RAPID IDENTIFICATION OF PRETOLEUM CONTAMINATED SOILS USING MULTI-SENSORS AND DATA FUSION APPROACH

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Soil Matrices

Solid & Inhomogeneous matrices

Natural Constituents

Organic Matter, Minerals, Trace Elements, etc …

Targeted Polluants

Pollutants targeted: PAH Polycyclic Aromatic Hydrocarbons

Soil Analysis

By **LIF** (Light Induced Fluorescence) Spectroscopy & **Multivariate Analysis** Models (PLS, …)

Goal = Rapid & In situ analysis to reduce lab analysis for the **diagnostic of polluted soils**

BUT

Matrices induce **locks** with signal processing (inner filtering, quenching, …)

Need **more information on the** soil **matrices** to **improve models** built (Xu et al, 2019, Chakraborty et al, 2015).

→ XRF Elemental Data could bring additional matrix knowledge to improve the Regression Models

Sources:
XU, D., et al. Multi-sensor fusion for the determination of several soil properties in the Yangtze River Delta, China. *European Journal of Soil Science* [en ligne]. 2019, Vol. 70, nº 1, p. 162-173. DOI 10.1111/ejss.12729.
CHAKRABORTY, S, et al. Development of a hybrid proximal sensing method for rapid identification of petroleum contaminated soils. *Science of The Total Environment* [en ligne]. Mai 2015, Vol. 514, p. 399-408. DOI 10.1016/j.scitotenv.2015.01.087.

XRF data: 396 samples from a polluted soil in Eastern France
127 common samples /w LIF data

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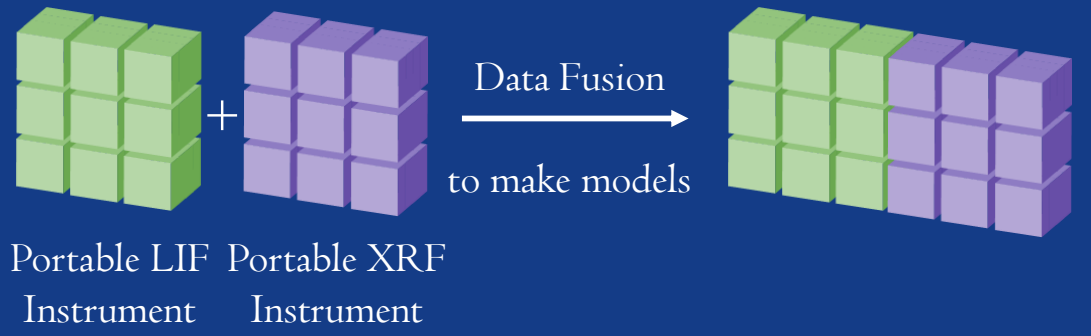
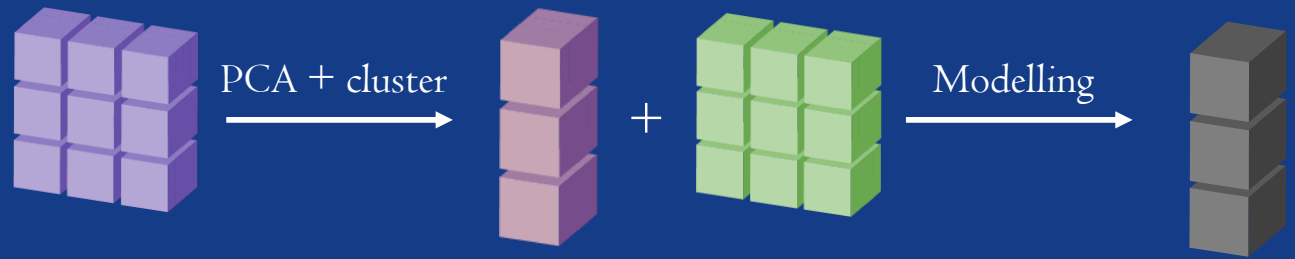
Data Fusion: low level
Single blocks used as such
Modelling of Augmented Data



