INTERNSHIP OFFER : Laboratoire d'Informatique de Paris Nord (LIPN)

Structured Binary Polynomial Optimization

Research topic description

Mathematical optimization plays a crucial role in many fields, from logistics and economics to natural sciences. As optimization models evolve and become more accurate, they often incorporate discrete variables and nonlinear functions, leading to challenging classes of Mixed Integer Nonlinear Programming (MINLP) problems. Although current solvers for Mixed Integer Linear Programming (MILP) are quite advanced, they often struggle with the added complexity of MINLP, particularly as the problem size increases.
To tackle this, the project explores a prototypical problem in MINLP: Binary Polynomial Optimization (BPO), where the goal is to optimize a polynomial function under the only constraint that its variables must be binary (0 or 1). A key aspect of this study involves using hypergraph-based representations to better understand the problem's structure. By analyzing such structures, we aim to identify novel conditions under which BPO becomes tractable. This would provide new insights into more efficient algorithms for MINLP.

Mission of the intern

The intern is expected to work on novel relaxations of BPO. We will explore descriptions of the convex hull of the feasible region, and assess the computational impact.

Profile required

This position is aimed at students who have a background in the basics of mathematical optimization (discrete optimization in particular).
We look for advanced undergraduate / master's / PhD students with a good level of English. The candidate is expected to have organizational ease, high motivation and autonomy, as well as willingness to collaborate in the tasks designated by the researchers involved.

The duration of the internship is between 4 and 6 months. The starting date is flexible, ideally from February. We can offer the minimal compensation. Successful completion of the internship may lead to the opportunity to pursue a PhD within our research group.

Application portfolio

The application must contain:
- CV
- Courses taken and grades
- Courses being taken this semester

Contacts

Location: Algorithms and Combinatorial Optimization (AOC) team at LIPN – Laboratoire d'Informatique de Paris-Nord. We are on the Villetaneuse campus of the Université Sorbonne Paris Nord.
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