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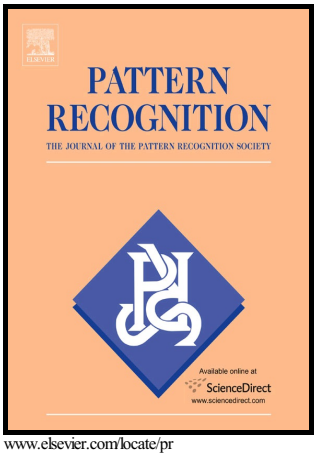

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A Novel Spectral-Spatial Co-Training Algorithm for the Transductive Classification of Hyperspectral Imagery Data

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Abstract

The automatic classification of hyperspectral data is made complex by several factors, such as the high cost of true sample labeling coupled with the high number of spectral bands, as well as the spatial correlation of the spectral signature. In this paper, a transductive collective classifier is proposed for dealing with all these factors in hyperspectral image classification. The transductive inference paradigm allows us to reduce the inference error for the given set of unlabeled data, as sparsely labeled pixels are learned by accounting for both labeled and unlabeled information. The collective inference paradigm allows us to manage the spatial correlation between spectral responses of neighboring pixels, as interacting pixels are labeled simultaneously. In particular, the innovative contribution of this study includes: (1) the design of an application-specific co-training schema to use both spectral information and spatial information, iteratively extracted at the object (set of pixels) level via collective inference; (2) the formulation of a spatial-aware example selection schema that accounts for the spatial correlation of predicted labels to augment training sets during iterative learning and (3) the investigation of a diversity class criterion that allows us to speed-up co-training classification. Experimental results validate the accuracy and efficiency of the proposed spectral-spatial, collective, co-training strategy.

Keywords: Hyperspectral imagery classification, Transductive learning, Collective Inference, Co-training, Spectral-spatial data

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1. Introduction

Hyperspectral Image (HSI) collected by imaging spectrometers has captured increasingly rich spectral information. Advances in hyperspectral imaging technology allow nowadays the simultaneous measurement of hundreds of spectral bands for each image pixel. This high spectral resolution increases the possibility

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