

Adaptive Hybrid Conditional Random Field Model for SAR Image Segmentation

Abstract:

For random-field-based image segmentation, the conditional random field (CRF) model offers theoretic advantages over the generative Markov random field one, since it directly models the posterior distribution of label field conditioned on an observable image. In this paper, we propose an adaptive hybrid CRF (AHCRF) model for synthetic aperture radar (SAR) image segmentation. Based on the generation of superpixels and their boundary feature analysis, the proposed method adaptively divides SAR image into different parts, namely, homogeneous regions, heterogeneous regions, and edges. In homogeneous regions, the regional-level CRF is defined on superpixels, and the pixels within each superpixel force to have the same segmentation label. Oppositely, the pixel-level CRF is defined on pixels within heterogeneous regions or edges, and local autocovariance features are extracted for constructing the unary and pairwise potentials to incorporate effective local contextual information. The integration of regional-level and pixel-level CRFs gives the proposed AHCRF model, and it is validated by experiments on several real SAR images. The experimental analysis indicates that the AHCRF is robust to speckle noise and preserves detailed features well in segmentation.