# New approach to combine spatial and spectral features : Application to disease detection

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Introduction

- Most HSI methods consider only spectral information ~ HS camera is a high-throughput spectrometer - > Sample selection problems

- Recent related works that proposed to process the spatial and spectral properties together, like the works of Cyril Ruckebusch and Anna De Juan.

- Epidemiological surveillance

- Hyperspectral imaging (HSI), in proximal sensing

Methodology

Scores images
e.g. PCA/ PLS

p

p

GLCM*

Textural information   Textural information

sample x

Cube P*P*λ

P*P

λ

PCA/PLS

Loading 1   Loading 2   Loading n

sample x
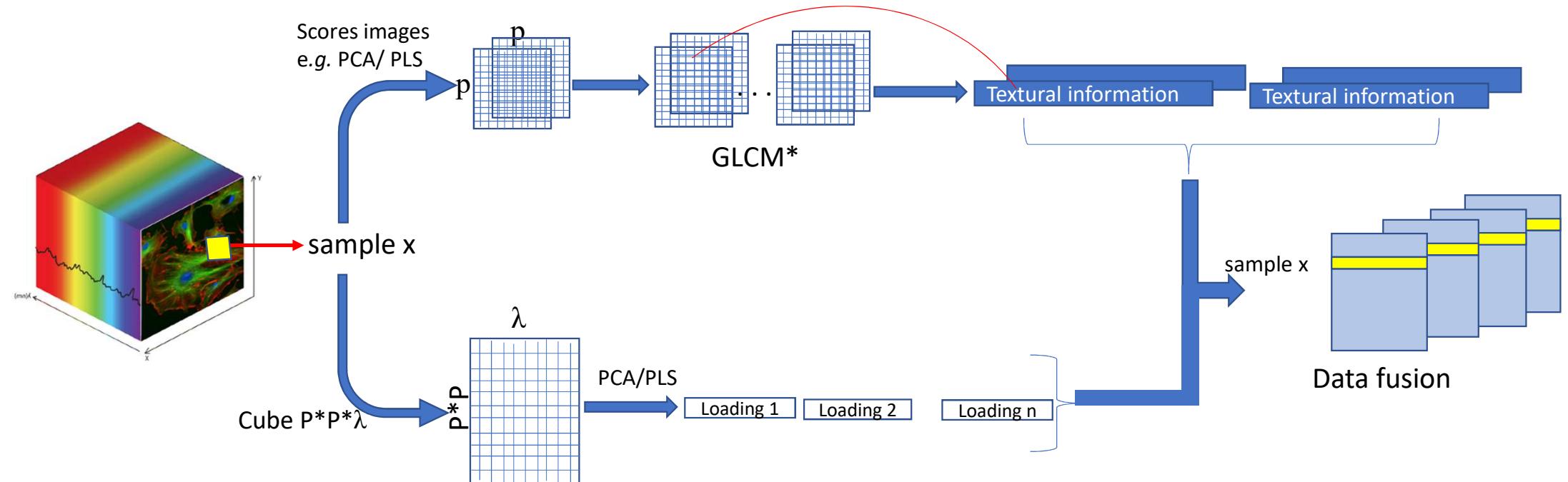
Data fusion

GLCM*: Gray Level Cooccurrence Matrix

Materials & Methods

6 images of apple leaves at λ=1930 nm

Infected leaves
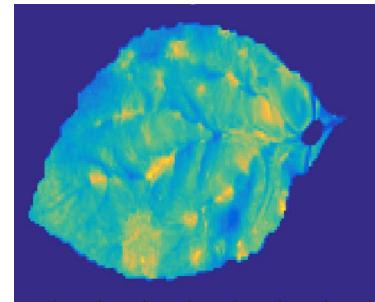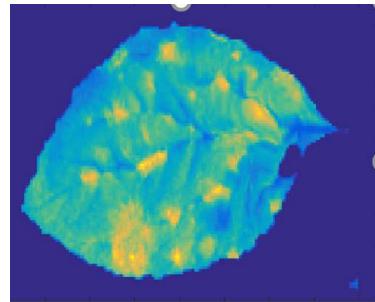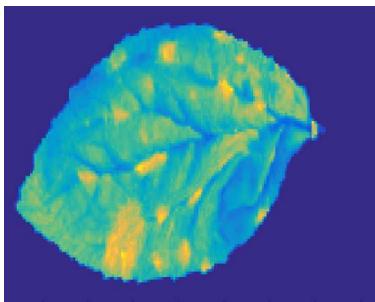
Healthy leaves
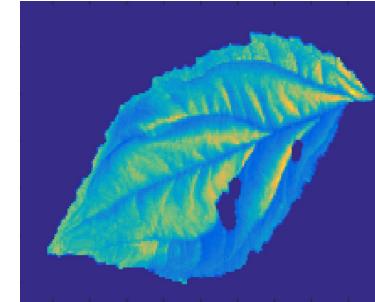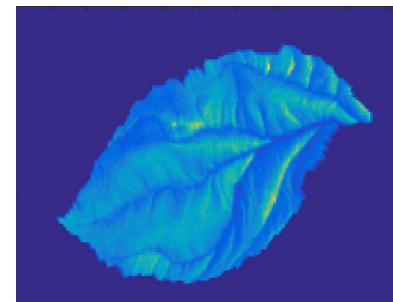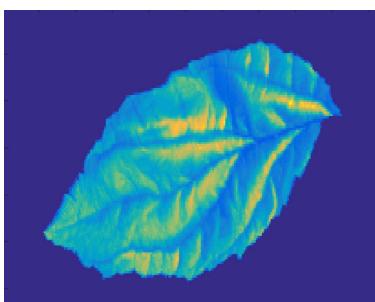
How to extract spatial samples
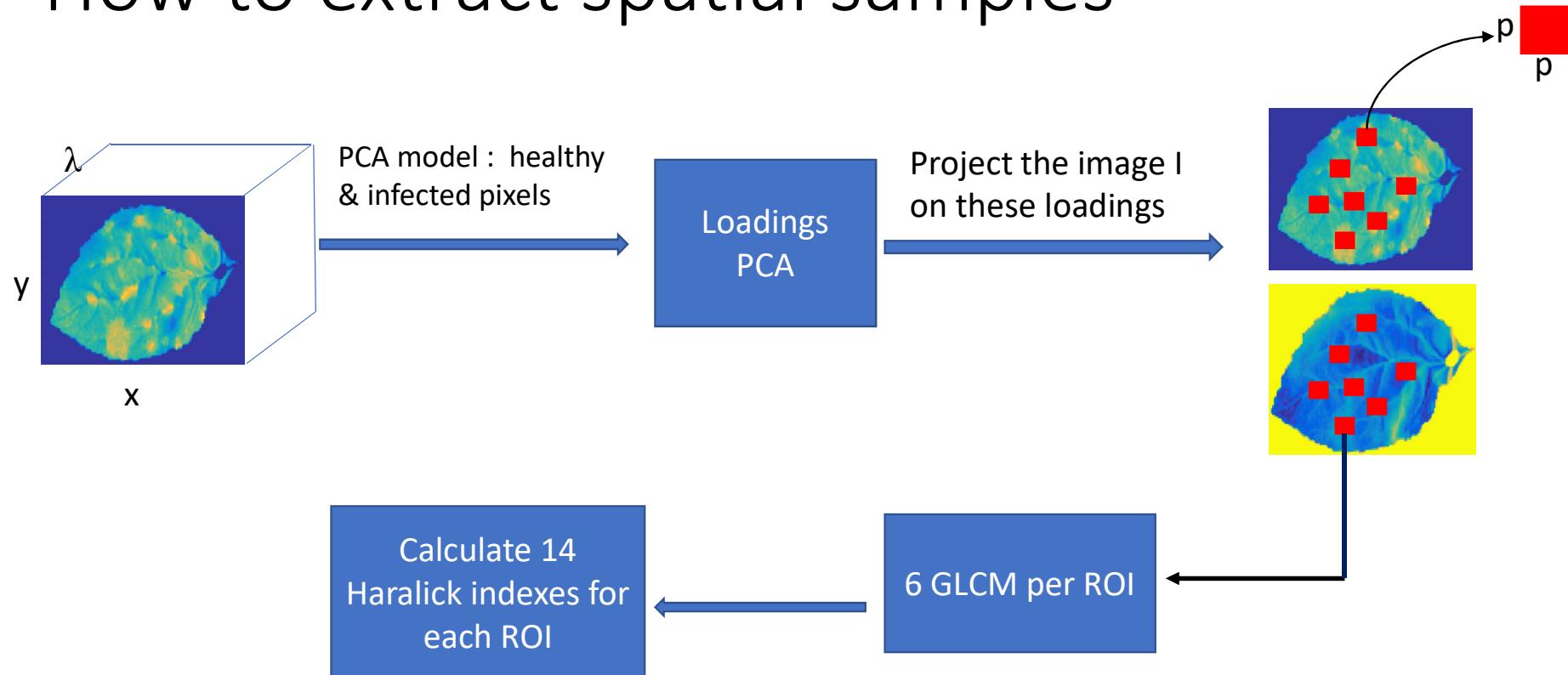
# How to construct spectral samples

