

Popular science summary of the PhD thesis

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Title of the PhD thesis	Single-trajectory Search Heuristics on Discrete Multimodal Optimization Problems
PhD school/Department	DTU Compute

Science summary

Nature-inspired computation is a framework for global optimization algorithms that mimic optimization in nature. Famous examples include evolutionary algorithms (EAs), which follows Darwin's principle of survival of the fittest, ant colony optimization (ACO), which simulates the foraging behavior of ants, and particle swarm optimization (PSO), which is inspired by bird flocks. Methods of nature-inspired computation are well established in numerous engineering disciplines. They are easy to implement, yield surprisingly good results and are therefore popular in many sectors, including engineering, biomedicine and finance. For example, they are used to plan production processes, optimize networks, and construct work pieces.

Single-trajectory search heuristics are nature-inspired optimization algorithms that iteratively develop a trajectory of solutions to a problem. They have a straightforward structure which can be seen in many powerful nature-inspired algorithms. They typically have some parameters (e.g., mutation rate) to be set and need a selection strategy for developing the sequence of solutions. Runtime analysis of nature-inspired algorithms is a line of research that offers suggestions for parameter tuning in nature-inspired algorithms. Also, several studies have been conducted to determine how to pick the selection mechanisms in such algorithms.

For a single-trajectory search heuristic, getting out of a local optimum, where all nearby solutions are of lower quality, is difficult, and its mutation and selection mechanism significantly impact the escaping time. This thesis discusses three main strategies used in the literature to overcome local optima in nature-inspired algorithms: (1) global mutations, (2) self-adjusting mechanisms, and (3) non-elitist algorithms.

Please email the summary to the PhD secretary at the department