ON AN APPROACH TO FINDING ROBUST SOLUTIONS TO DISCRETE LOCATION PROBLEMS [1]

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We consider two fundamental problems in discrete location theory — the uncapacitated facility location problem and the p-median problem, that can be formulated in the following. Given a set $J = \{1, \dots, n\}$ of clients, a set $I = \{1, \dots, m\}$ of potential sites, costs d_{ij} of satisfying the demand of client $j \in J$ from the facility located at site $i \in I$, and the demand ω_j of client $j \in J$. The p-median problem is to choose exactly p sites for opening facilities in order to minimize the overall total cost of satisfying the demands of all clients

$$\min_{S \subseteq I} \Big\{ \sum_{j \in J} \omega_j \min_{i \in S} d_{ij} : \ |S| = p \Big\}.$$

In the uncapacitated facility location problem the number of facilities to be opened is not fixed in advance. Instead, there are fixed costs f_i of locating a facility at site i. The problem consists in minimizing both the total transportation cost and a cost associated with the plants to be opened.

For two discrete location problems presented above we consider robust versions [3] based on a threshold model, which concept was introduced in [1, 2]. The main idea of the approach is that the demand of each client may be unknown in practice precisely, but some estimates $\widehat{\omega}_j$ are given instead. In the threshold model, a threshold value $\tau > 0$ is introduced, to be interpreted as the highest admissible total cost (or budget) of satisfying the demands of all clients. In this case the robustness $\rho(S)$ of a solution $S \in I$ is defined as the smallest difference between the demands ω_j and their estimates $\widehat{\omega}_j$, which makes the total cost exceed the threshold τ. In the case of the p-median problem the robustness of a solution $S \in I$ can be written as follows

$$\rho(S) = \min \Big\{ \|(\omega_j)_{j \in J} - (\widehat{\omega}_j)_{j \in J}\| : \sum_{j \in J} \omega_j \min_{i \in S} d_{ij} > \tau \Big\}, S \subseteq I, |S| = p,$$

In the talk we consider bi-criteria versions of the discrete location problems presented above with one additional criterion maximizing the robustness. A method of finding Pareto optimal solutions based on a well-known approach in the field of bi-criteria optimization is proposed and the results of the extensive computational experience are demonstrated.

REFERENCES

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