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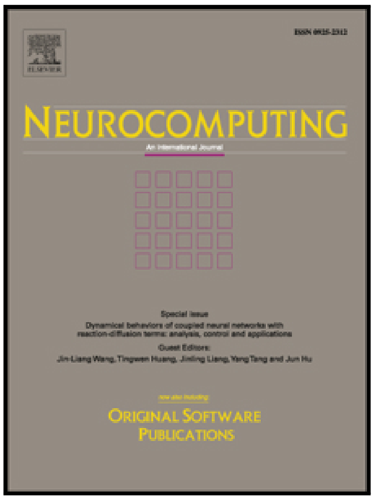

Spectral-Spatial Classification of Hyperspectral Image Based on Discriminant Sparsity Preserving Embedding

Min Han , Chengkun Zhang

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Spectral-Spatial Classification of Hyperspectral Image Based on Discriminant Sparsity Preserving Embedding

Min Han*, Chengkun Zhang

Faculty of Electronic Information and Electrical Engineering, Dalian University of Technology, Dalian, China

Abstract

The last few years have witnessed the success of sparse representation in hyperspectral image classification. However, the high computational complexity brings some worries to its applications. In this paper, a novel sparse representation based feature extraction algorithm, called discriminant sparsity preserving embedding (DSPE), is proposed by constructing a sparse graph and applying it to the graph-embedding framework. The proposed algorithm encodes supervised information mainly in stage of sparse graph construction, in which only the training samples in the same class are used to calculated the reconstructive coefficients during sparse reconstruction. An approach combining l_1-norm and l_2-norm is applied to solve the reconstruction weights, where l_1-norm ensures the sparsity of the graph weights, l_2-norm shrinks the weight coefficients to make the construction more stable and alleviate the reconstruction errors possibly caused by small-size training samples. On the premise of satisfied classification results, here a spectral-spatial classification strategy which takes spatial information into consideration is used to evaluate the efficiency of the proposed algorithm. Experiments on the Indian Pines and Pavia University hyperspectral image datasets demonstrate the superiority of the proposed algorithm.

Keywords

Hyperspectral image; Graph-embedding framework; Sparse graph construction; Sparse representation

1. Introduction

Benefiting from the dense spectral sampling rate, hyperspectral image (HSI) provides detailed spectral information of the observed materials with numerous and contiguous spectral bands. The rich spectral and spatial information in hyperspectral images makes it possible to better distinguish different kinds of materials. Therefore, HSI has been widely used in target detection [1], accurate classification [2], spectral unmixing [3], etc. HSI classification technology assigns pixels to different kinds of classes according to their spectral features, and it plays a vital role in HSI analysis [4,5]. However, Hughes phenomenon caused by the high dimensionality and small size of samples are the main factors affecting HSI classification result [6]. So feature extraction which can reduce data redundancy and find the intrinsic features becomes a critical procedure in HSI classification [7-9]. A variety of feature extraction methods, including linear algorithms and nonlinear ones, has been developed and

*Corresponding author.
E-mail address: minhan@dlut.edu.cn