

# PhD position / Master internship

## Variational methods for graph signal processing

**Keywords:** machine learning, networks, graph signal processing, optimization.

**Supervision & contact:**

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**Place:** Institut de Mathématiques de Bourgogne, Université de Bourgogne, Dijon, France.

**(Preferred) starting date:**

- Master internship: March 2020 (up to 6 months). Available now.
- PhD position: September 2020 (3 years program). Available now.

**Context:** Handling large datasets has become a major challenge in fields such as applied mathematics, machine learning and statistics. However, many methods proposed in the literature do not take into account the fine structures behind the underlying data. Such structures can often be modeled by graphs. Though many worldwide companies such as Google, Facebook or Twitter, have made their success extracting information where the signals live natively on a graph, a refined analysis of the underlying graph influence is still missing and most of the literature neglects, for simplicity, the underlying graph structure, or uses over simplistic linear estimators to overcome these issues. We advocate the use of robust non-linear regularizations to deal with inverse problems or classification tasks on such signals.

**Objectives:** This research proposal is part of the French project ANR GraVa *Variational Methods for Graph Signals* which is an endeavor to solve such concrete and difficult issues through the mathematical perspective of variational methods for graph signal processing. This stance raises several challenges. Which estimators are good candidates for such tasks, and how to assess their performance? How to design computationally tractable algorithms for these methods? How to tackle time-dependent signals? The PhD candidate will have to encompass recent contributions from communities of graph harmonic analysis, statistics and optimization, and develop new tools in nonlinear spectral graph theory which is only emerging.

**Skills:**

- Master degree in (Applied) Mathematics or Computer Science.
- Mandatory: competency in at least one programming language, Master-level knowledge in machine learning.
- Appreciated: Python and scientific stack associated, basic knowledge of graph theory.

**Application:** Send to [samuel.vaiter@u-bourgogne.fr](mailto:samuel.vaiter@u-bourgogne.fr) AND [joseph.salmon@umontpellier.fr](mailto:joseph.salmon@umontpellier.fr)

- Curriculum vitae,
- Contact details of one or two referees,
- Recent university records.

