RED de LOCALIZACIÓN y PROBLEMAS AFINES

Workshop on Locational Analysis and Related Problems

Las Palmas de Gran Canaria
Facultad de Economía, Empresa y Turismo
2-5 de Febrero de 2011

GOBIERNO DE ESPAÑA · MINISTERIO DE CIENCIA E INNOVACIÓN · i-math · La Caja de CANARIAS · UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA · dmc · SEIO

Workshop on Locational Analysis and Related Problems
y
Reunión de la Red Temática de Localización y Problemas Afines 2011
(MTM2009-07290-E)
Las Palmas de Gran Canaria, 2-5 de Febrero de 2011

Presentación

La *Red de Localización y Problemas Afines* es un grupo consolidado de investigadores de universidades españolas y extranjeras que trabajan en el ámbito de la localización y problemas relacionados. Iniciada en el año 2002, con antecedentes en el *Grupo Español de Localización* (GELOCA), actualmente la Red tiene 140 investigadores, distribuidos en 14 nodos, interviniendo 21 universidades españolas y 9 extranjeras. Sus miembros acumulan una gran experiencia en temas de localización, diseño de redes, y transporte, así como en técnicas de optimización en general, reconocida a nivel internacional.

La *Localización* es un área de investigación dirigida a determinar las ubicaciones óptimas de proveedores de servicios, instalaciones, objetos o estructuras de cierto tipo, de manera que se alcancen ciertos objetivos. Lleva inherente el concepto de espacio y de su uso, y está fuertemente ligada a las áreas del transporte, las comunicaciones y la logística. Los fines perseguidos dependen del objeto de la localización, puede tratarse de la maximización de los beneficios derivados del funcionamiento de las instalaciones que se van a localizar, de la minimización de costes de desplazamiento, de la maximización de la población cubierta por unos puntos de servicio, o de la minimización de los efectos no deseados o nocivos producidos por estas instalaciones.

La Red persigue varios objetivos. Por un lado, se desea potenciar el desarrollo científico del área, fomentando la comunicación entre sus miembros, facilitando la formación de los investigadores noveles y ampliando la de otros con experiencia. Por otro lado, La Red quiere impulsar la transferencia de conocimientos entre la Universidad y la Industria, Empresa y Sociedad. Ambos objetivos no son independientes ya que el desarrollo de cualquiera de ellos influirá en los avances que puedan llevarse a cabo en el otro.

En la convocatoria del año 2011, la Reunión de la Red aparece integrada en el *Workshop on Locational Analysis and Related Problems 2011*. Este encuentro combinará la participación de investigadores invitados con la presentación de trabajos por parte de varios miembros de la Red, y con la intervención de personas que realizan actividades en el ámbito empresarial y de la Administración.

Comité Científico

José Miguel Díaz Báñez
Elena Fernández Aréizaga
José A. Moreno Pérez
Justo Puerto Albandoz

Comité Organizador

Emilio Carrizosa Priego (US-EIO)
José Miguel Díaz Báñez (US-MA)
Pablo Dorta González (ULPGC)
Isabel Dorta González (ULL)
Elena Fernández Aréizaga (UPC-EIO)
Casiano Manrique de Lara Peñate (ULPGC)
Alfredo Marín Pérez (UM)
Juan Antonio Mesa Colmenar (US-MA)
José A. Moreno Pérez (ULL)
Blas Pelegrín Pelegrín (UM)
Melquíades Pérez Pérez (ULPGC)
Justo Puerto Albandoz (US)
Manuel Rodríguez Díaz (ULPGC)
Dolores R. Santos Peñate (ULPGC, coordinadora)
Rafael R. Suárez Vega (ULPGC)

