JUDGMENTAL FORECASTING AND SIMULATION

Abstract

The article deals with the build-up of a model for judgmental forecasting. The built up model is described, its inputs and outputs are explained and interpretation of its results are mentioned. The two dimensional partial differential equation of second order is used for the simulation. The possible usages are mentioned such as hospital, hotels, banks, warehouses, petrol station and restaurant competitive environment. The judgmental forecasting serves as a support of decision making processes to entrepreneurs, managers and investors.

1 Introduction

The two dimensional partial differential equations of second order can be used for the simulation of competitive environment in various branches. The article presents the equation necessary for calculation, explains the used variables and their interpretation in the competitive environment. The use of competitive environment simulation is described generally and it includes various branches.

2 Theory

Two dimensional partial differential equations of second order is used for the simulation of competitive environment in the form

$$\frac{\partial U}{\partial t} = C_x \frac{\partial^2 U}{\partial x^2} + C_y \frac{\partial^2 U}{\partial y^2}.$$

The used differential equation [Dostál 2008] is in the form

$$U_{t+1,i,j} = U_{t,i,j} + C\left[Cx_{i,j}\left(U_{t,i,j-1} - U_{t,i,j} + U_{Ut,i,j+1}\right) + Cy_{i,j}\left(U_{t,i+1,j} - 2U_{t,i,j} + U_{t,i-1,j}\right)\right],$$

where

$$C = \frac{\nabla t}{(\nabla x)^2}.$$

3 Build-up simulation model

The model was build-up for the simulation of the competitive environment. The input C is a simulation constant, the constants matrixes $Cx_{i,j}$ *(n* x *m)* and $Cy_{i,j}$ *(n* x *m)* present the rate of "resistance" of competition environment in the direction of coordinates *x*, *y* of each cell and matrix $U_{0,i,j}$*(n* x *m)* represents the initial conditions of utilization in time $T_0 = 0$. The value of T_{end} is the end time of simulated process. The meaning of used variable in the competitive environment simulations is as follows: The values of "cells" represent the utilization of searched objects $U_{t,i,j}$ with index of time *t* and coordinates *i, j*. The utilization is in the range from *0%* to *100%*, where *0%* means the zero utilization and *100%* means the maximum utilization. The various conditions and situations and their changes in time create the dynamic competitive environment.

4 The use of build-up model

The model for simulation was build up. The grid 10 x 10 is used for simulation, where the searched objects are placed. The results of competitive environment simulation are represented by spectrum of colours used from green (0%), via yellow (50%) to red (100%) and it presents the utilisation ***U*** of searched objects in *x* and *y* coordinates in end time. See fig.1. Each cell has a colour that corresponds with the value of the utilization ***U*** of searched object.

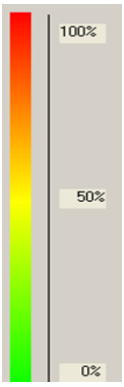

Fig.1. Scale

The various simulations can be done by changing the conditions and various end time of simulation. It was processed many applications of simulation of competitive environment such as hospitals (fig.1), hotels (fig.2), banks (fig.3), markets (fig.4), petrol stations (fig.5) and restaurants (fig.6). Each picture represents the map with placement of searched objects (on the left) and the graph of results of simulation in various branches (on the right).

The fig. 2 represents the simulation of competitive environment in hospital branch after 200 days. The orange colour of hospitals represents the utilization of hospitals in the range from 70% to 85% and they correspond to colour scale. The red colour of hospitals represents the capacity of the usage of hospitals in the range from 85% to 100%. The conclusion of simulation was that the new built up hospital *1c* in sector I3 and cooperating hospitals *1a* and *1b*, have the higher capacity of the utilization of hospital then the competing hospitals *2, 3, 4, 5, 6, 7, 8, 9, 10*. The simulation supports the decision to built-up a new hospital *1c* in sectors E3, The sectors D9, I9 gives worse results of utilization for cooperating hospitals [6].

