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Classification for Hyperspectral Imaging

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One of the objectives of HSI data analysis is identification of imaged objects.

One pixel vector not necessarily represent pure signature of the object. In most of the cases the spectra contain micro- or macroscopically mixed signatures of different materials which occupy the same pixel.

Measured spectrum can be decomposed into linear combination of pure spectral signatures called endmembers - process this is known as spectral unmixing.

Definition of one endmember per object do not necessarily properly represent all the pixels which contain this object on the image.

Spatial classification could divide the image into local areas where endmember extraction would be more reliable.

PLS based spectral classification

- PLS - Partial Least Squares or Projection to Latent Structures
- Multivariate analysis technique helpful to predict set of properties based on range of measurements.
- Two-block PLS regression method models relationship between matrices X (predictors) and Y (responses).
- Method this can be used for spectral unmixing where observations of reflectance spectra are in the predictors matrix and the fractions of all the endmembers form the response matrix.

SVM based spatial classification

Basic architecture of spatial image classification

One could consider various approaches for image classification. In this example spatial classification was done based on textures present on the image.

Since texture is a spatial property that characterises groups of pixels, their features are computed locally over selected area of the image.

Two feature extraction techniques implemented in the experiment

- Statistical
- Signal processing

The SVM classifies data by finding the best hyperplane that separates all data points of one class from those of the other class.

4 different classes – training data

Test images

Ground truth

Nowadays Hyperspectral Imaging is being transformed from sparse research tool into a commodity product available to a broad user community.

Signal processing tools can change this sophisticated way of capturing images into a source of specific and meaningful information.