MODIFIED WAVELET SUPPORT VECTOR MACHINES FOR HYPERSPECTRAL IMAGE CLASSIFICATION

Xiu-Man Huang[1], Pai-Hui Hsu[2]

[1]*Department of Civil Engineering, National Taiwan University, No.1, Sec. 4, Roosevelt Road, Taipei 10617, Taiwan, d01521003@ntu.edu.tw*

[2]*Department of Civil Engineering, National Taiwan University, No.1, Sec. 4, Roosevelt Road, Taipei 10617, Taiwan, hsuph@ntu.edu.tw*

Abstract: Hyperspectral images with find and rich spectral information can improve land use/cover classification accuracy. Due to the high dimensionality of hyperspectral data, it is ineffective when traditional statistics-based classification methods are applied to hyperspectral images with limited samples. This problem has been termed the "curse of dimensionality." Besides using dimensionality reduction to solve this problem, support vector machines (SVMs) have been successfully used in hyperspectral image classification during the past decade. SVM is a machine learning algorithm and has been widely applied to data regression and pattern recognition. The basic concept of SVM is to map the original data from the input space to a high-dimensional feature space by using a kernel function, so that the problem can be solved linearly in the feature space. In SVM applications, the selection of kernel functions plays an important role in effective support vector machine learning. The most common kernels include linear, polynomial, and radial basis function. In addition, it has been proposed that wavelet kernel is also an admissible support vector kernel, and the SVM with wavelet kernels is called wavelet support vector machine (WSVM). The wavelet kernel with multidimensional wavelet functions can find the optimal approximation of data in feature space for classification. Still, wavelet support vector machines have been also applied to hyperspectral data and improve classification accuracy. In this study, a modified WSVM algorithm was proposed and implemented on hyperspectral images with different wavelet basis functions. The modified WSVMs consider not only the approximation but also the detail information of hyperspectral data in wavelet kernels, and the parameters of wavelet kernels are decided by the data property and structure of the hyperspectral image. In our experiment, a real hyperspectral data set is used to test the performance of the modified wavelet support vector machines; then, the results are compared with SVMs which use other kernel functions. According to the experiment results the proposed modified WSVM methods in this study have better performance than other SVMs, and the modified WSVM is exactly an appropriate tool for hyperspectral image

classification.

Keyword: Hyperspectral Image, Support Vector Machine, Wavelet Kernel, Classification