Approximation and Optimization in Image Restoration and Reconstruction
Ile de Porquerolles, France
June 8–12, 2009

SAR IMAGE REGULARIZATION WITH GRAPH-CUTS BASED FAST APPROXIMATE DISCRETE MINIMIZATION

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Synthetic aperture radar (SAR) images, like other coherent imaging modalities, suffer from speckle noise. The presence of this noise makes the automatic interpretation of images a challenging task and noise reduction is often a prerequisite for successful use of classical image processing algorithms.
Markov Random Field (MRF) modelization provides a convenient way to express both data fidelity constraints and desirable properties of the filtered image. In this context, total variation minimization has been extensively used to constrain the oscillations in the regularized image while preserving its edges.
However, heavy-tailed speckle distributions such as Nakagami law that governs SAR amplitude lead to non-convex likelihood terms. The underlying MAP optimization problem is therefore difficult since many local energy minima are present. Moreover, we consider a non-smooth joint prior that favors the co-localization of edges in multi-channel images.
Graph-cuts algorithms offer an efficient way to handle both non-convexity and non-smoothness. Although they can theoretically reach a global minimum, they can hardly be applied in practice due to computational and memory constraints. We derive a minimization algorithm suitable for (joint) regularization of large images.
It has been applied applied to joint regularization of the amplitude and interferometric phase in urban area SAR images. A satisfying solution can be reached in few iterations by performing a graph-cut based combinatorial exploration of large trial moves. This algorithm is faster than existing graph-cut-based techniques. We also show that joint regularization can be performed with little computation overload. Last it helps preventing the loss of small objects (over-regularization) by merging all information.