

# Masters' internship followed by a PhD

Optimization of the deployment of environmental sensors

Internship starting from March 1st 2026, PhD starting from September 1st 2026

## Summary

The research collective ConnecSenS deploys environmental sensors, with application in fields such as biology and hydrogeology. Currently, the sensors' positions are decided by hand by the experts. The goal is to conceive methods to automatize the process and optimize the sensors' positions with regards to different criteria (type of sensors, geographical constraints, spatial covering, communication, etc).

An example, which is the topic of the **internship**, is pluviometers: in a given region, we want to deploy them to cover the area. The collected data will allow to understand the hydrogeological profile of the region, allowing a new subdivision into several subregions, for a new deployment. Furthermore, while in some areas the sensors can send their data to a node, others will have to be deployed in areas without coverage. The approach will be to divide the region into sub-areas, to define how many pluviometers will be deployed in each of them, and to apply Lloyd's algorithm (or Voronoi iteration) to decide the sensors' positions. The standard approach for this algorithm uses optimal transport. A validation phase by experts will allow to refine the algorithm.

The goal of the **PhD thesis** is to analyze the needs and constraints of a diverse array of scientists deploying environmental sensors, and to propose generic algorithmic solutions adapted to said needs. Those solutions will always be evaluated by the expert users in order to refine and improve them. Different approaches will be used, for different types of sensors, constraints and goals. Those approaches will come from graph theory, operations research, algorithmic geometry, etc.

The funding is secured. It is also possible to apply only for the internship or the PhD.

## Conditions

- The internship and PhD will take place at INRAE Clermont-Ferrand.
- Work in person only for the internship; up to 100 days of work from home for the PhD (two days each week in person).
- 2.5 vacation days for each full month (internship). 6 weeks of paid vacation per year (PhD), plus working time reduction if applicable.
- Subject to approval of a security officer.

## Contact

Antoine Dailly - antoine.dailly@inrae.fr

To apply, send your CV and your grades since the first year of Masters'.