

**IFAC MIM 2022**

**June 22-24, 2022, Nantes, France**

**Invited Session on:**

**Data-driven Meta-heuristics to Solve Combinatorial Optimization Problems**

**Proposed by:**

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**Aim and content of the invited session:**

Combinatorial Optimization Problems (COPs) are optimization problems with discrete decision variables and a finite search space. Most COPs belong to the NP-hard class of optimization problems, for which no polynomial-time algorithm exists to find optimal solution. Solving NP-hard COPs using exact algorithms is therefore a challenging issue enforcing the need for approximate algorithms. Among them, meta-heuristics are able to provide COPs with (near-) optimal solutions with acceptable gaps in a reasonable computational time. Meta-heuristics are iterative algorithms that process a high volume of data through their search process and their success depends on the choice/design of their search mechanism (e.g., initial solutions, exploration & exploitation operators, evolution, etc.) [1].

Data-driven meta-heuristics have become a paradigm that aims at extracting useful knowledge from the resolution process of the optimization process and injecting this knowledge into the search process to improve the overall performance of the meta-heuristic algorithm. In this regard, machine learning techniques are used to extract knowledge from available data to allow solving the optimization problems more efficiently. Machine learning techniques have shown effective impacts in improving the performance of classical meta-heuristic algorithms by extracting useful knowledge from the available data and injecting this knowledge into the resolution process [1,2].

This invited session welcomes innovative ideas and applications of machine learning techniques in heuristics/meta-heuristics to solve COPs. Topics to be captured contain, but are not limited to, the following:

- Algorithm Selection
- Learning Evolutionary Algorithms
- Adaptive Operator Selection
- Online Parameter Control
- Learning-based Cooperative Algorithms
- And other related aspects where machine learning techniques are integrated to heuristics/meta-heuristics to solve COPs.

**References:**

1. Karimi-Mamaghan, M., Mohammadi, M., Meyer, P., Karimi-Mamaghan, A. M., & Talbi, E. G. (2022). Machine Learning at the service of Meta-heuristics for solving Combinatorial Optimization Problems: A state-of-the-art. *European Journal of Operational Research*, 296(2), 393-422.
2. Bengio, Y., Lodi, A., & Prouvost, A. (2021). Machine learning for combinatorial optimization: a methodological tour d'horizon. *European Journal of Operational Research*, 290(2), 405-421.