ind$_1$ P*P λ

ind$_2$ P*P λ

ind$_n$ P*P λ

PCA Model on each ROI

Loading n

loading2

loading1

ind$_1$
ind$_2$

Ind$_n$

60 amples & 6 loadings blocks

Data fusion: framework

textural index 1   textural index 2   textural index 3   textural index n

Loading 1   Loading 2   Loading 3   Loading n

Spatials blocks

Spectrals blocks

Data Fusion with multiblock method : ROSA*
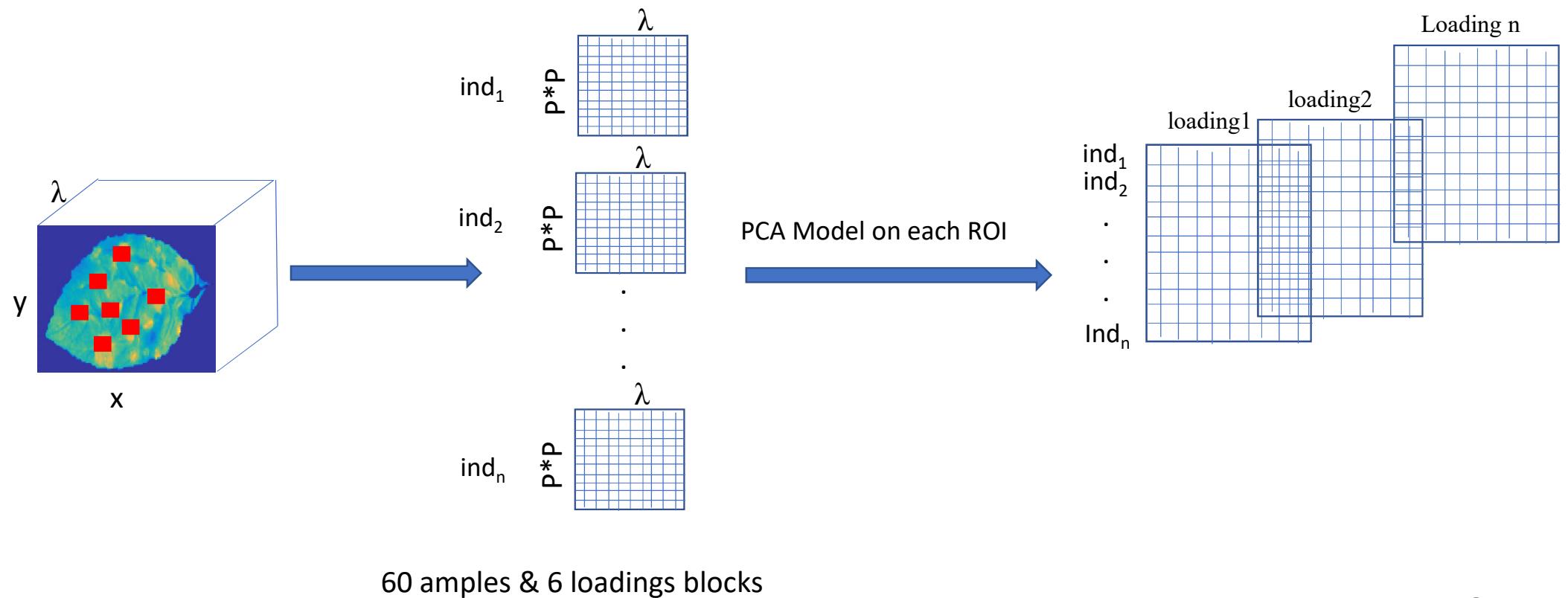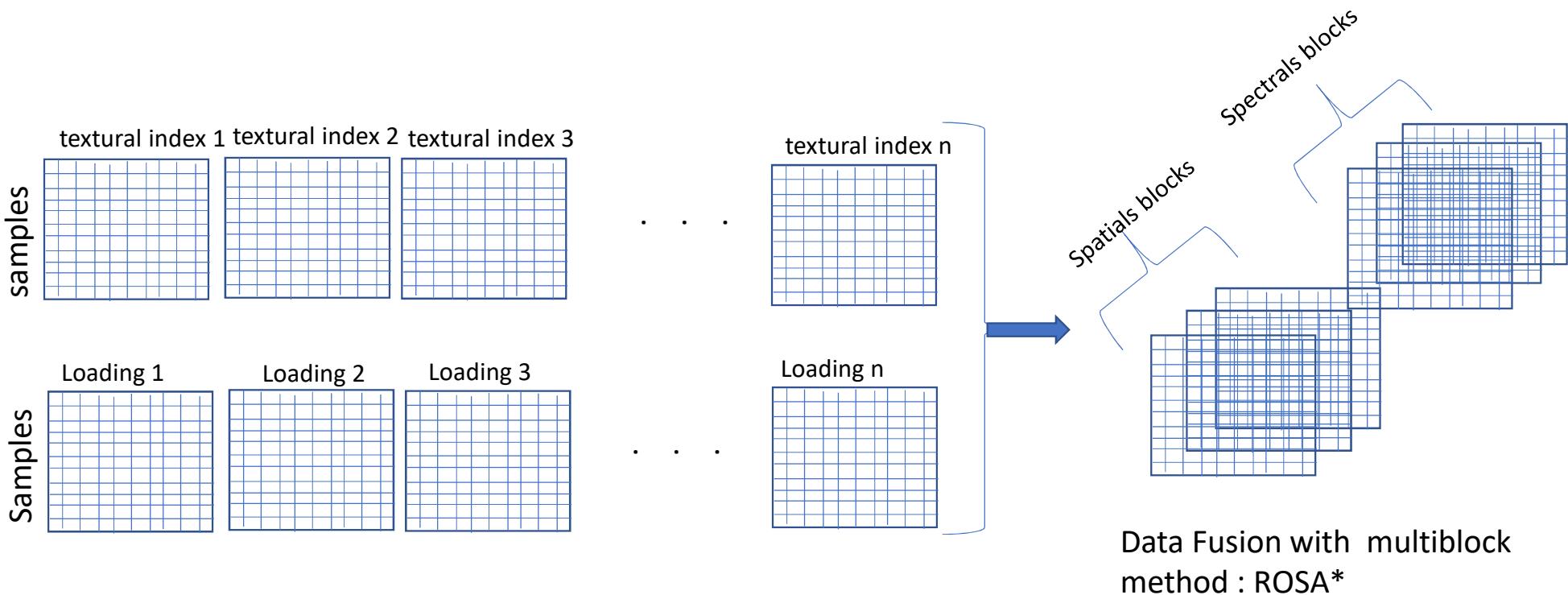
ROSA: Kristian Hovde Liland, Tormod Næs, Ulf G. Indahl