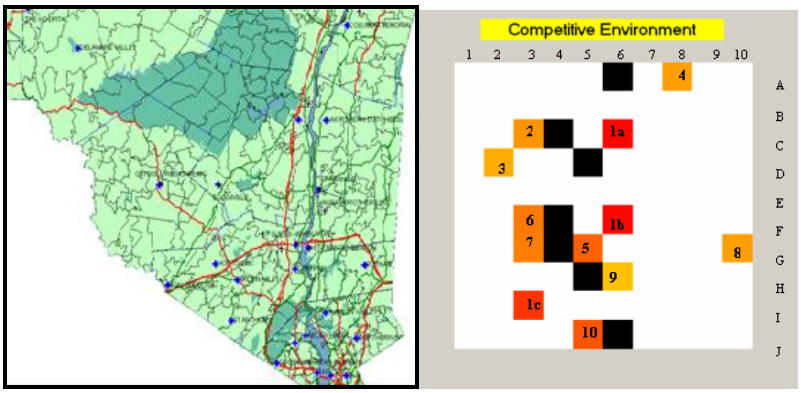

Fig.2 The placements and simulation of hospitals

The fig. 3 represents the simulation of competitive environment in hotel branch after 100 days. The searched utilization of hotel *7* increased from 80% to 91%. The utilization of other hotels was nearly constant or decreasing. The simulation supports the decision of managers of the hotel to start the advertise campaign [8].

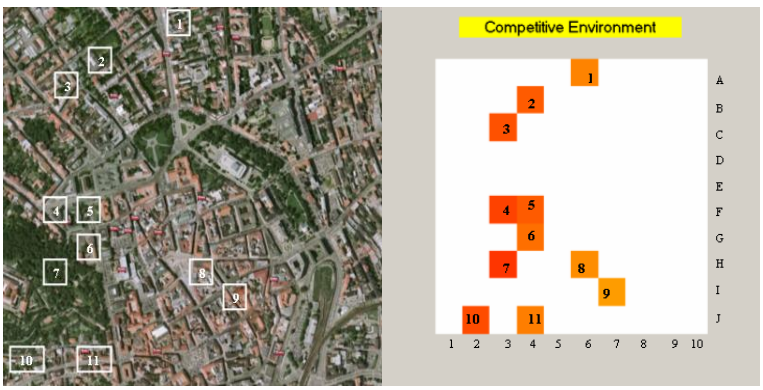

Fig.3 The placements and simulation of hotels

The fig. 4 represents the simulation of competitive environment in bank branch after 200 days. The close of bank *7* increased the utilization of other cooperating ones. The simulation supported the decision making of managers [7].

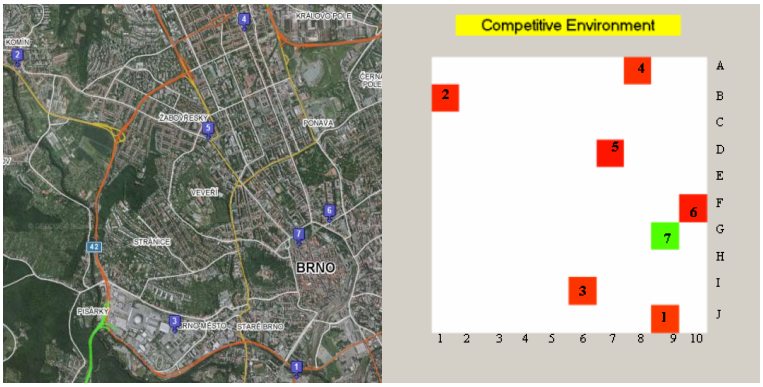

Fig.4 The placements and simulation of bank

The fig. 5 represents the simulation of competitive environment in warehouses branch after 300 days. The utilization of possible built up of a new warehouse *14* increased only from 0% to 35%. The values of utilization of cooperating warehouses were slightly decreasing. Only the utilizations of warehouses *1*, *8*, *9* and warehouse *3* near big cities represent small increase of utilization. The result of simulation for the support of decision making is not to build a new warehouse *14* placed at F6 sector [11].

