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CONVEX NON-CONVEX SEGMENTATION OVER SURFACES

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Summary: The use of variational methods for the mathematical modelling of image/surface processing tasks has become extremely popular over the last decades. Under this modelling, the processed output is obtained as the minimiser of a suitable energy functional typically made of the weighted sum of two terms: a fidelity term, which measures the fit with the observed data, and a regularizer encoding a-priori information on the desired solution in terms, for instance, of its regularity. It is well known that using non-convex regularizers holds the potential for more accurate results than using convex regularizers. However, the optimization problem becomes typically non-convex (and non-smooth) thus presenting all the associated mathematical and numerical complexities. A recent solution to this problem is the so-called Convex Non-Convex (CNC) strategy, consisting in constructing and then optimizing convex functionals containing non-convex regularizers.
We present a CNC variational model for multiphase segmentation of real-valued functions defined on surfaces. More precisely, we present a three-stage segmentation algorithm that first computes a piecewise smooth multi-phase partition function, then applies clusterization on its values, and finally tracks the boundary curves to obtain the segmentation on the surface.
An appropriate numerical scheme based on the Alternating Directions Methods of Multipliers is proposed to efficiently solve the nonlinear optimization problem. Experimental results show the effectiveness of this three-stage segmentation procedure.