

# WTSS-EMP

Experimental results related to the paper Exploring the Impact of Wavelet-based Denoising in the Classification of Remote Sensing Hyperspectral Images by Pablo Quesada-Barriuso, Dora B. Heras and Francisco Argüello, published in the [SPIE Remote Sensing Conference \(2016\)](#).

## Abstract

The classification of remote sensing hyperspectral images for land cover applications is a very intensive topic. In the case of supervised classification, Support Vector Machines (SVMs) play a dominant role. Recently, the Extreme Learning Machine algorithm (ELM) has been extensively used. The classification scheme previously published by the authors, and called WT-EMP, introduces spatial information in the classification process by means of an Extended Morphological Profile (EMP) that is created from features extracted by wavelets. In addition, the hyperspectral image is denoised in the 2-D spatial domain, also using wavelets and it is joined to the EMP via a stacked vector. In this paper, the scheme is improved achieving two goals. The first one is to reduce the classification time while preserving the accuracy of the classification by using ELM instead of SVM. The second one is to improve the accuracy results by performing not only a 2-D denoising for every spectral band, but also a previous additional 1-D spectral signature denoising applied to each pixel vector of the image. For each denoising the image is transformed by applying a 1-D or 2-D wavelet transform, and then a NeighShrink thresholding is applied. Improvements in terms of classification accuracy are obtained, especially for images with close regions in the classification reference map, because in these cases the accuracy of the classification in the edges between classes is more relevant.

## Downloads

MATLAB code, including some tools for data management and the training and test samples used in the experiments.

- WTSS-EMP scheme: [wtss-emp.zip](#)
- Training / Test samples used in the experiments: [tt\\_samples.zip](#)
- Hyperspectral datasets from Universidad del Pais Vasco: [www.ehu.es](#) except for the Indian Pines dataset downloaded from [ftp://ftp.ecn.purdue.edu/biehl/MultiSpec/92AV3C.tif.zip](#)
- Supervised classification carried out using the [LIBSVM library](#) and the [ELM algorithm](#) (with random hidden nodes and random hidden neurons).

## Classification Maps

Execution outputs as TXT

- Pavia Univ.: [results\\_paviau\\_pixelwise.zip](#), [results\\_paviau\\_wtemp.zip](#), [results\\_paviau\\_wtssemp.zip](#)
- Pavia City:
- Indian Pines: [results\\_indianp\\_pixelwise.zip](#), [results\\_indianp\\_wtemp.zip](#), [results\\_indianp\\_wtssemp.zip](#)
- Salinas:

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