Master Thesis

The group Distributed Artificial Intelligence (OFFIS R&D division Energy) has an announcement for an immediate master thesis.

Fitness landscape analysis for the operational planning of distributed energy resources

CHALLENGES:

The analysis of so-called fitness landscapes is often used to better understand the structure and characteristics of optimization problems and thus to select suitable algorithms. A fitness landscape is defined by the search space, which contains all possible solutions of the problem, a distance measure, which indicates how far apart these solutions are, and an objective function, which assigns a certain value to each solution and for which the optimal value must be found. For continuous problems, the fitness landscape can therefore be described as a landscape where the search space is the lower ground and the landscape surface is raised according to the values of the objective function. Analogous to a geographic landscape, fitness landscapes can consist of peaks, valleys, plains, ravines, cliffs, plateaus, and basins. Examining these landscape features provides insight into how difficult it is to find an optimum, i.e., the highest mountain peak (maximization) or the lowest valley (minimization) (link: https://www.researchgate.net/publication/225336568_A_Comprehensive_Survey_on_Fitness_Landscape_Analysis).
The scheduling of decentralized energy resources is an optimization problem in which the schedules of all plants have to be coordinated to achieve a common target schedule (link: https://www.annals-csis.org/Volume_18/drp/pdf/160.pdf). Here, the analysis of the problem properties should also provide valuable information for the selection and parameterization of optimization algorithms. In this case, the search space is composed of the flexibilities, i.e., the operating possibilities of all plants.

REALIZATION:

There are two challenges in fitness landscape analysis for distributed operational planning. On the one hand, many landscape features rely on so-called random walks. This involves changing candidate solutions gradually, resulting in a trajectory through the search space. To apply this to asset flexibility, a suitable sampling strategy must be developed to create a set of valid schedules.
On the other hand, the search spaces of the individual plants are coupled, since the schedule selection of other plants influences how well the target schedule is jointly achieved. Existing concepts for fitness calculation in coupled search spaces must therefore be adapted accordingly.
To evaluate the fitness landscape features, small optimization scenarios will be created and solved by agent-based distributed optimization heuristics. Subsequently, correlation analysis will be used to investigate the strength of the fitness landscape features.

YOUR PROFILE:

- Enrollment at a university or university of applied sciences in computer science or a comparable course of study
- goal-oriented and independent way of working
- Programming skills in Python
- Desire for an above-average result

If you are interested, please simply write an e-mail to the address below.

CONTACT AND SUPERVISION:

Stefanie Holly
OFFIS - Institute for Information Technology, Escherweg 2, 26121 Oldenburg
Tel: 0441-9722-732
Mail: stefanie.holly@offis.de