SECTOR: Higher Education Institution

LOCATION: France, Grenoble

RESEARCHER PROFILE:
□ First stage researcher,

INSTITUTION: Univ. Grenoble Alpes, University of Innovation

One of the major research-intensive French universities, Univ. Grenoble Alpes\(^1\) enjoys an international reputation in many scientific fields, as confirmed by international rankings. It benefits from the implementation of major European instruments (ESRF, ILL, EMBL, IRAM, EMFL\(^*\)). The dynamic ecosystem, grounded on a close interaction between research, education and companies, has earned Grenoble to be ranked as the 5th most innovative city in the world. Surrounded by mountains, the campus benefits from a natural environment and a high quality of life and work environment. With 7000 foreign students and the annual visit of more than 8000 researchers from all over the world, Univ. Grenoble Alps is an internationally engaged university.

A personalized Welcome Center for international students, PhDs and researchers facilitates your arrival and installation.

In 2016, Univ. Grenoble Alpes was labeled «Initiative of Excellence ». This label aims at the emergence of around ten French world class research universities. By joining Univ. Grenoble Alpes, you have the opportunity to conduct world-class research, and to contribute to the social and economic challenges of the 21st century ("sustainable planet and society", "health, well-being and technology", "understanding and supporting innovation: culture, technology, organizations" "Digital technology").

\(^*\) ESRF (European Synchrotron Radiation Facility), ILL (Institut Laue-Langevin), IRAM (International Institute for Radio Astronomy), EMBL (European Molecular Biology Laboratory), EMFL (European Magnetic Field Laboratory)

Key figures:

- + 50,000 students including 7,000 international students
- 3,700 PhD students, 45% international
- 5,500 faculty members
- 180 different nationalities
- 1st city in France where it feels good to study and 5th city where it feels good to work
- ISSO: International Students & Scholars Office affiliated to EURAXESS

\(^1\) https://edu.univ-grenoble-alpes.fr/en/
MANDATORY REFERENCES:

PROJECT TITLE: MIAI @ Grenoble Alpes
SUBJECT TITLE: AI based approaches for source separation, detection and clustering of geophysical data.

RESEARCH FIELD (cf mots clefs sur Euraxess Jobs): Information sciences, Geosciences
SCIENTIFIC DEPARTMENT (LABORATORY’S NAME): GIPSA-Lab, ISTERRE
DOCTORAL SCHOOL’S: EEATS (https://www.adum.fr/as/ed/page.pl?site=edeats)
SUPERVISOR’S NAME: Olivier MICHEL, Michel CAMPILLO

SUBJECT DESCRIPTION:
The purpose of the project is to understand the origin of weak geophysical signals of tectonic origins simultaneously observed in geodesy (InSAR, GPS) and seismology (seismograms, velocity changes). These complex signals are hard to disentangle because of the presence of noise, and may be additionally contaminated by external forcings such as hydro-meteorological processes. Blind source separation approaches have been applied separately onto seismic or geodetic signals, e.g. to identify time varying components related to different perturbations in the InSAR phase data. These very promising results motivate the need to combine those different measurements in order to improve the separation of physical processes. This work includes (1) theoretical developments in order to build a framework adapted to the analysis of geophysical observations and (2) applications to actual geophysical data.

Blind source separation methods implemented in ongoing research operates over the temporal axis and rely on classical Independent Component Analysis (ICA). These methods do not consider constraints from either the natural nature of the signals (such as smoothness, frequency range…) or from observations issued by sensors of different types (seismometers, GPS, rain gauges…). Adding the constraints as regularizers in the ICA contrast function as well as flexible coupling is one primary goal in the theoretical developments of this work. Sparse approaches, or deep learning strategies will be of interest for improving both computational performances and ability to select most relevant features for the separation problem. This naturally leads to address dimension reduction as well as the definition of an efficient (computational as well as for physical interpretation) metrics, which are open problems. Joint feature extraction and clustering approaches will be investigated, both theoretically and experimentally.

The candidate should be able to acquire and develop knowledge in blind source separation, deep learning and signal processing. He will conduct original scientific research by designing novel algorithms with theoretical and applied aspects. A pronounced interest for geophysical problems is strongly encouraged. Programming skills in Matlab or Python will be appreciated.

ELIGIBILITY CRITERIA
Applicants must hold a Master’s degree (or be about to earn one) or have a university degree equivalent to a European Master’s (5-year duration),

Applicants will have to send an application letter in English and attach:
- Their last diploma
- Their CV
- A short presentation of their scientific project (2 to 3 pages max)
- Letters of recommendation are welcome.

Address to send their application: olivier.michel@grenoble-inp.fr, michel.campillo@univ-grenoble-alpes.fr

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5 Mackey, L. W. (2009). In Advances in neural information processing systems (pp. 1017-1024).