Type: Minisymposium Contribution

Conditional gradient methods in total variation regularization of inverse problems for PDEs

Monday, August 12, 2024 2:30 PM (30 minutes)

A very common ansatz in inverse problems for PDEs is that the sought solutions are piecewise constant, modelling situations like localized inclusions of different material properties within an otherwise homogeneous medium. In this situation, variational regularization with a total variation penalty balances being compatible with piecewise constant minimizers with retaining convexity of the regularizer. However, its lack of differentiability means that most numerical methods require some level of smoothing, so that such piecewise constant structures can be observed only approximately and/or at very fine resolutions.

In this work, we instead consider generalized conditional gradient methods that provably approximate minimizers as linear combinations of characteristic functions, by alternating insertion and correction steps. Specifically, we focus on a discretised setting of functions defined on triangulations. This framework allows standard FEM discretizations to coexist with fast graph cut approaches to the total variation, which have long been used in image segmentation and related tasks. We present variants of such methods which allow for pointwise constraints and insertion steps with as small as possible computational cost. After considering some convergence results, these are applied in various canonical test cases, such as inverse source problems with different kinds of measurements.

Author: IGLESIAS, Jose A. (University of Twente)

Co-authors: Prof. WALTER, Daniel (Humboldt-Universität zu Berlin); Mr CRISTINELLI, Giacomo (University of Twente)

Presenter: IGLESIAS, Jose A. (University of Twente)

Session Classification: MS 10: Inverse Problems for Partial Differential Equations

Track Classification: Minisymposia: MS 10: Inverse Problems for Partial Differential Equations