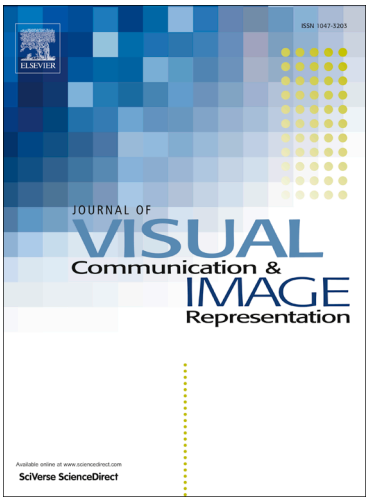


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# Adaptive Total Variation-based Spectral-Spatial Feature Extraction of Hyperspectral Image☆

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**Abstract**

In this paper, a simple yet quite useful hyperspectral images (HSI) classification method based on adaptive total variation filtering (ATVF) is proposed. The proposed method consists of the following steps: First, the spectral dimension of the HSI is reduced with principal component analysis (PCA). Then, ATVF is employed to extract image features which not only reduces the noise in the image, but also effectively exploits spatial–spectral information. Therefore, it can provide an improved representation. Finally, the efficient extreme learning machine (ELM) with a very simple structure is used for classification. This paper analyzes the influence of different parameters of the ATVF and ELM algorithm on the classification performance in detail. Experiments are performed on three hyperspectral urban data sets. By comparing with other HSI classification methods and other different feature extraction methods, the proposed method based on the ATVF algorithm shows outstanding performance in terms of classification accuracy and computational efficiency when compared with other hyperspectral classification methods.

*Keywords:* Hyperspectral Image Classification; Principal Component Analysis; Adaptive Total Variation Filtering; Extreme Learning Machine

## 1. Introduction

Hyperspectral image (HSI) provides rich spectral information which regards the physical nature of the materials, and thus, it is widely used in different application domains now, such as environment monitoring [1], precision agriculture [2], and national defense [3]. Moreover, in most of these applications, HSI classification technology plays an important role [4, 5]. For HSI classification, many spectral pixel-wise machine classifiers have been developed, including the support vector machine (SVM) [6], support vector conditional random classifier [7], neural network [8], sparse representation classification [9, 10], tensor decomposition [11], and extreme learning machine (ELM) [12].

These classifiers have been successfully applied to solve the HSI classification technology,

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