PCA plots from infected and healthy samples
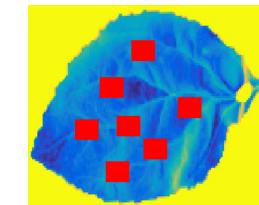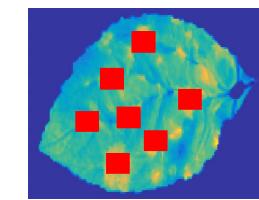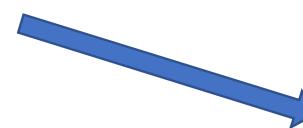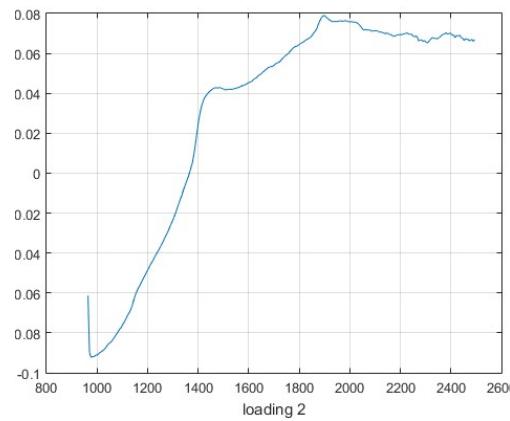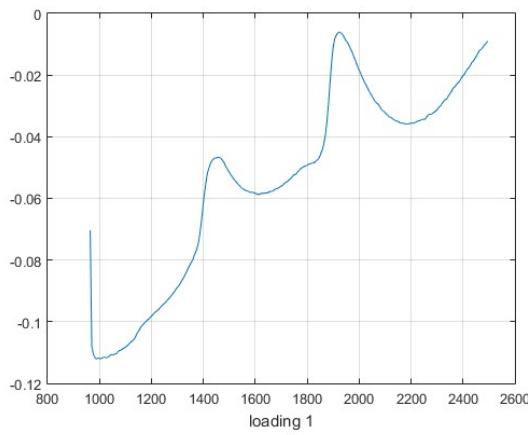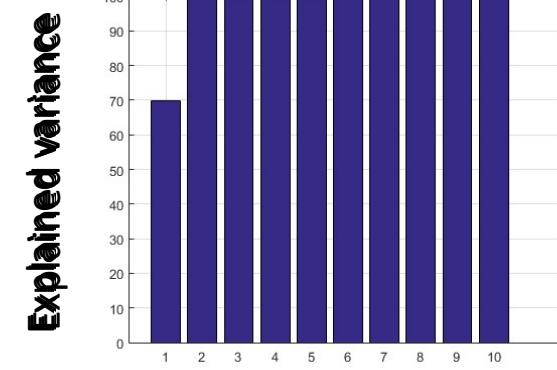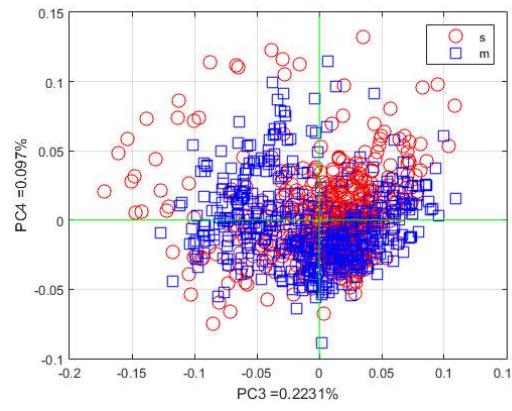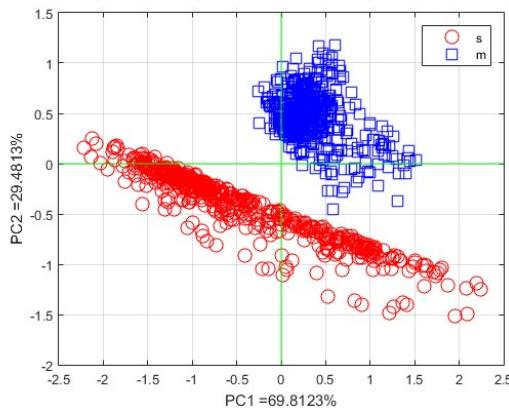
Data Fusion with ROSA :Preliminary results

