Ph.D. positions in the intersection of Operations Research (OR) and Machine Learning in Montreal

We invite applications for fully funded Ph.D. positions in Montreal in the intersection between Operations Research and Machine Learning. These positions aim at advancing our collective capabilities to solve hard optimization problems and our understanding of how external data sources and real-time data can be used to improve the decision-making process. Potential starting dates are September 2024 or January 2025.

Research Topics

Research topics may be aligned with the interests of the students. Several pre-defined research projects are also available (some of them in collaboration with industrial partners). Topics may generally include the following:

- Large-scale optimization for dynamic (combinatorial) planning problems (e.g. Benders decomposition, Column Generation, Lagrangian Relaxation)
- Optimization under uncertainty (e.g., stochastic programming, robust optimization, improvement of uncertainty sets and scenario generation through external data)
- Use of machine learning models (e.g., Reinforcement Learning) to tackle large-scale combinatorial optimization problems.
- Improvement of (à priori and real-time) planning through integration of external data sources via machine learning
- Discrete choice-models, their efficient estimation and the solution of the resulting optimization problems.

Research may be fundamental, applied, or a mix of both. Applications may include domains such as Logistics and Transportation (e.g., airline industries, vehicle sharing systems, facility location, traffic management), Telecommunications and Revenue Management (e.g., assortment planning). Note that these positions are centered around Operations Research. While they may include components of Machine Learning, they are not explicitly focusing on those.

Research supervision and environment

The students will work under the supervision of Dr. Sanjay Dominik Jena and Dr. Frédéric Quesnel, professors at the Department of Analytics, Operations and IT (aoti.esg.uqam.ca) at the Management School of Université du Québec à Montréal (École des Science de la Gestion, UQAM). Students will be registered within the joint PhD program in Administration at UQAM, within which they have access to a diversified set of courses among all participating universities (i.e., ESG UQAM, HEC Montréal, McGill & Concordia university). They will also be integrated into one or several of the renowned research centres in Montréal: CIRRELT (www.cirrelt.ca), GERAD (www.gerad.ca) and the Research Center for Intelligent[2] Management of Complex Systems (http://cri2gs.esg.uqam.ca).

Montreal is a dynamic Metropolis, located in the province of Québec, Canada. The city is bilingual (French/English) and known for its international atmosphere. Montreal is known for its vibrate research environment, hosting 5 major universities and several research

centers in the domains of Operations Research and Machine Learning. The successful candidates will be working in one of the above-mentioned research centers.

Candidate profile

Students are expected to carry out top-level research. They will develop efficient solution algorithms to difficult planning problems such as those in the above-listed domains. Candidates should have a Masters degree (or equivalent) in Computer Science, Operations Research, Applied Mathematics, or a related field. They should demonstrate good programming skills. Experience in mathematical optimization, machine learning, or data analysis is an asset. Candidates should possess a good level of written and oral English. Even though they may eventually learn French during their stay, French knowledge is not obligatory.

Application procedure

Interested candidates should send their application package electronically to Sanjay Dominik Jena (sanjay.jena@cirrelt.ca). The application should contain the following documents:

- Cover letter explaining the motivation to perform a Ph.D. in one of the domains mentioned above in Montreal, your research interests, as well as your preferred starting date.
- Detailed curriculum vitae and list of publications (if any).
- Grade records of Bachelor and Master programs.
- Reference letters or contact details of references (one of them should be the supervisor of the candidate's Master studies).

If you have further questions regarding these positions, possible research topics, etc., please contact Sanjay Dominik Jena (sanjay.jena@cirrelt.ca). Positions will remain available until filled.