

# Postdoc position: Convolutional neural networks on superpixel graphs for medical image segmentation



IMT Atlantique, Brest, France

## 1 Summary

**Goals** Extend convolutional neural networks on superpixel graphs to perform medical image segmentation.

**Research areas** artificial intelligence, biomedical image processing, deep learning, semantic segmentation, graph theory, mathematical morphology

**Advisors** Pierre-Henri Conze and Nicolas Farrugia, IMT Atlantique.

**Collaborations** Vincent Gripon, IMT Atlantique and Montreal Institute for Learning Algorithms (MILA), Montréal and Gwenolé Quéléec, Inserm.

**Location** IMT Atlantique, Brest, France

**Start date** March 2019, for a duration of 10 months

**Deadline for application** **Accepting applications now, will remain open until filled**

## 2 Research project

Our project addresses medical image segmentation using techniques based on artificial intelligence. To efficiently assist clinicians, computer-aided diagnosis and follow-up tools require reliable methods to segment anatomical and pathological structures. In order to increase the reliability and speed of these methods, we aim at extending convolutional neural networks to support regions that adapt to the medical content: superpixels.

Superpixels are visual primitives generated by aggregating neighboring pixels sharing similar characteristics to form homogeneous and regular regions. Deep learning applied to superpixel graphs represents a promising perspective, requiring the adaptation of existing graph signal processing techniques to semantic segmentation. The generalization of convolutional neural networks to graphs has been formerly studied for image classification. A research effort is needed to adapt these approaches to medical image segmentation based on superpixel graphs.

The purposes of this study is to propose methodological contributions at the interface between several disciplines (artificial intelligence, image processing, graph theory, mathematical morphology) and to contribute to concrete medical applications including massive diagnosis and follow-up of breast cancer using mammographies.

### 3 Environment

**Funding** The present postdoctoral position is funded by the Télécom Société Numérique Carnot Institute (Carnot TSN) which carries out scientific resourcing.

**Host organization** IMT Atlantique is a public technological university focusing on the training of engineers at the MSc. level and junior researchers at the PhD level. The Brest campus of IMT Atlantique is ideally located at the sea front<sup>1</sup> and benefits from a high quality of life.

### 4 Candidate profile

- PhD in machine learning, biomedical imaging or computer science,
- Interest in the fields of health and artificial intelligence,
- Strong theoretical and practical knowledge in applied mathematics, image processing and machine learning,
- Ability to communicate in English, intermediate level in French, fluent English for reading/writing scientific articles,
- Experience in deep learning.

### 5 How to apply

Send an email to [pierre-henri.conze@imt-atlantique.fr](mailto:pierre-henri.conze@imt-atlantique.fr) and [nicolas.farrugia@imt-atlantique.fr](mailto:nicolas.farrugia@imt-atlantique.fr) with the following:

- a full curriculum vitae including a list of scientific contributions
- up to two representative scientific articles or conference papers
- recommendation letters or contacts from former teachers/advisors
- a cover letter stating your motivation and fit for this project

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<sup>1</sup>[http://inovadys.com/29/telecom\\_bretagne/](http://inovadys.com/29/telecom_bretagne/)