Feature-Based Diversity Optimization for Problem Instance Classification

Wanru Gao Optimisation and Logistics School of Computer Science The University of Adelaide Adelaide, Australia

Samadhi Nallaperuma Department of Computer Science The University of Sheffield Sheffield,UK

Frank Neumann Optimisation and Logistics School of Computer Science The University of Adelaide Adelaide, Australia

Understanding the behaviour of heuristic search methods is a challenge. This even holds for simple local search methods such as 2-OPT for the Traveling Salesperson problem. Understanding the conditions under which optimization algorithms perform well is essential for automatic algorithm selection, configuration and effective algorithm design. The feature-based analysis of heuristic search algorithms has become an important part in understanding such type of algorithms and is able to complement more rigorous analyses on the runtime behaviour of heuristic search methods. It characterizes algorithms and their performance for a given problem based on features of problem instances.

We present a new approach of constructing different hard and easy instances based on problem features. Following some recent work on using evolutionary algorithms for generating diverse sets of instances that are all of high quality, we introduce an evolutionary algorithm which maximizes diversity of the obtained instances in terms of one or more given features. Examining the constructed instance sets, we show that many combinations of two or three features give a good classification of the TSP instances in terms of whether they are hard to be solved by 2-OPT.