Application of Aggregated Indices Randomization Method for Prognosing the Consumer Demand on Features of Mobile Navigation Applications

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1 ABSTRACT

The issue of this paper is to implement aggregated indices randomization method for prognosing the consumer demand on features of mobile navigation applications. Modern consumers are eager for the applications to provide them with more vast and sophisticated set of options than just building a shortest rout from A to B. Our goal is to analyse and compare the market leading navigating products and to compile the number of necessary and useful features the future product ought to possess for it to be competitive and profitable. After we examined a set of competing products we distinguish the most popular properties they possess. Using the „NNN-information" from several groups of experts, we then range this properties according to their „value" to the predicted success of future application.

2 INTRODUCTION

One of the most relevant products on navigation market are mobile applications [8]. The market is full of vast selection of various navigating applications by different developers for any sort of devices [2]. Yet mobile apps producers are mostly focused on development aspect of their product [4, 6, 7]. Many articles dealing with app development pay much more attention to the technical side of the process [9, 10, 11], rather than exploring what features of the popular products make them market-leaders. In our paper we focus on the matter of developing of new mobile navigation application, competitive and able to satisfy a growing consumer demand, based on the analysis of distinctive features of existing successful products.

Research ProblemConsidering the fact that navigation application market is already quite full [3, 5], in order to successfully win over the market niche for a new application, the idea behind new GIS navigation product should be to satisfy more vast and sophisticated set of consumer needs than building a shortest rout from A to B. We shall use the aggregated indices randomization method to make the closest to accurate prediction about the short-term future needs of the consumers. We shall analyse the number of most popular navigation apps existing (see part IV), and single out the most distinctive features of each product. Then, according to the method given in part III, using the "expert data", we shall range the features according to their "relevance". Thus yielding the set of features our future product ought to possess in order to be commercially successful.MethodIn this project we regard the stage of designing features our product shall hold. The method we use is based on the Bayesian model of uncertainty randomization [1]. Additional non-numeric, non-exact, and non-complete expert knowledge (NNN-knowledge, NNN-information) is used for final estimation of the alternatives' probabilities.

General scheme of the method [1]:

Consider at a present time-point t_1 a complex system, which can proceed to one of the finite number of alternatives $A_1,\dots,A_r$ at a future time-point t_2. Suppose that a decision maker has m different sources of information (experts) about probabilities $p_i=P(A_i), i=1,\dots,r, p_i\geq 0, p_1+\dots+p_r=1$ of the system transition into alternative states $A_1,\dots,A_r$ at the time-point t_2. The decision maker obtains NNN-knowledge I_j from "experts", which can be presented as a vector $I=(I_1,\dots,I_m)$ that consists of systems of equalities and inequalities for probabilities $p_1,\dots,p_r$. The decision maker has NNN-knowledge J about the comparative ''weights" of the sources of information. So, the whole NNN-knowledge constitutes vector $(I;J)=((I_1,\dots,I_m);J)$ $(I;J)=((I_1,\dots,I_m);J)$, where I_j, is information obtained from jth source, and system J is NNN-knowledge that expresses preferences of the decision maker about the comparative significance of sources of information. If we take into account information I_j, we can form a set $P(r;I_j)$

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of all admissible (according to information I_j), probability vectors $p=(p_1,\dots,p_r)$. Modelling uncertain choice of vector $p=(p_1,\dots,p_r)$ from the set $P(r;I_j)$ by a random choice, we obtain random probability vector

$\tilde{p}_1(I_j)+\dots+\tilde{p}_r(I_j)=1$ $\tilde{p}(I_j)=(\tilde{p}_1(I_j),\dots,\tilde{p}_r(I_j)),\tilde{p}_i(I_j)\geq 0,$ which has uniform distribution on set $P(r;I_j)$. Component $\tilde{p}_i(I_j)$ of random vector $\tilde{p}_i(I_j)$ represents random estimation of probability of alternative A_i according to information I_j, obtained from jth source. Vector of mathematical expectations $\bar{p}(I_j)=(\bar{p}_1(I_j),\dots,\bar{p}_r(I_j))$ we will interpret as numerical image of NNN-information I_j. In other words, vector $\tilde{p}_i(I_j)$ is a result of information I_j quantification. In these terms random vector $\tilde{p}_i(I_j)$ is a stochastic quantification of NNN-information I_j.

