
DRF: Thesis SL-DRF-20-1012

RESEARCH FIELD

Mathematics - Numerical analysis - Simulation / Engineering sciences

TITLE

Sparse spectral unmixing for the spatial and temporal data fusion in gamma spectrometry

ABSTRACT

The general objective of the proposed thesis is the development of new algorithms for data analysis in gamma spectrometry allowing the joint processing of multiple data, taking into account both spatial and temporal information. To this end, the thesis will be composed of following three stages: i) Joint analysis of spectrometric data of measurements made on different aerosol sampling stations distributed in France, using a joint sparse modeling of the spectra to be analyzed in order to take into account the correlations between the measurements. These developments will be tested on measurements made during European-wide events of abnormal detection of radionuclides in the air (I-131, Ru-106, Se-75 ...), ii) Temporal fusion: joint processing of successive spectrometric data making it possible to use the a priori knowledge of the decay of radionuclides. The previously developed method will be extended to the case of unmixing with energy and time signatures in order to allow early detection of anomalies on continuous measurements. This approach will be tested on continuous measurements of aerosol sampling filters collected at Orsay, iii) Spatial and temporal fusion: joint processing of spectrometric data in situ continuously. In this case, an approach based on statistical learning, in particular via the use of recurrent networks (reproducing the inversion process of classic optimization algorithms in order to learn the regularization term from a training set data) will be implemented to capture time dependencies of background noise.

LOCATION

Institut de recherche sur les lois fondamentales de l'univers
Département d'Electronique, des Détecteurs et d'Informatique pour la physique
Laboratoire de cosmologie et statistiques
Place: Saclay
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