INF379 Selective topics in optimization: Metaheuristics

Course plan and syllabus for the spring semester 2018

Objectives and Content

The course will give an overview of modern heuristic optimization methods that are suitable for solving practical optimization problems. Finding one solution to a problem is almost always very easy and can be done extremely fast, finding the best possible solution is what takes very long. Metaheuristics optimization algorithms bridge this gap: They trade in solution quality for runtime, by finding very good (but not necessarily optimal) solutions within feasible time. In this course, we explore the state-of-the-art Metaheuristics optimization algorithms and learn how to implement them for a wide range of practical optimization problems through case studies.

Learning Outcomes

Upon completion of INF379 Metaheuristics, the student is supposed to be able to

- explain what a metaheuristic is
- understand for what type of problems it can be/should be used
- explain the fundamental properties of metaheuristics
- implement a metaheuristic on a given problem

Recommended Previous Knowledge

Basic programming skill, Basic knowledge on optimization

Compulsory Assignments and Attendance

Project-based exercises

Forms of Assessment

Project-based exam. It is opportunity for grades on exercises, which can be included in the final grade.

Grading Scale

The grading scale used is A to F. Grade A is the highest passing grade in the grading scale, grade F is a fail.

Reading list:

Lecture slides, Handouts (selected chapters in selected books, selected articles)

Lectures:

- Introduction
- Heuristics
- Components of Metaheuristics
- Local Search
- Simulated Annealing
- Case study (VRP and Location Routing)
- Tabu search
- Guest lecture 1 (Heuristics in predictive analytics: classification of binary vectors)
- Genetic Algorithm
- Greedy and Approximation algorithms
- Guest lecture 2 (Multi-Echelon Location-Routing)
- Ant-colony and Particle Swarm
- Variable Neighborhood Search and Adaptive Large Neighborhood Search
- Case study (Ship routing & Scheduling)
- Sweep and Clustering algorithm
- Hybrid Algorithms and Mathheuristic
- Case Study (MIRP)
- Non randomized Metaheuristic