

## Post doc: Hyperspectral Image Analysis for bathymetry reconstruction and subtidal habitat identification

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### Description of the Cluster of excellence CPU (IdEx)

The Cluster of excellence CPU (IdEx) brings together teams belonging to 6 research laboratories in Bordeaux. This cluster is expected to have a long-term structuring role in both the academic and economic spheres through the production and transfer of cutting-edge knowledge in numerical and digital technologies.

Numerical and digital technologies are omnipresent in our everyday life and their use in the scientific and industrial worlds are constantly evolving. Numerical computations were first used as a tool to explain complex phenomena for which explicit computations or direct experiments were not possible. The next stage was the use of scientific computing as a dimensioning and designing tool in some industrial sectors.

CPU researchers will focus their energy on three main research areas heading to important breakthroughs in several high reliability demanding application domains (Health, Fluids, Aeronautics and telecom, Land transportation and Energy). The aim of this project is easy to state: we want to develop numerical sciences at such a level that it can be used as a certification tool.

For more information: [cpu.labex-u-bordeaux.fr](http://cpu.labex-u-bordeaux.fr)

**Duration:** 1 year

**Job status:** Post-doctoral researcher, full time

**Location:** IMS lab, Signal and Image group, University of Bordeaux – Talence, France

Start between March and June 2015

### Description:

The post-doctoral fellow will develop non-Gaussian multivariate stochastic models in order to characterize efficiently the spatial and spectral dependencies existing in the hyperspectral images [1-2]. Many works have been recently proposed in the literature including the use of copula based models and elliptical distributions (Gaussian scale mixtures, multivariate generalized Gaussian distributions, ...). Based on those approaches, the post-doctoral fellow will evaluate the potential of each model. A particular interest will also be dedicated to the development of non-parametric features issued from Mellin kind statistics to describe those multivariate dependencies [3].

Moreover, since hyperspectral components are numerous and redundant, they usually entail computing and methodological issues. Therefore the post-doctoral fellow will also evaluate the benefit of preliminary dimensional reduction (Principal Component Analysis, Independent Component Analysis).

From a practical point of view, these models and features will be implemented in classification (SVM, maximum likelihood, ...) and detection (Generalized Likelihood Ratio Test, ...) algorithms [4] and applied to natural habitats mapping of the ocean floor (in shallow coastal water). They will also be used to provide better estimations of coastal bathymetry [5].

#### CPU

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Hyperspectral images of shallow waters will be acquired by EPOC Laboratory in the Arcachon bay, from a ship on which a compact hyperspectral camera will be installed. Additional measurements will be acquired jointly using various spectral and biochemical sensors of the ship (ground truth). Besides, EPOC will bring expertise regarding bathymetry estimation and subtidal habitat.

**Profile of applicant:** The candidate should have a PhD in image processing. A good experience in remote sensing and good programming skills in Matlab are required.

#### References:

- [1] O. Regniers, L. Bombrun, D. Guyon, J.-C. Samalens, et C. Germain, Wavelet-Based Texture Features for the Classification of Age Classes in a Maritime Pine Forest, IEEE Geoscience and Remote Sensing Letters, Mars 2015, Vol. 12, n.3, pp. 621-625.
- [2] F. Pascal, L. Bombrun, J.-Y. Tourneret, et Y. Berthoumieu, Parameter Estimation for Multivariate Generalized Gaussian Distributions, IEEE Transactions on Signal Processing, Décembre 2013, Vol. 61, n. 23, pp. 5960-5971.
- [3] S.N. Anfinsen, et T. Eltoft, Application of the matrix-variate Mellin transform to analysis of polarimetric radar images, IEEE Transactions on Geoscience and Remote Sensing, 2011, Vol. 49, n. 6, pp. 2281-2295.
- [4] D. Manolakis, D. Marden, et G. A. Shaw, Hyperspectral image processing for automatic target detection applications, Lincoln Lab. J., 2003, Vol. 14, n. 1, pp. 79 -116.
- [5] B. Lubac et H. Loisel, Variability and classification of remote sensing reflectance spectra in the eastern English Channel and southern North Sea, Remote Sensing of Environment, 2007, Vol. 110, pp. 45-58.

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***Please send a CV and a motivation letter to the supervisors.***