Post-doc or Research Engineer 2026-2027
Hyperspectral Foundation Models for Chemical Soil Analysis

Description

The foundation model (FM) paradigm is undoubtedly a major breakthrough in Machine Learning (ML) for Artificial Intelligence (AI). An FM is a large-scale neural network pre-trained with self-supervision on a vast unannotated dataset and designed to perform downstream tasks with minimal fine-tuning on small, annotated datasets. While FMs have made an outstanding leap in computer vision and large language models, they have not yet emerged in more complex fields, such as chemical analysis. The HyFoundationS project aims to devise an FM for chemical soil analysis, through the lens of hyperspectral imaging.

Unlike traditional cameras with their three primary colors (red, green, and blue), hyperspectral cameras capture detailed spectral information at every pixel, providing a detailed description of the material properties in the scene [1]. ML methods have been devised to explore hyperspectral images, mainly addressing spectral unmixing, classification, and segmentation tasks. With the FM paradigm reshaping the landscape of ML, there is growing interest in FMs for hyperspectral imaging, with several papers published very recently, focusing primarily on image segmentation in satellite images [2-6].

HyFoundationS (Hyperspectral Foundation Models for Chemical Soil Analysis) is an interdisciplinary research project funded by the ANR. It aims to develop an FM for chemical analysis of soil pollution by hyperspectral imaging. In order to unleash the full potential of FMs in the analysis of soil pollution, HyFoundationS brings together an AI Lab (LITIS), a chemistry laboratory (CARMeN), as well as a startup specialized in soil pollution analysis (Tellux). This consortium has been working together for more than 5 years, developing ML and chemical analysis for soil pollution assessment using hyperspectral cameras installed on a bench in lab conditions, which allows full environmental control over a wide variety of pollutants. HyFoundationS aims to provide major innovations to overcome key scientific and technical barriers for soil pollution analysis with FMs.

We are seeking a Post-doc or a Research Engineer who will collaborate with a PhD student and senior researchers in AI, in chemical analysis, and in geosciences, to design and train an FM for chemical soil analysis. For this purpose, we aim to take advantage of recent advances in FMs for hyperspectral images and overcome their limitations as they are mainly restricted to airborne and satellite-based Earth observations, making them less relevant for chemical soil analysis. It is therefore necessary to properly define chemical analysis downstream tasks, while considering the complexity of the chemical compositions and their interactions, as well as the significant variability in the lithology matrix and the wide variety of pollutants. Therefore, developments will explore advances in cross-domain transfer learning and adapters [7-9]. Experiments and empirical evaluations will be carried out in close collaboration with CARMeN and Tellux.

Profile of the candidate

We are seeking a highly motivated candidate for a postdoctoral position or research engineer role, with a strong interest in AI for science. The candidate must have a PhD in AI, computer science, computational mathematics, signal and image processing, applied physics, remote sensing, geosciences, or a related field. The candidate must have solid technical skills in deep learning, with experience in Python and the common ML libraries. Expertise in hyperspectral imaging is not necessary.

Candidates with a strong interest in interdisciplinary research and the ability to work in a collaborative environment are strongly encouraged to apply.

If you are interested, please send your CV with contact references in a motivational email to paul.honeine@univ-rouen.fr.

Location: LITIS Lab, Rouen Normandy

Expected starting date: 2026 or 2027 (flexible).

Duration: 12 months with possibility of extension

References

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[6] D. Hong, B. Zhang, X. Li, Y. Li, C. Li, et al., “SpectralGPT: Spectral remote sensing foundation model,” *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2024.
[7] Hurtado, J. V., Mohan, R., & Valada, A. “Hyperspectral adapter for semantic segmentation with vision foundation models.” *IEEE Robotics and Automation Letters*, 2026.
[8] Theisen, N., & Neubert, P. “Cross-Domain Transfer of Hyperspectral Foundation Models.” *arXiv preprint arXiv:2604.26478*, 2026.
[9] Paeedeh, N., Pratama, M., Shiddiqi, A., Cao, Z., Prasad, M., & Jatmiko, W. “Cross-Domain Few-Shot Learning for Hyperspectral Image Classification Based on Mixup Foundation Model.” *arXiv preprint arXiv:2601.22581*, 2026.