Recoverable Robust Shortest Path Problems

C. Puhl[1]

Abstract: The shortest path problem with nonnegative arc lengths can be solved easily. Yet, in many real-world applications the arc lengths underlie significant uncertainties. To deal with these, the classical strict notion of robustness yields a solution, which is feasible for any scenario, but has unacceptably high costs. To avoid this drawback, the recoverable robust approach allows a solution to be recovered to a certain extent after a change of data.

We investigate two settings of recoverable robust shortest path problems. In both settings the costs of the arcs are subject to uncertainty. For the first setting, at most k arcs of the chosen path can be altered in the recovery. In the second setting, we commit ourselves to a path before the costs are fully known. Deviating from this choice in the recovery comes at extra costs. For each setting we consider three different classes of scenarios sets.

We show, that both problems are $\mathbf{NP}$-hard for discrete scenario and Γ-scenario sets. For the second setting with Γ-scenarios we give an approximation algorithm depending on the inflation factor and the so-called rental factor. Finally two polynomial algorithms are presented to solve the problems with interval scenario sets.

[1] Institut für Mathematik, Technische Univeristät Berlin
Straße des 17. Juni 136, 10623 Berlin, Germany
puhl@math.tu-berlin.de