PROGRAMA

MIÉRCOLES 2 DE FEBRERO 2011	
18:00-19:00	Entrega de documentación (en Aula de Piedra, Sede Institucional de la ULPGC)
JUEVES 3 DE FEBRERO 2011	
9:30-10:30	Charla Robert Aboolian An Efficient Exact Approach for Preventive Healthcare Facility Network Design with Congestion
10:30-11:30	Charla Jean-ClaudeThill Spatio-Temporal Location Modeling of Emergency Devices in a 3D Environment: The case of Automated External Defibrillators
11:30-12:00	Descanso
12:00-13:00	Charlas miembros de la Red
13:00-13:30	Reunión de GELOCA
13:30-15:30	Comida
15:30-16:30	Reunión de la Red Temática
16:30-18:00	Charlas de los miembros Red
EXPOSICIÓN PERMANENTE DE PÓSTERES	
VIERNES 4 DE FEBRERO 2011	
9:30-10:30	Charla Vladimir Marianov Localización de Transmisores en Telecomunicaciones
10:30-11:30	Charla Rolf Möhring Routing in Graphs with Applications to Traffic and Logistics
11:30-12:00	Descanso
12:00-14:00	Sesión Universidad-Sociedad-Empresa
14:00-16:00	Comida
16:00-18:00	Reunión de grupos para la planificación de trabajos conjuntos (I)
EXPOSICIÓN PERMANENTE DE PÓSTERES	
SÁBADO 5 DE FEBRERO 2011	
10:00-13:00	Reunión de grupos para la planificación de trabajos conjuntos (II)

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Título de la charla: Spatio-Temporal Location Modeling of Emergency Devices in a 3D Environment: The case of Automated External Defibrillators
Moderador: Emilio Carrizosa

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INTERVENCIONES DE MIEMBROS DE LA RED

I. Presentaciones orales

Sesión 1. Jueves de 12:00 a 13:00
Moderador: Pablo Dorta González

1. Inmaculada Espejo Miranda, A. Marín Pérez y A.M. Rodríguez-Chía
   Restricciones de asignación al servicio más cercano en problemas de localización discreta
2. Eligius M.T. Hendrix, P.M. Ortigosa, J.L. Redondo
   On a specific method to solve semi-obnoxious location problems heuristically
3. Daniel Serra
   From location modelling to reality: experiences, successes and frustrations

Sesión 2. Jueves de 16:30 a 18:00
Moderador: Rafael Suárez Vega

1. Clara Campos Rodríguez, José A. Moreno Pérez y Dolores R. Santos Peñate
   Solution procedures for solving the leader-follower problem
2. Eduardo Aníbal Lalla Ruiz, Crístofer Expósito Izquierdo, María Belén Melián Batista, José Marcos Moreno Vega
   Intelligent system based on advanced metaheuristic for solving problems at a container terminal
3. Antonio J. Lozano, Juan A. Mesa, Frank Plastria
   Locating Straight-lines in the Plane: Generalized Problems
4. Ángel Marín Gracia
   Rapid Transit Networks: Robustness by integrating planning steps
5. Maria Albareda-Sambola, Antonio Alonso-Ayuso, Laureano F. Escudero, Elena Fernández y Celeste Pizarro
   On solving the multi-period location-assignment problem under uncertainty

II. Pósteres

1. Javier Alcaraz, Mercedes Landete, Alfredo Marín, Juan Francisco Monge
Modelos lineales de fiabilidad para problemas de localización sin capacidades tipo mediana
(Linear models for the uncapacitated realibility facility location problems)
2. Luis Cadarso, Ángel Marín
Airline planning considering competition effects
3. Pablo Dorta González, María Isabel Dorta González, Dolores R. Santos Peñate
Production and impact analysis of the research area “Locational Analysis and Related Problems” trough journal articles in ISI-Web of Science database 2000-2009
4. J. Barceló and H. Grzybowska
Decision support system for real-time freight management
5. Miguel Ortega-Mier, Álvaro García-Sánchez, Judit Cosme Rosario, Andrés Ramos[2]
Benders Decomposition Methods for solving a Stochastic Model to design Multi-layer Reverse Logistic Systems
6. Francisco Ortega Riejos, Miguel A. Pozo Montaño y Emma Torres Luque
Optimization in the Design of Cultural Routes through Theatres of Andalucía
7. Rafael Suárez Vega, Dolores R. Santos Peñate
Combining muti-criteria analysis and GIS tools to solve competitive location problems

RESÚMENES / ABSTRACTS

I. Conferenciantes invitados

Robert Aboolian, Oded Berman and Vedat Verter

An Efficient Exact Approach for Preventive Healthcare Facility Network Design with Congestion

