

Signal-aware Graph Summarization with GNN Guarantees (SIGMA)

PhD position in graph signal processing and graph machine learning

- **Research areas:** Graph signal processing, graph machine learning, geometric deep learning
- **Keywords:** Graph summarization, graph signals, higher-order structures, graph neural networks, scalable learning
- **Research groups:** LTCI, Télécom Paris and SAMOVAR, Télécom SudParis, Institut Polytechnique de Paris
- **Supervisors:** Jhony H. Giraldo and Aref Einizade
- **Funding:** This PhD project is funded by Hi! PARIS.
- **Duration and expected start:** 3 years, starting in December 2026

Project context

Graphs are used to represent connected data in social networks, recommender systems, biological networks, knowledge graphs, and the web. These datasets can contain millions or billions of nodes and edges. Their scale creates major challenges for storage, analysis, and the training of graph neural networks (GNNs) or graph mining tasks.

Existing methods usually address only one part of this problem. Graph-signal sampling selects a limited number of signal values while keeping the original graph. Graph coarsening reduces the number of nodes, but often focuses mainly on topology. This PhD will study how to compress the graph and its associated signals together, while preserving the information needed for reconstruction and downstream tasks.

The central idea is to use meaningful higher-order structures as the units of summarization. These structures can capture relationships that are not visible from individual nodes or edges alone. They can also provide a local and interpretable description of how the compressed graph is formed. The project will investigate when such structures are useful and how they can be selected efficiently on large graphs.

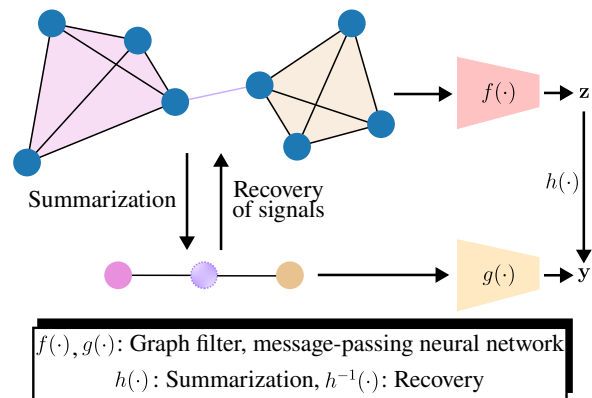


Figure 1: The project will jointly summarize graph structure and graph signals, and support reconstruction and learning on the compact representation.

Candidate profile

We are looking for candidates:

- Currently holding or finishing an M2 in engineering, data science, computer science, applied mathematics, signal processing, statistics, or equivalent, with a strong background in signal processing and machine learning. The student should have a genuine interest in working in graph signal processing and geometric deep learning.
- Have strong programming skills in Python (including PyTorch).
- Have a genuine interest in understanding the mathematics behind graph signal processing and geometric deep learning (this is a strong requirement).
- Have good communication skills.

Team and location

Télécom Paris and Télécom SudParis are premier engineering schools in France and constituent members of Institut Polytechnique de Paris. Institut Polytechnique de Paris is consistently ranked among the best uni-

versities worldwide ([QS Ranking](#)). Télécom Paris and Télécom SudParis are located on the outskirts of Paris (around 45 minutes by train from the center of Paris) at the center of the Paris-Saclay cluster—a fast-growing research and industrial ecosystem. The student will be integrated within the [MM Team](#) at [LTCI lab](#) and the [ARMEDIA Team](#) at [SAMOVAR](#). This PhD is funded by the [Hi! PARIS](#) project SIGMA.

How to apply

Please send your application to Jhony and Aref including the following:

- A full CV.
- A motivation letter explaining your interest in the position (max 1 page).
- Transcript of records (grades).
- At least one recommendation letter.

We're reviewing applications on a rolling basis, and we'll close the call once a suitable candidate is found.

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