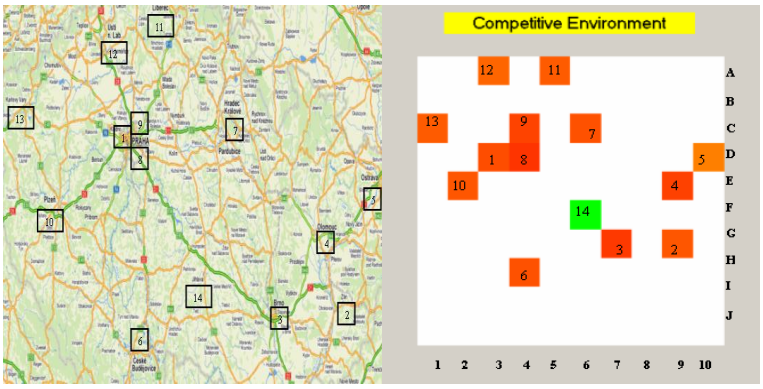

Fig.5 The placements and simulation of warehouses

The fig. 6 represents the simulation of competitive environment in petrol stations. The petrol stations are owned by various companies therefore there is a strong competitive environment. The simulation was used for the decision making process whether to build up (or not) a new petrol station *13a* in sector C4 or *13b* in sector J6.

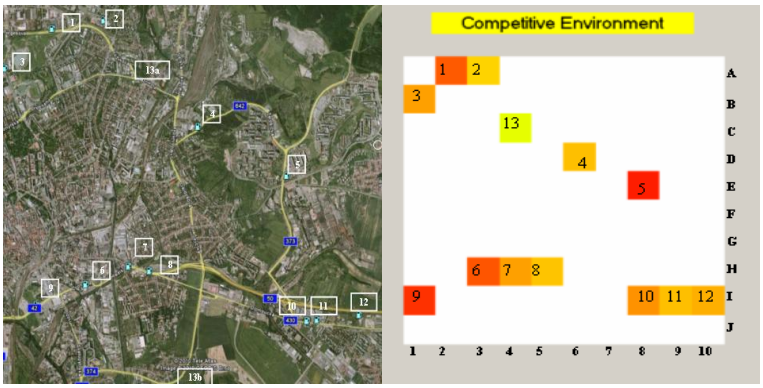

Fig.6 The placements and simulation of petrol stations

The simulation model includes the influence of surroundings, the availability, population density etc. The first simulation leads to low increase of utilization of a new petrol station *13a* and supported the solution not to build up a new one in sector D4. The second simulation leads to higher utilization of a new petrol station *13b* in the sector J6 and supported solution to build up a new one [9].

The fig. 7 represents the simulation of utilization of restaurants during winter time. The results are as follows. The decrease of customers is approximately 10% during 50 days of time of simulation. The decrease influenced all searched restaurants. Some are effected more and some one less. The results support the decrease of customers that enables to plan the reduction of number of workers during the winter time. There was no simulation of special actions represented for example by extra advertising campaigns, X-mas time etc [10].

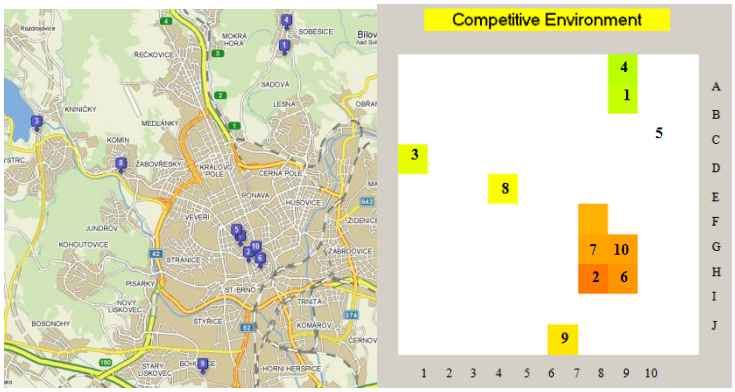

Fig.7 The placements and simulation of restaurants

5 Conclusion

The designed methodology enables to simulate the competitive environment where the utilization of searched objects is the output. The simulation can be very important and its results can be used for decision making processes. The calculation can support the decision making processes of managers. It can help to reduce the losses and increase possible and avoid bad decision. The designed methodology was presented in the branches such as hospitals, hotels, banks, warehouses, petrol stations and restaurants, but it could be used in more branches such as supplier-customer relations etc.