Title: Estimating the GMRF Model Parameters for Remote Sensing Image Textures

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Abstract:

The Markov Random Field has a property of dependence between neighboring sites is a very attractive model in characterizing correlated observations and it has potential applications in various areas such as spatial-temporal modeling, medical imaging, and computer vision. This study highlights the application in the area of scene classification for multispectral and multitemporal satellite remote sensing images.

The image random field is modeled conditionally given the texture label as a multivariate Observation Gauss Markov Random Field (MGMRF). Although there have been recent characterizations of the some competing MGMRF models, these have been limited to cases where the interaction matrices have some special form. The aim of this study is to derive an estimator using the maximum pseudo-likelihood estimation for an anisotropic MGMRF for an arbitrary neighborhood system. Although the MGMRF is a natural generalization of its univariate counterpart, there are new problems have arisen especially in the estimation procedure. Moreover. Moreover, for spectro-temporal observations, a separable structure between the spectral and the temporal dimensions on the MGMRF parameters has been proposed. Finally, the texture map is recovered by the iterated Conditional modes algorithm.

The results show that in general, there is an improvement in the classification performance in terms of global accuracies and thematic class accuracies over the discriminant analysis as well as some competing MGMRF models. In addition, for a spectro-temporal observation case, a separable covariance matrix and interaction matrix structure has an improved classification performance over the non-separable case.

Keywords: Markov Random Fields, Bayesian Image Processing, Spectro-Temporal Modeling, Separability, Maximum Pseudo-likelihood Estimation, Remote Sensing, Classification