Many diseases can be prevented, yet health care systems do not make the best use of their available resources to support this process. Preventive healthcare's goal is to reduce the risk and severity of potentially life-threatening diseases by early detection. The effectiveness and efficiency of any preventive healthcare program is highly dependent on the participation level of its clients. We address the problem of design of a service network consisting of preventive healthcare facilities facing uncertain participation from its clients residing at the nodes of the network. Each facility has a limited processing capacity and thus the uncertainty of participation may lead to congestion delays at the facilities. The problem is to decide the number, locations and service capacities of the facilities so as to maximize the overall participation of potential clients. It is assumed that the service quality is the main mechanism for attracting customer demand. Customers choose the facility with the highest service quality. The "service quality" in our context consists of two components: the travel time from client's location to its chosen facility and the waiting time at that facility. We assume that customer participation is elastic with respect to sum of these components. We will consider two potential queuing disciplines for the facilities: the M/M/k queue with k identical parallel servers and the M/M/1 single-channel service queue. We present an exact methodology for designing a network of preventive healthcare facilities to improve its accessibility to potential clients, so as to maximize participation to preventive healthcare programs. Traditionally, the problem has been formulated as a mathematical program with equilibrium constraints (MPEC) resulting a nonlinear optimization model. We formulate the problem as an MIP. The exact methodology is based on solving the MIP. Based on our computational experiments, large-sized instances can be solved in a reasonable time.

Vladimir Marianov

Localización de Transmisores de Telecomunicaciones

Se presentan modelos de localización óptima de transmisores, para dos casos particulares de sistemas de telecomunicaciones. El primero corresponde a localización o reforzamiento de estaciones base de sistemas de comunicaciones móviles, las cuales son localizadas de tal modo que el sistema sea robusto ante desastres naturales (o acciones intencionales), es decir, que ante un evento de este tipo, sean capaces de mantener cierta capacidad mínima. El segundo caso corresponde a transmisores de televisión digital terrestre (TVD) o radiodifusión digital (DAB), tanto para el formato OFDM utilizado por las normas europea y japonesa, como para el formato ATSC de la norma norteamericana. Se complementan los modelos con casos específicos de aplicación.

Rolf Möhring

Routing in Graphs with Applications to Traffic and Logistics

Traffic management and routing in logistic systems are optimization problem by nature. We want to utilize the available street or logistic network in such a way that the total network "load" is minimized or the "throughput" is maximized. This lecture deals with the mathematical aspects of these optimization

problems from the viewpoint of network flow theory and scheduling. It leads to flow models in which—in contrast to static flows—the aspects of "time" and "congestion" play a crucial role.
We illustrate these aspects on several applications:

(1) Traffic guidance in rush hour traffic (cooperation with ptv).

(2) Routing automated guided vehicles in container terminals (cooperation with HHLA).

(3) Ship Traffic Optimization for the Kiel Canal (cooperation with the German Federal Waterways and Shipping Administration).

All these applications benefit from new insights into routing in graphs. In (1), it is a routing scheme that achieves traffic patterns that are close to the system optimum but still respect certain fairness conditions, while in (2) it is a very fast real-time algorithm that avoids collisions, deadlocks, and other conflicts already at route computation. Finally, (3) combines techniques from (2) with special purpose scheduling algorithms.

Jean-Claude Thill

Spatio-Temporal Location Modeling of Emergency Devices in a 3D Environment: The case of Automated External Defibrillators

This research innovatively extends optimal emergency facility location models to the interior space of multi-story buildings with an integrated spatial-temporal framework. We present the case of deployed emergence medical devices known as Automated External Defibrillators (AEDs), which serve to treat sudden cardial arrest (SCA) on site within the first few critical minutes of the event. AEDs have become a critical element of basic life support services in many public buildings. The proposed framework is based on the concept of discrete time windows to capture the time-dependence of potential demand and stochastically model the detection time component of impedance as a function of space-time distribution of demand. Different optimization objectives minimizing SCA outcome consequences (e.g. brain damage or death) as a function of suffering time are formulated and solved. The first model is the Multiple-Time-Window Maximal Covering Location Problem (MTW-MCLP) model which optimizes the placement of AEDs by maximizing the covered demand over all time periods. The second is the Multiple-Time-Window P-Median (MTW-P-Median) model which places AEDs to maximize the expected value of prevented death or permanent brain impairment in case of defibrillation treatment over multiple time windows. Both models are implemented through tight coupling of commercial GIS software and a linear programming solver. The models are novel in two primary respects, namely location modeling in three-dimensional micro-scale spaces and the integration of spatial and temporal considerations. Innovative visualization techniques for AED indoor location and coverage are also presented.

