case of the Mumford-Shah formulation (2PCMS) is most suitable for images with simple and homogeneous features where the intensity variation is limited. However, it has been applied to many different types of synthetic and real images after some adjustments to the formulation. Recent approaches have applied the idea of segmentation with shape matching in various forms. However, in the convex relaxation framework, where the global minimiser can be found for a fixed fitting term, it is natural to consider binary shape priors which offers many difficulties in terms of implementation.

This talk addresses the task of generalising the 2PCMS model to account for intensity inhomogeneity which is common for real life images. We first review existing methods for treating inhomogeneity and demonstrate inconsistencies in these methods. We propose a modified variational model to account for these problems by introducing additional constraints, and extend this concept to the incorporation of binary shape priors. We also present an improved additive operator splitting method, that is consistent with the convex relaxation framework. Finally, we present numerical results that demonstrate an improvement to existing methods in terms of reliability, and results for our new method for shape prior segmentation.