A PROBLEM IN CLASSIFICATION SCHEME OF LOCATION MODELS

Osinuga I. A. [*], *Kazakovtsev L. A.* [**]
[*]***Federal University of Agriculture, College of Natural Science, Department of Mathematics, Abeokuta, Nigeria***
[**]***Krasnoyarsk state agrarian university, Krasnoyarsk, Russia***

Статья является продолжением предыдущих работ авторов в области классификации задач размещения, посвященных разработке наиболее адекватных средств для понимания задач размещения. Предложены изменения в классификации для дискретных и сетевых моделей.

Introduction.

Facility location constitutes a broad spectrum of mathematical problems for researchers to consider in the fields of operations research. It is an interesting topic for theoretical studies, experimental research and real-world applications. Well-known examples include storage facilities, warehouses, police and fire stations, base station for wireless services and others [1].

In the field of location theory, planar location problems have always played an important role. A large body of literature [2, 3, 4, 5] is witness to the development of location theory within a planar framework and its various successful applications. Historically, planar location models are the oldest location models and deal with geometrical representations of real-world problems, a broad range of different model types exists and must be taken into account when trying to solve location problems.

Different classification schemes exist based on different criteria such as objective, decision variables and system parameters [6]. On the other hand, schemes are proposed with specific application to network or competitive location models [7, 8]. Revelle et al. [9] provided a brief taxonomy of broad field of facility location modeling in a bibliography in median, center and covering models. For a detailed survey on classification schemes, see ([10, 11, 12] and references therein). In [11], a five-position scheme was proposed suitable for all location models using codes similar to queue and schedule.

The aim of this research work is to compose a specific instance of the model classification based on special class of metrics including those metrics that are reducible to l_1 metric [5, 13, 14], those employed for a shortened distance only [15] and those employed in certain settings [16]. These kinds of metrics can be employed to review position dealing with the relation between new and existing facilities and position specifying the particularities of specific location problem. Special metrics occur in less obvious contexts in facility location problems, but indeed have numerous applications.

Spath [17] introduced Jaccard metric in minisum models applicable in location-allocation problems from cluster analysis.

Metrics based on angular distances [15], French metro metric [5, 18], lift metric [14, 18] and Moscow metric [13, 18] can be used in location problems with special transportation means such as lifting cranes and other manipulators. Others include Mahalanobis distance, Hamming distance, Aisle distance and distance matrix useful in multi-facility, and facility layout and location models [16]. However, recent efforts in this direction can be found in [5, 14, 18].

Facility location models can be predominantly classified as follows:

a. Shape and topography of the facility and demand sites: The topological characteristics of the facility and demand sites lead to different location models including planar and 3D location models (see references), discrete location models (including sampled continuous models) [19] and network location models [20]. For each of the subclasses, distances are determined using some metrics. In the most cases, the distance function is defined algorithmically [1, 8, 15].

b. Objectives. An objective function involving distances between facilities and demand points are formulated to model the travel cost between existing and new facilities. Two main objectives can be distinguished -minisum and minimax. The former of these two objectives attempts to determine optimal location so as to minimize weighted total distance to demand points. In contrast, the latter strives to determine the optimal location so as to minimize the maximum distance between a new facility to be located and demand points.

c. Restriction / constraints. Facility location models have been extended by various restrictions and constraints in order to provide better representations of the real-world problems. For detailed survey on location problems with forbidden region, barriers or congestion, see ([2, 3] and references therein).

d. Solution methods. Location problems can also be distinguished by solution methods and techniques. Researchers had proposed dozens of exact optimization algorithms and heuristics [21, 22].

Additional features that can be employed in distinguishing location models include number of facilities to be located such as single-vs-multi-product [4, 5], applications such as supply chain, distribution system design, etc [1, 22], Time horizon [23] etc.

According to Tafazzoli and Mozafari [8], examples from the literature indicated the ability of 5-position classification scheme proposed in [11] to describe location models. In this section, we review the general classification scheme developed in [11] and use it to introduce our modifications. We have the following five-position classification:

pos1 / pos2 / pos3 / pos4 / pos5,

where the meaning of the positions is described below:

Pos1: This position contains information about the number and the type of the new facilities.

Pos2: The type of the location problem with respect to the decision space.

Pos3: In this position is room for describing particularities of the specific location problem, such as polyhedral barriers, restricted zones, etc.

Pos4: This position is devoted to the relation of new and existing facilities. This relation may be expressed by some distance function or simply by assigned costs.

Pos5: The last position contains a description of the objective function.

We believe that the scheme needs to be supplemented and we propose a revision of position 3 and position 4. In addition to the criteria in pos 3, we proposed capacity restrictions such as the case of movement of load in a shortened distance only while pos 4 proposed special type of metrics as distance measurements.

This research includes specific instances of model classification in the afore-mentioned metrics into the five-position classification scheme. It is our hope that these metrics will provide an insight into better classification of planar location models due to its numerous applications.

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