RESEARCH GROUP

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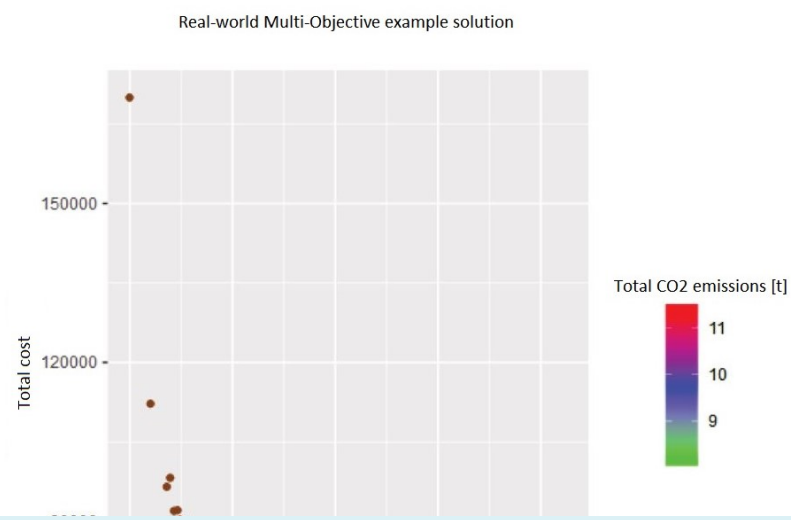
Optimization & Decision Systems



The Optimization and Machine Learning group (ORISON) aims at developing real-world solutions based on the latest results of two strategic fields of today's Computer and Data Science: Numerical Optimization and Machine Learning (i.e. data-based Modelling).
In that respect it seeks to sit at the top of two megatrends strongly driving innovation in the world today and for the foreseeable future: the optimisation of the usage of resources and the use of machine learning/artificial intelligence everywhere it can help improve current processes (industrial, logistics, or other).
Unlike research groups hosted in Universities which typically have academic perspectives, the ORISON research group belongs to an RTO and so in that sense it has a strongly applied focus: its goal is to leverage the best of state-of the-art and mature academic concepts to solve real-world problems emanating from LIST partners or societal challenges. The breadth of problems ORISON can address is then very large, with the only desired prerequisite to have adequate data or information/know-how of the problem considered to start working from.

Main expertise fields:

- Operations Research/ Numerical Optimization: local/global, non-linear, non-convex, mixed-integer and/or combinatorial optimization.
- Modelling: data-driven and know-how (expert)based modelling, reinforcement learning
- Decision Support Systems & Simulation

Research challenges:

The research field as described for the ORISON group is today very much an applied field and in that sense many tools in there can be developed or improved, and there is even more room for furthering theoretical results in that direction (a second direction which would be more the focus of universities research groups). Such challenges belong to topic areas like:

- Investigate how to hit the best trade-offs between *complexity vs accuracy* of the models developed, in view of using them to best improve the considered problem/process via leveraging numerical optimization procedures.
- Investigates the profound and powerful links between numerical optimisation and data-driven modelling, machine learning and other branches of artificial intelligence. It pursues the quest towards automated approaches for various challenges such as combinatorial problems, dynamic behaviour of real-time adaptive algorithms as well as ability to handle unpredictable instance characteristics (exact, stochastic and metaheuristic-based solutions). It seeks to contribute to a deeper understanding of the automated learning of model characteristics from data and of the impact of available knowledge on the quality of the optimized solution.

Application areas:

- Industrial applications or manufacturing (B2C, B2B, services or products for industry 4.0)
- Real-world scheduling, logistics, transportation,
- Bio-informatics,
- E-learning,
- Cloud load balancing,
- Communications,
- Industrial Internet of Things applications
- Systems control/automation (e.g. robotics, energy, auto-mobility).

Main assets:

- OCTogone (collaborative project),
- SWAM (Bridge Project),
- SUCCESS CCC (EU project),
- Evacuate solution (PhD Thesis Peiman ALipour)
- Goodyear Data Science for Tires project (collaborative project)
- Control Tower (acting now) – COVID project funding

Selected publications:

1. Sarvari P.A., Ikhelef I.A., Faye S., Khadraoui D. A dynamic data-driven model for optimizing waste collection. 2020 IEEE Symposium Series on Computational Intelligence, SSCI 2020.
2. Gutierrez-Gomez L., Petry F., Khadraoui D. A Comparison Framework of Machine Learning Algorithms for Mixed-Type Variables Datasets: A Case Study on Tire-Performances Prediction. IEEE Access.
3. Rezgui D., Bouziri H., Aggoune-Mtalaa W., Siala J.C. A comparative study of local search techniques addressing an electric vehicle routing problem with time windows. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)
4. Imeri A., Lamont J., Agoulmine N., Khadraoui D. Model of dynamic smart contract for permissioned blockchains. CEUR Workshop Proceedings.
5. Sébastien Faye, Foued Melakessou, Wassila Mtalaa, Prune Gautier, Neamah AlNaffakh, Djamel Khadraoui; 2019/11/13; Proceedings of the 1st ACM International Workshop on Technology Enablers and Innovative Applications for Smart Cities and Communities; Pages: 38-45
6. Kanwar Singh, Peiman Alipour, Frank Petry, Djamel Khadraoui; Application of machine learning & deep learning techniques in the context of use cases relevant for the tire industry; 2019/10; VDI Wissensforum, Hannover
7. Peiman Alipour Sarvari, Mohammad Nozari, Djamel Khadraoui; The Potential of Data Analytics in Disaster Management; 2019; Industrial Engineering in the Big Data Era; Pages 335-348; Springer, Cham

Partenaires

Polygone, Luxembourg, Goodyear, Luxembourg, LCL â Luxembourg Centre of Logistics, Proximus Luxembourg, Hopital Robert Schuman

Contact
5, avenue des Hauts-Fourneaux
L-4362 Esch-sur-Alzette
tél : +352 275 888 - 1 | LIST.lu

Dr Djamel KHADRAOUI (djamel.khadraoui@list.lu)

LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY | LIST