II. Miembros de la red

Javier Alcaraz, Mercedes Landete, Alfredo Marín, Juan Francisco Monge
Modelos lineales de fiabilidad para problemas de localización sin capacidades tipo mediana
(Linear models for the uncapacitated realibility facility location problems)

The poster revises the linear formulations for the uncapacitated realibility facility location problem in the literature. Then, the poster proposes several improvements and presents a new formulation for the same problem. Computational results illustrate the performance of both the improvements and the new formulation. Finally, some conclusions and future work are discussed.

María Albareda-Sambola, Antonio Alonso-Ayuso, Laureano F. Escudero, Elena Fernández y Celeste Pizarro
On solving the multi-period location-assignment problem under uncertainty

We present a risk neutral framework for solving the strategic problem of timing the location of facilities and the assigning of customers to facilities in a multi-period environment under uncertainty in the facilities setup and maintenance costs, customers assignment cost to the facilities, timing at which the customers need to be assigned to the facilities, the minimum number of customers to be served for each facility at each time horizon, and the minimum number of facilities to open at each time period. By considering a compact mathematical representation of the Deterministic Equivalent Model of the stochastic pure 0-1 problem, we specialize the so-called Branch-and-Fix Coordination algorithmic framework to develop a heuristic algorithm, so called-Fix-and-Relax Coordination. It exploits the structure of the model and, specifically, the nonanticipativity constraints (NAC) for the variables. The algorithm uses the Twin Node Family (TNF) concept bounding. Our procedure is specifically designed for coordinating the selection of the branching TNF, such that the NAC are satisfied.

J. Barceló and H. Grzybowska
Decision support system for real-time freight management

The urban network is a highly dynamic system. Thus, a modern and efficient fleet management in urban areas should account for dynamics of traffic conditions, variability in travel times and changes in demand and fleet availability, since they significantly affect the distribution of goods and the provision of services. As a consequence, the freight operations optimizing approaches should be based on the time-dependant travel time estimates rather than on the average static values commonly employed as input data.
The proficient dynamic fleet management decisions need to take into consideration all the factors conditioning the addressed problem. Hence, the customers' requests and service conditions (demands, time windows, etc.), operational conditions of employed fleet (vehicles' availability, status, positions, current occupancy of the carriage space, etc.) and the traffic conditions need to be reckoned with. This information can be provided in the real-time fashion and at affordable price by the ICT applications and tools such as: ATIS, GPS, GPRS or other.
It is proper instead of relying exclusively on the experience of a dispatcher, to base the freight management decisions on information provided by a professional Decision Support System facilitating the consideration of all the factors conditioning the addressed problem.
The current poster presents the Decision Support System developed for real-time freight management able of accounting for all mentioned dynamic factors. Its architecture was implemented and

computationally tested on the basis of simulation. Its design is based on integration of selected pickup and delivery vehicle routing model and dynamic traffic simulation models, which purpose is to carefully emulate the evolving traffic conditions. The optimal dynamic routing and scheduling of a vehicle fleet is obtained due to dynamic modifications of the current routing and scheduling plan on the basis of the newly revealed information conditioning the addressed problem.

Luis Cadarso, Ángel Marín
Airline planning considering competition effects

The airline schedule design and fleet assignment problems consist of determining flight departure times and the assigned fleet type. They are usually solved sequentially without accounting for market competition. We propose a new integrated approach to design flight legs accounting for fleet assignment and market competition, providing robust itineraries for connecting passengers. An application of the model for a simplified IBERIA network is shown.

Clara Campos Rodríguez, José A. Moreno Pérez y Dolores R. Santos Peñate
Solution procedures for solving the leader-follower problem

The leader-follower location problem consists of determining an optimal strategy for two competing firms which make decisions sequentially. The leader optimization problem is to minimize the maximum market share of the follower. The follower problem has the objective of the maximization of its market share. We describe the formulation of both problems and show some procedures to find optimal solutions.

Pablo Dorta González, María Isabel Dorta González, Dolores R. Santos Peñate y Rafael Suárez Vega
Production and impact analysis of the research area "Locational Analysis and Related Problems" trough journal articles in ISI-Web of Science database 2000-2009

An analysis of the research area "Locational Analysis and Related Problems" trough publications and citations is presented in this work. All publications containing facility location or location problem terms in the title, abstract or keywords were searched in the ISI-Web of Science database. A total of 1859 publications were obtained in the period 2000-2009. The citations average per item is 5.65 and the h-index is 38. Some results about production by institution, document type, year, country, journal, and research area are shown. Finally, most cited articles are analysed.

