

**Call for application: Ph.D position at the University Clermont Auvergne, France**

## **Deep Learning analysis of multiprobe sensor networks to assess risk scenario's at volcanic hydrothermal ecosystems**

*Beginning:* September 2020.

*Duration:* 36 months.

*Location:* LIMOS, UMR 6159 CNRS, Campus des Cézeaux, F-63178 AUBIERE.

*PhD supervisor:* Prof. Vincent BARRA (LIMOS).

### **Description**

Volcanic hydrothermal systems are poorly-considered, long-fuse environmental time bombs. They involve complex process-response systems with spatially and temporally varying flows of heat and mass from deep volcanic sources to the Earth's surface.

Across such zones, high concentrations of volcanic gas and extreme heat fluxes act as environmental pollutants, killing-off flora and fauna across wide zones. Such systems are extremely common and involve some of the highest, sustained, heat fluxes on the planet.

The objective of this research project is to **build Deep-Learning data-driven models** that will allow to send alerts concerning the timing, location and hazard level of environmental crises at hydrothermal systems. Potential outcomes can then be assessed by examining past crises and their ecosystem impacts.

The scientific context of this work is the **ANR funded project DIRE** (Data-Integration, Risk and the Environment) led by three CNRS labs of Clermont-Ferrand (LMV<sup>1</sup>, LIMOS<sup>2</sup>, LPC<sup>3</sup>), in collaboration with national (IRD) and international (INGV Italy, Univ. Geneva) partners.

The heterogeneous big data originate from high-temporal resolution temperature, pressure, gas composition, humidity, windspeed and rainfall sensors, seismicity and physical deformation measures, as well as satellite images (IR and NDVI values) and new and exclusive measures developed in this ANR project concerning muography. Measures are collected from Vulcano (Eolian Islands, Italy), a test bench for understanding active hydrothermal systems. The resulting dataset consists of thousands of multiparametric timeseries, from which probabilistic risk assessment and short-term event-scenario prediction is expected.

Once the model will be built and validated, it is expected to track degassing scenario's and crises at active hydrothermal systems previously identified as possible targets (Indonesia, Vanuatu, Ecuador...)

### **How to apply**

Send an email with a zip folder attached including:

- A short curriculum-vitae (max 2 pages)
- A letter of motivation
- A scanned copy of a valid identification document (Passport or ID card)
- A copy of education certificates and transcripts of records.
- A copy of the degree thesis and publications (if any)

Subject of the email should be: FIRST NAME\_FAMILY NAME\_APPLICATION.

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<sup>1</sup> <https://lmv.uca.fr/>

<sup>2</sup> <http://limos.fr>

<sup>3</sup> <http://clrwww.in2p3.fr/>

The total size of emails to the above address cannot exceed 10 megabytes. If the provided material does not fit in 10 megabytes, candidates are allowed to submit it in multiple emails.

**Applications must be sent on or before June 15<sup>th</sup>, 2020 to the following contact person:**  
Prof. Vincent BARRA [vincent.barra@uca.fr](mailto:vincent.barra@uca.fr), +33 4 73 40 74 92

Incomplete applications or applications sent after the above deadline will not be considered.

### Criteria for selection

Candidates with a background of Computer Sciences will be considered seriously for this position. Speaking French is not mandatory but in any case, good English skills are necessary.

### The candidate will be ranked on the basis of the following criteria:

- Topic, content, and score of evaluation of the degree thesis.
- Curriculum of studies and research. Publications (if any).

The selected candidate will be required to move to Clermont-Ferrand or its vicinities at the beginning of the contract and start attending Ph. D courses at the university. This is a mandatory requirement.

### General information

#### *Clermont-Auvergne University*

The University Clermont Auvergne is located in Clermont-Ferrand, a medium-sized but dynamic city in the east of the Auvergne-Rhône-Alpes region, 3h30 drive from CERN. The city is on the edge of the Auvergne Volcanoes Regional Park, recently inscribed on UNESCO's World Heritage List. Many cultural activities are available, culminating each February with the International Short Film Festival (the world's largest festival in this field). Clermont-Ferrand is also the heart of the Michelin tire company. The public transport network is efficient, the LPC and LIMOS laboratories in particular benefits from a tram stop in the immediate vicinity. The cost of living in Clermont-Ferrand is low compared to large cities such as Lyon or Paris. Renting an apartment between 20 and 30 m<sup>2</sup> in the city centre near the tram costs about 400 euros per month.

#### *The LIMOS Lab*

The Laboratory of Computing, Modelling and Optimization of the Systems (LIMOS) is a Mixed Unit of Research (UMR 6158) in computing, and more generally in Sciences and Technologies of information and the Communication (STIC). The LIMOS is mainly connected with the Institute of the Sciences of the Information and their Interactions (INS2I) of the CNRS, and in a secondary way to the Institute of the Sciences of the Engineering and the Systems (INSIS). LIMOS has for academic supervision the Clermont Auvergne university and the graduate school of Mines of Saint-Etienne (EMSE), and as partner establishment the Engineer Institute SIGMA. The scientific positioning of the LIMOS is centered around the Computing, the Modelling and the Optimization of the Organizational and alive Systems.

#### *Vincent BARRA*

Vincent Barra<sup>4</sup> headed UCA's engineering school in Computer Sciences (2012-2017), with research interests in image processing and machine/deep learning. He has published more than 40 papers in the field of image analysis and machine learning. In 2018 he co-authored a book on machine learning entitled "Apprentissage artificiel. Deep Learning, concepts et algorithmes". He has coordinated, and participated in a number of national and European projects to this end, including RACE that resulted in a successful PhD with six papers published in the domain of particle tracking in Volcanology.

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<sup>4</sup> <http://www.isima.fr/vbarra>