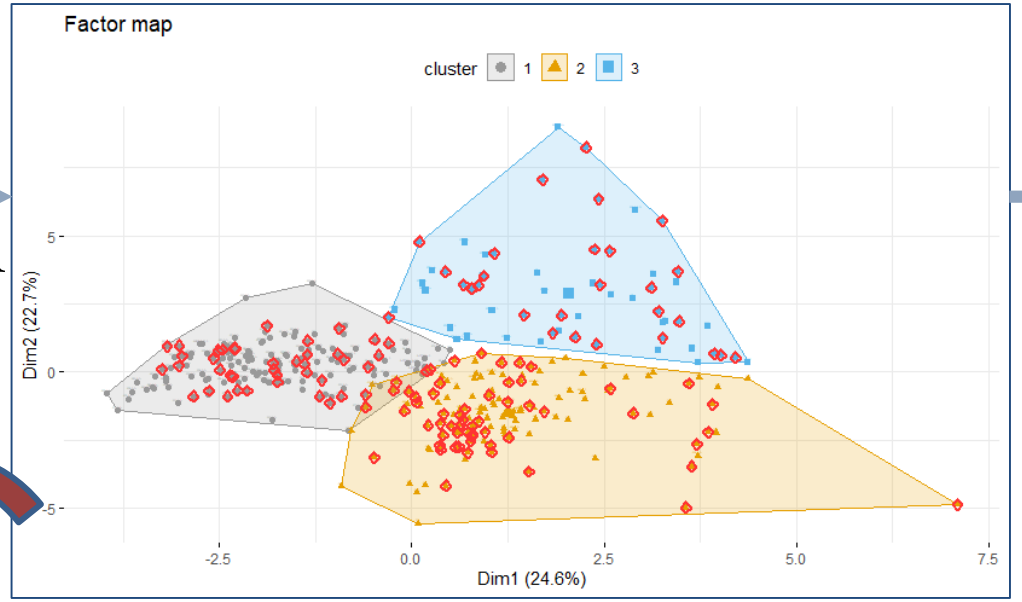
Data Fusion: mid level
Data reduction/Features extraction from the single blocks
Modelling of "fused features"

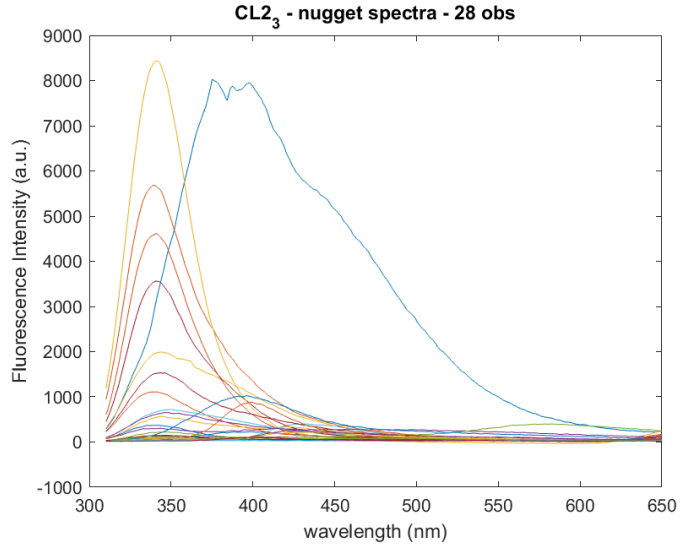
Data Fusion: high level
Individual models built on each block
Modelling of "fused results"



RAW XRF DATA

ACP + HCA





LIF DATA (Variable Selection)

3 clusters, 3 soil « types »: Silicates, Carbonates & Clay

1 PLS Model for Each Cluster on LIF Data

Method	obs	LV	RMSEcv	R² adj
PLS	181	5	890,9	0,60
PCA+Cluster +PLS	41	8	274,9	0,77
	58	8	1453,0	0,79
	28	3	53,3	0,94

→ Improvements: R² adj & RMSE

→ Though, insufficient to create predictive models yet.

Prospects:

- TOC: add LIF-TRES & MIR analysis.
- MINERALOGY: LOI, H2O2 attacks + LIF analysis