Managing The Contributions Of The Spectral And Contextual Information In Markov Random Field

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Abstract: As remote sensing technology continues to be rapidly developed and utilized in different research areas, demands for robustness is increased and a large and growing body of literature has investigated the development of new techniques and algorithms for extraction of information from the images. Many image processing methods attempt to assign classes labels to remote sensing data. Markov random field (MRF) also called undirected graphical model is currently the most common classification method used to find the optimal solution for incorporating contextual visual information. Parameter estimation on these models is still an open issue.

Through the energy function definition in MRF, labeling for a site in MRF is dependent on smoothing parameters which show the contributions of the spectral and spatial information of the site and its neighbours via a neighbourhood system. Therefore, this paper deals with the development of a method to determine the smoothing parameters to balance the spatial and spectral energies by considering edge-preserving for the purpose of maximizing the classification accuracy. WorldView-2 satellite image is employed in this research.

In this research a support vector machine (SVM) and MRF are integrated for classification of multispectral data. In the first step, a support vector machine (SVM) as the state-of-the-art technique with sigmoid kernel function was used to provide a vector of multi-class probabilities and class labels. Then the spectral and spatial components were normalized within the range 0 to1. In the second step, the simulated annealing (SA) optimization method which can estimate a good global optimum is used to estimate the smoothing parameter.

Finally, to demonstrate the impact of the smoothing parameter on MRF results, nine values within the range from 0.1-0.9 were used to produce the thematic map of the synthetic image. The validation of the MRF is done by a pixel-based method and the quality of the derived MRF map is assessed by computing the kappa coefficient. The results show that the MRF algorithm performance depends on the availability of correct parameter estimates.

Key words: Markov Random field, smoothing parameter, image classification, simulated annealing