

Multi-objective robust shortest paths

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Abstract

Only recently have concepts of multi-objective optimization (considering several (conflicting) objective functions) and robust optimization (dealing with uncertain optimization problems) been combined to multi-objective robust optimization. The scope of our research is to regard the well-known shortest path problem in terms of multi-objective robust optimization. We investigate, if methods and algorithms from multi-objective optimization and from robust optimization can be enhanced to find robust efficient solutions, considering different robustness concepts and uncertainty sets.

An algorithm to find minmax robust efficient paths for non-negative edge lengths will be presented, which is based on an algorithm for the single-objective case by Yu and Yang (1998). If time permits, an algorithm for a special uncertainty set (Γ -uncertainty) by Bertsimas and Sim (2003) and its transfer to the multi-objective problem will be shown for a special case.

As an application and motivation, the question, how to use a given resource (here: a piece of wood) in a “best possible” way, is modelled as a multi-objective, uncertain shortest path problem. This question is quite complex since wood can be used and reused in many different ways e.g. as building material, as raw material for paper and chemical products or as an energy source.