Paper from: *Management Information Systems 2002*, CA Brebbia and P Pascolo (Editors).
ISBN 1-85312-907-0

Automatic neuro-hyperspectral unmixing: a new approach

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Abstract

The present work studies an Artificial Neural Network (NN) used to calculate the abundances of hyperspectral signatures obtained from remote sensors, in an automated fashion. Hyperspectral images are used to obtain the mineralogical composition of earth canopies, where the pixels (hyperspectral signatures) basically consist of a mixture of radiance spectra.
The use of non-supervised neural computation for hyperspectral analysis is based on the robustness and the inherent parallelism of NN. The proposed NN model has one input node for each band of the hyperspectral signature and so many output nodes as possible endmembers. It obtains the proportions (abundances) from each endmember, giving one solution to the hyperspectral unmixing problem. Some types of experiments have been achieved for validating the model, studying the ratio error-value in the unmixing task, initially adjusting network parameters (learning parameter and stop criteria) in order to use them for the rest of the experiments that consist on the study of the network behaviour vs. the Signal-to-Noise Ratio, correlation rate between components, endmember number and proportion on the mixture, providing always low Error Ratios for all cases.
The model has great noise robustness, a correlation rate and endmember number independence great discrimination ability on unlike signatures, giving a robust and efficient solution to the unmixing problem.

1 Introduction

Most of the natural electromagnetic (EM) radiations are not pure, including a broad range of different wavelengths. Laboratory and field spectrometers have proved the value of obtaining a "continuous" spectral curve for the broad band radiation resulting of the interaction of EM radiation with one material in order to obtain detailed information about it in a non destructive way.