

2 RESEARCH ENGINEER POSITIONS AVAILABLE
Machine Learning & Metaheuristics with Applications

- **Duration:** 1.5 years
- **Employer:** University of Haute Alsace
- **Location:** IRIMAS laboratory, Mulhouse, France
- **Salary:** ANR funding (may vary according to experience)
- **Supervisors:** L. Idoumghar, J. Lepagnot & M. Brévilliers

1. Context

This research engineer position is part of a joint French–German research project on future security in urban areas, funded by the French National Research Agency ([ANR](#)) and the German Federal Ministry of Education and Research ([BMBF](#)), from 2017 to 2020. This project is entitled “Organized Pedestrian Movement in Public Spaces: Preparation and Crisis Management of Urban Parades and Demonstration Marches with High Conflict Potential” (OPMoPS). The main outcome of this project will be a decision support tool based on mathematical, computer science and sociological research, which will help the forces of civil security (FCS) to prepare and control urban parades and demonstration marches (UPM), to detect risk situations, and to react to possible threats to individuals and civil security fast and efficiently.

In this context, the IRIMAS institute coordinates the work of the French involved partners and leads an optimization work package devoted to solve the following research problems: find good locations for security personnel before and during the UPM, roster plans for security personnel, evaluate suggested and recommend good UPM routes, placement of cameras and drones with automatic detection of main hazardous situations.

The selected candidates will join the IRIMAS optimization group involved in OPMoPS.

First results in optimal camera placement [1, 2, 3] and automatic path planning of drones [4] have already been published.

2. Mission

As research engineers, your role will be to assist this group in the following possible tasks:

- The design and implementation, in an optimization algorithm library of the team, of new metaheuristic-based algorithms to solve hard optimization problems related to the OPMoPS context.
- Integrating machine learning techniques to metaheuristics.
- Performing experimental studies, then gathering and analyzing the results.
- Modelling and integrating real-world test cases into the OPMoPS framework.
- Developing tools to easily create, handle and display test cases and results.

3. Required skills and background

- The candidates must have a Master degree or equivalent in computer science or applied mathematics.
- The candidates should have knowledges in optimization and metaheuristics.
- Main programming languages: C/C++, Matlab, Python.
- Good knowledges of development in Linux environment.
- The candidates must be fluent in English.
- Knowledges in GPU and/or MPI programming and/or algorithm development for drone control would be appreciated (not mandatory).

4. Application

To apply to this position, please send to lhassane.idoumghar@uha.fr, julien.lepagnot@uha.fr and mathieu.brevilliers@uha.fr: **CV, motivation letter, copy of Master degree, transcript of grades from last two years of study**, 2-3 recommendation letters, name and contact information of at least one previous supervisor or teacher that can support your application.

5. References

- [1] Brévilliers M., Lepagnot J., Kritter J. & Idoumghar L. (2018). "Parallel Preprocessing for the Optimal Camera Placement Problem". *International Journal of Modeling and Optimization*, 8(1), 33–40.
<https://doi.org/10.7763/ijmo.2018.v8.621>
- [2] Brévilliers M., Lepagnot J., Kritter J. & Idoumghar L. (2018). "Hybrid differential evolution algorithms for the optimal camera placement problem". *Journal of Systems and Information Technology*, Vol. 20 Issue: 4, pp.446-467.
<https://doi.org/10.1108/JSIT-09-2017-0081>
- [3] Kritter J., Brévilliers M., Lepagnot J. & Idoumghar L. (2019). "On the optimal placement of cameras for surveillance and the underlying set cover problem". *Applied Soft Computing*, 74, 133–153.
<https://doi.org/10.1016/j.asoc.2018.10.025>
- [4] Ghambari S., Lepagnot J., Jourdan L. & Idoumghar L. (2018), "A comparative study of meta-heuristic algorithms for solving UAV path planning". *IEEE-Symposium Series on Computational Intelligence (SSCI) 2018*, Bangalore, India, November 2018.