A Two-Phase Heuristic Approach for the Biobjective k-Dissimilar Vehicle Routing Problem

Sandra Zajac[*][†][1]

[1]Helmut Schmidt University / University of the Federal Armed Forces Hamburg – Holstenhofweg 85 22043 Hamburg, Germany

Abstract

In cash-in-transit operations, significant amounts of money need to be delivered or picked up from a set of customers leading to some risk of robbery. A potential approach to decrease this risk is to generate k spatially dissimilar vehicle routes. By periodically changing the implemented route to a spatially dissimilar route, the unpredictability of the actually driven route can be increased which in turn can reduce the risk of robbery. A solution to the k-dissimilar vehicle routing problem is therefore a solution set. It will only be accepted by the decision maker if the difference between the distances of the longest route in the set to the distance of the shortest solution in the considered instance is within reasonable limits. Since the k shortest vehicle routes are often similar to each other, the k-dissimilar vehicle routing problem is inherently bi-objective. In this paper, the tradeoff between the minimization of the longest route and the maximization of the minimum dissimilarity between two vehicle routes is examined for k > 1. For this, a new dissimilarity index is defined which measures the spatial distance of two solutions on the base of a grid in an intuitive way. A two-phase heuristic approach is presented which takes into account these two objectives and approximates the efficient set of all solution sets. The method as well as the impact of different parameter settings are tested and studied on selected instances of the capacitated vehicle routing problem.

[*]Speaker
[†]Corresponding author: sandra.zajac@hsu-hh.de