Hardness of TSP instances: a computational study

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Abstract. In this talk, we investigate the difficulty of the metric Traveling Salesman Problem (TSP). Starting from the instances proposed in [2], we perform parameter tuning to make such instances hard-to-solve for `concorde`, the state-of-art metric TSP solver. We compare the difficulty of such instances with other families published in the literature. For each of these families, we analyze features computed from instances to investigate if it is possible to predict the hardness of an instance without effectively solving it. Some features, such as the variance of the cost matrix, have already been studied in the literature. Furthermore, we introduce new features that depend only on the costs of the TSP instance. We note that none of these parameters is completely able to predict the difficulty of an instance by itself. Thus, we combine such parameters by training a decision tree. The training set consists of instances from the families available in the literature with less than 80 nodes. We complete the dataset with random-easy instances to make it balanced. Preliminary tests show that the tree can predict easy and hard instances with an average accuracy higher than 95% both on the train and on the validation set.
Keywords: Integer Programming; Integrality gap analysis; Metric Traveling Salesman Problem

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