Inmaculada Espejo Miranda, A. Marín Pérez y A.M. Rodríguez-Chía
Restricciones de asignación al servicio más cercano en problemas de localización discreta

En muchos problemas de localización se asume que, una vez que los servicios han sido localizados, los clientes serán asignados al servicio más cercano. Sin embargo, esta propiedad no siempre está garantizada por el modelo clásico, siendo necesario incorporar algunas restricciones adicionales. En la literatura se han estudiado y formulado como problemas de programación entera modelos en los que este tipo de restricciones han sido necesarias y usualmente se han propuesto nuevos conjuntos de restricciones de asignación al servicio más cercano sin tener en cuenta las desigualdades previamente existentes en la literatura. En este trabajo se analizan las restricciones de asignación al servicio más cercano utilizadas en la literatura, estudiando las posibles relaciones de dominancia, lo que permite

seleccionar las más prometedoras. Además mostramos que algunas de estas restricciones presentan buenas propiedades, como por ejemplo que se pueda relajar la integridad de las variables de asignación. Por otro lado, proponemos un nuevo conjunto de restricciones con muy buenas propiedades desde el punto de vista teórico. Finalmente, se presenta un pequeño estudio computacional que ilustra el comportamiento de diferentes restricciones en diferentes modelos de localización.

Eligius M.T. Hendrix, P.M. Ortigosa, J.L. Redondo
On a specific method to solve semi-obnoxious location problems heuristically

Semi-obnoxious continuous location problems are mostly modeled in literature combining a convex objective function representing minimum cost with a multiextremal objective function representing the nondesirable part of a facility. Deterministic methods have been designed to solve such problems and generic one or bi-objective heuristic methods have been applied. This talk describes a dedicated method for using heruristics to solve semi-obnoxious location problems making use of its specific convex-nonconvex structure.

Eduardo Aníbal Lalla Ruiz, Crístofer Expósito Izquierdo, María Belén Melián Batista, José Marcos Moreno Vega
Intelligent system based on advanced metaheuristic for solving problems at a container terminal

Container port terminals are competing for a market that annually moves about 100 million TEUs worldwide. It constitutes a highly competitive market where the big operators choose, as operational base, ports located in countries that are politically and socially stable, well located and with good cost/quality. In this regard, people responsible for the terminals require management and control systems to help make appropriate decisions to cope with the threats.
In order to design and develop an intelligent system based on advanced metaheuristics for the logistic management of a port container terminal we will focus on three topics: integration of advanced memory structures, use of intelligent stopping criteria and metaheuristic-expert interaction.

Antonio J. Lozano, Juan A. Mesa, Frank Plastria
Locating Straight-lines in the Plane: Generalized Problems

Two of the most well-known problems in the area of location of extensive facilities are the straight-line center and median problems. When the linear facility to be located is not attractive but repulsive or obnoxious, the corresponding straight-line anti-center and anti-median problems arise. Research efforts have been aimed at stating characterization properties for the optimal solutions, and to design computational low-cost algorithms. The k-centrum and the ordered median are problems that enclose the center and the madian as particular cases. In this talk, the properties that characterize optimal solutions for both the ordered and anti-ordered median problems, as well as the k-centrum, are revised and efficient algorithms for finding optimal solutions proposed.

