A relaxation algorithm for solving inverse interface problems

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Abstract:

The scope of this work is the field of inverse problems, where the unknown is the boundary of a set. A well-known way to approach such problems is e.g. by the level-set method. In this talk we propose an alternative which is based on Tikhonov regularization. Instead of working with a level-set function we formulate a Tikhonov functional in the space of characteristic functions, which leads to a difficult minimization problem over the set of characteristic functions. We propose a new method for finding a minimizer of this optimization problem – or at least a critical point – by combining recent results from regularization theory and image processing.

The method of surrogate functionals can be used to find a sequence of simpler optimization problems, which can be solved by the method of exact relaxation. This leads to an iterative algorithm, where in each step a Rudin-Osher-Fatemi-(ROF)- functional has to be minimized, which solution is then projected onto the set of characteristic functions by simple thresholding. We discuss convergence questions of this algorithm and give numerical results for a simple deblurring operator.