An Efficient Graph Reduction for Optimizing and Bounding the Value of Side

Information in Shortest Path Optimization.

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Abstract:

Consider an agent who seeks to traverse the shortest path in a graph having random edge weights. If the agent has no side information about the realizations of the edge weights, it should simply take the path of least average length, a deterministic optimization. We consider a generalization of this framework whereby the agent has access to a limited amount of side information about the edge weights ahead of choosing a path. Specifically, we define a notion of information and information capacity, provide bounds on the agent's performance relative to the amount of side information it receives, and offer algorithms for optimizing information within a capacity constraint. The results are based on a new graph reduction for shortest path optimization that strikes a balance between the amount of information about the graph and the distribution of the edge weights used to compute performance bounds.