Ángel Marín Gracia

Rapid Transit Networks: Robustness by integrating planning steps

Designing a railway network, or even extending one that is already functioning, is a vital subject due to the fact that it reduces congestion, travel time and pollution, especially if we design it to produces robust infrastructure, with an important effect to recoverability in case of incident.
In network design the capacity is not considered, so it is considered in the following step where the railway service network is planned by its lines (origin and destination stations, stops and frequencies). This step is mentioned by the railway line planning problem. A service or line is defined by trains with the same route and stop stations. The frequency of a service is the number of trains that run in each direction per cycle on their common route. The line design considers the demand satisfaction and some capacity constraints. The objective may be oriented to optimizing passenger service or minimizing operational costs of the railway, considering the network topology (solution of the Network Design) as a parameter.
The next planning step, the train timetabling problem, provides a timetable for a number of trains on a certain lines of the railway network (solution of the Line Planning), considering the line planning solution a framework where the train scheduling is decided.
Rolling stock planning determines how many locomotives and passenger carriages are needed and how to use them to meet the demand and to meet the given schedule (solution of the Time Table). The three major objectives in rolling stock planning are service quality, operating costs and robustness. A good service quality means that trains have enough capacity to cover the passenger demand. Everyday railway operations have to face with disruptions and delays; robust rolling stock schedules are less affected by them. Robustness of the schedules can be increased when the number of possible sources for delays is kept low and spreading of delays is prevented as much as possible.
The solution obtained from the Rolling Stock assignment problem identified the flow of different vehicles through the rapid transit network. However, it does not identify which specific vehicle is assigned to each service. Rolling stock routing is the process of assigning each individual vehicle, referred to as an identification number, to every operation. Given an assignment of material types to operations, we must determine a sequence of operations to be rolled by an individual material such that every operation is included in exactly one sequence, and there are always enough resources available for every operation.
In each planning step the robustness may be considered but in an isolated way. Moreover, each step uses as input the solution of the previous one, so each approach leads to a suboptimal solution because: the network design does not account for capacity, the line planning does not account for infrastructure decisions, the timetable does not account for fleet resource assignment, the rolling stock does not take account for changes on the scheduled services, the routing does not account the rolling stock decisions.
In this presentation different integrations of planning steps are considered to obtain more integrated and robustness solutions: network design versus line planning, time table versus rolling stock and rolling stock versus routing.

Miguel Ortega-Mier, Álvaro García-Sánchez, Judit Cosme Rosario, Andrés Ramos

Benders Decomposition Methods for solving a Stochastic Model to design Multi-layer Reverse Logistic Systems

Reverse Logistics is a topic which has drawn ever more attention over the last decades. Society is more and more concerned with environmental aspects. Research has also followed this trend and has addressed several problems related to Reverse Logistics.
One of these problems is deciding where to locate facilities to treat all waste generated in a particular region. In order for waste to be appropriately handled, waste has to be collected and treated, which it

either means disposing of it or obtaining sellable products. Generally, there are multiple types of facilities (and with different capacities) to locate and decisions to be made.
In this communication a multi echelon and multi-product model to locate several types of facilities in a context with uncertainty (transport costs an amount of waste generated each year) is presented. Recovery centers may operate with different capacities and different technologies).
This problem is difficult to solve for "real" instances using *Branch&Bound* in desktop computers due to memory limitations. We have applied different Benders-based methods to decompose and solve this problem.

Francisco Ortega Riejos, Miguel A. Pozo Montaño y Emma Torres Luque
Optimization in the Design of Cultural Routes through Theatres of Andalucía

In Andalusia (Spain) there are a hundred publicly owned scenic sites who serve in the town where they are located as cinemas, auditoria to music and theater and dance performance. On this set of scenarios, theater companies design an annual tour of visits such that an economic benefit is maximized. In formulating the interest of the companies, a series of temporal parameters (calendars) and spatial (population applicant, architectural capabilities and constraints of the rooms) are involved. Another different point of view is due to the town manager of each stage space, which provides its own cultural agenda based on an initial budget rates to apply to theater companies and grants from regional and national governments) that help for funding the stay of visiting troupes. In this paper, we present integer linear optimization models for the design of cultural routes along the Andalusian network of scenic areas, considering the double set of social and economic objectives, as well as structural constraints, logistical and architectural which concur in this context.

Daniel Serra
From location modelling to reality: experiences, successes and frustrations

Since the late sixties a myriad of location models have been developed in order to address the issue of facility location. Most of the models are intended to solve real world problems, and emphasis is done both in the mathematical model and/or the solution method to be used. But little attention has been paid to the issue of implementing them in the real world. In this paper we present several successes and failures of implementing location models in real problems experimented by the Researh Group in Logistics from the Pompeu Fabra University.

Rafael Suárez Vega, Dolores R. Santos Peñate y Pablo Dorta González
Combining muti-criteria analysis and GIS tools to solve competitive location problems

In this paper, a competitive location problem is solved using Geographical Information Systems (GIS). A new firm wants to determine the best location for a facility that must compete with the existing stores in the market. First, we show how a map with the estimated Huff capture for the planar and network competitive location problems considering both continuous and discrete demand distributions, can be obtained using GIS tools. Later, these maps can be incorporated as a criterion together with other spatial characteristics into a multi-criteria analysis in order to improve the solution obtained by the simple location problem. The final result is a map where the potential locations are scored representing the goodness of the site for locating a new facility in the competitive market.