Calibration set : 4 images (40 samples)
Cross-validation with 5-fold
Test set : 2 images (20 samples)
Number of blocks : 18 (12 spatial blocks and 6 spectral blocks)

Cross-validation error curve
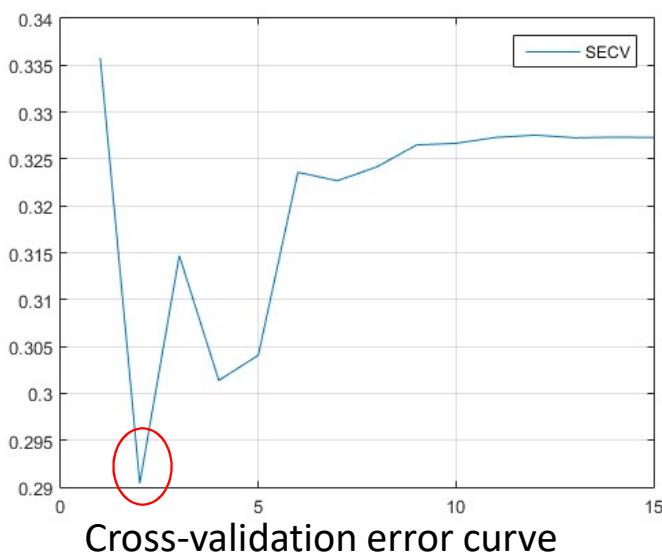
Block 12	Spatial matrix $\theta = 90°$, d=1, GL=32
Block 13	Spectral matrix (loading 1)

	Infected	healthy
Infected	100%	0%
Healthy	10%	90%

Confusion matrix

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Conclusion & perspectives

- Simple case-study to validate the methodology

- It is possible to merge spatial and spectral information

- Proposal of a new method to merge spatial and spectral information

- Rosa selected a spatial block and a spectral block => the two pieces of information are complementary

- Testing the method on other images /data in a more practical context

Thank You for your intention