3 IMPLEMENTATIONFOR DESIGNING OUR APPLICATION USING METHOD ABOVE, WE ANALYSE MOST POPULAR NAVIGATION PRODUCTS OF THE COMPETITORS.

Top apps for Android:

1. Google Maps [12]

The app allows you to see your location on a map, even if you don't have GPS, load offline maps, shows traffic, brows for local places of interest and rate and review them, can get you routes and schedules to travel via subway, bus, bike, or on foot and provides street view imagery, indoor maps, and 3D maps and etc.

2. Navfree [13]

Allows instant rooting and offline maps, option of viewing the map in 2D, 3D or a safety screen, automatic switching to Day & Night maps, browsing for POI, provides in-app purchasing of additional options (safety camera data, live parking information) and etc.

3. TomTom [14]

This app supplies offline maps, stored on your phone, and free lifetime maps, biggest database of real travel time, spoken instructions include street names, supports multitasking capability, 2D and 3D view, browsing for POI, provides lane guidance and in-app purchasing of additional options (speed cameras location, live traffic) and etc.

4. Sygic [15]

Provides up-to-date reports on traffic jams, road works and incidents, shows speed limit, current speed and speed cameras.

5. Waze [16]

Is a community-based traffic and navigation app (drivers in your area share real-time traffic and road information). Provides alerts before you approach police, accidents, road hazards or traffic jams, gas prices. Coordinates with Facebook and provides information about your friends vehicles, helps coordinate arrival time.

After analyzing and comparing the market leading products, we compile the list of features necessary for any future competitive app.

Our next step is contemplating which options existing in competitors' products are most significant for the future app.

We consult several groups of “experts” to range the features according to their relevance.

The NNN-information one group provides as an example:

Street view representation:

2D street view ≥ 3D street view ≥ imagery street view

According to the method above, numeralization of experts' estimations looks as follows (Table 1):

	2D street view	3D street view	Imagery street view
Means	0,5345	0,3103	0,1552
Dispersions	0,0209	0,0278	0,0209
Correlation matrix	1,0000	0,5000	0,3333
	0,5000	1,0000	0,6667
	0,3333	0,6667	1,0000
Covariance matrix	0,0209	0,0139	0,0070
	0,0139	0,0278	0,0139
	0,0070	0,0139	0,0209

Table 1: Distribution Estimations

Suppose, we have our experts divided into three groups according to the level of trust we hold in them.

$w(1), w(2), w(3); w(2) \geq w(3) > w(1)$

Numeralization of expert groups are presented in Table 2.

	First group	Second group	Third group
Means	0,1452	0,5000	0,3548
Dispersions	0,0183	0,0183	0,0243
Correlation matrix	1,0000	0,3333	0,5000
	0,3333	1,0000	0,5000
	0,5000	0,5000	1,0000
Covariance matrix	0,0183	0,0061	0,0122
	0,0061	0,0183	0,0122
	0,0122	0,0122	0,0243

Table 2: Distribution Estimations

We execute a correction of our earlier estimation of means of distribution in accordance with the ranking of our experts. (Table 3)

	2D street view	3D street view	Imagery street view
Means	0,5122	0,1792	0,3086
Dispersions	0,0397	0,0135	0,0194
Correlation matrix	0,0397	0,0159	0,0221
	0,0159	0,0135	0,0119
	0,0221	0,0119	0,0194
Covariance matrix	1,0000	1,1771	1,1366
	1,1771	1,0000	0,6096
	1,1366	0,6096	1,0000

Table 3: Resulting Estimations

Executing our method yields list of results as follows:

Street view representation:

(1) 2D street view

(2) Imagery street view

(3) 3D street view

These are some of the qualities, ranked by preference, that, according to our "experts", can guarantee the profitability of future navigation application. This set was selected and sorted by relevance by using experts' NNN-information and applying aggregated indices randomization method.

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ConclusionAggregated indices randomization method has shown accurate and consistent results. By using it it is possible to distinguish quite successfully between a number of similar alternatives. Yet the main imperfection of this method is that we wholly on our chosen experts and their opinion. Thus for this method to be consistent the chosen experts have to be highly qualified in the field of sturdy.

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