

COMPREHENSIVE EVALUATION AND ANALYSIS OF CHINA'S MAINSTREAM ONLINE MAP SERVICE WEBSITES

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ABSTRACT:

With the flourish development of China's Internet market, all kinds of users for map service demand is rising continually, within it contains tremendous commercial interests. Many internet giants have got involved in the field of online map service, and defined it as an important strategic product of the company. The main purpose of this research is to evaluate these online map service websites comprehensively with a model, and analyse the problems according to the evaluation results. Then some corresponding solving measures are proposed, which provides a theoretical and application guidance for the future development of fiercely competitive online map websites. The research consists of three stages: (a) the mainstream online map service websites in China are introduced and the present situation of them is analysed through visit, investigation, consultant, analysis and research. (b) a whole comprehensive evaluation quota system of online map service websites from the view of functions, layout, interaction design color position and so on, combining with the data indexes such as time efficiency, accuracy, objectivity and authority. (c) a comprehensive evaluation to these online map service websites is proceeded based on the fuzzy evaluation mathematical model, and the difficulty that measure the map websites quantitatively is solved.

1. INTRODUCTION

In recent years, with the rapid development of 3S technology and Internet technology, and the growing popularity of the application of geographic information services for the public, online mapping service with abundant information data, friendly interface, convenient function, and strong interaction, has gradually become an indispensable tool in daily life, which plays a more and more important role in all aspects of economics and social life, and promotes the geographical information industry development, it also brings great economic and social benefits.

In order to promote the online map service industry healthy development, encourage and guide the various website progress and provide an effective quality

assurance for service, an effective evaluation system with each own characteristics should be established. As the online map service website is both of generality and individuality, the existing evaluation methods is user evaluation method and traffic statistics law, which is too subjective without definite standards, and the result maybe undependable^[1-3]. Due to the evaluation factors of online mapping service website, and factors are fuzzy, the fuzzy mathematics method was used to make up for the above shortage at certain extent. It is started from a qualitative analysis, and a quantitative result is given through researching the roles of various factors.

This paper aims to solve the difficulty of evaluating websites quantitatively and provide development

suggestions in the future according to the evaluation results.

2. THE STATUS OF CHINA'S ONLINE MAP SERVICE WEBSITES

According to the IResearch Consulting Company's research result (Figure 1) [4], the China's online map service market scale was less than 1 billion yuan. The increasing application requirements of all trades and walks brought high speed to grow to the market, which appeared a vigorous development trend and achieved 3 billion yuan in 2008. At present, along with development of Chinese geographical information industries, and the application for the public and the interactive functions is growing up, the coverage of online map service will expand further, and the development of the market will be more steadily, which is hopeful to achieve 14 billion yuan [5-6].



Figure 1. 2006-2012 China online map service market scale

There are about 721,000,000 and 164,000,000 results in Google when searching “online map service” and “internet map”. These data evidenced that online map service is becoming a hot spot in digital age. Google Map and Baidu Map occupied larger market share depending on the search area influence. Based on the professional advantages and characteristic applications, other websites such as MapBar, MapABC, 51ditu, Sogou also hold parts of the market. As soon as Map World came out, which was constructed by National Mapping Bureau (STSP),

suffered fully fix eyes upon globally because of fresh data and authority. The group of portal websites led by Tencent and Alibaba also entered in the area, which attracted many young users through quick response and excellent interaction based on their technical advantages.

3. FUZZY COMPREHENSIVE EVALUATION

In order to select representative ones among so many online map service websites, the most basic selection standards were ensured based on the characters of online map service websites:

- (1) current potential and strong map data;
- (2) quick response;
- (3) friendly interface and interaction;
- (4) practical functions or unique function;
- (5) the secondary developing function;
- (6) wide consumer base.

According to the above standards, the following 10 websites in Table 1 were selected as the evaluation objects through investigation and test in this paper.

Name	Address
Google Map	http://maps.google.com/
Baidu MAP	http://map.baidu.com/
MapBar	http://www.mapbar.com/
MapABC	http://www.mapabc.com/
51ditu	http://www.51ditu.com/
Sogo Map	http://map.sogou.com/
Map World	http://www.tianditu.com/
SoSo Map	http://map.soso.com/
Aliyun	http://ditu.aliyun.com/
Bing Map	http://cn.bing.com/ditu/

Table 1. The selected websites

3.1 The establishment of evaluation index system

Each websites was analysed systematically so as to find out every important factor, including factors with its own characters, and some secondary factors should

be ignored properly. A tri-grade evaluation index system was established to assign value and compute. The first-grade indexes contained four aspects as

followed: map data, interface interaction, response and influence, also every index could be refined in Table 2.

1 st -grade index & weight	2nd -grade index & weight	excellent	good	middle	Qualified	Unqualified
Map data (0.30)	Accuracy (0.25)					
	Authority (0.20)					
	variety (0.15)					
	integrity (0.10)					
	date (0.30)					
Function and interaction (0.20)	color (0.15)					
	interface design (0.15)					
	function rich (0.20)					
	Function accessibility (0.20)					
	Friendly interaction(0.30)					
Response (0.30)	load (0.20)					
	tile load (0.40)					
	search (0.40)					
Influence (0.20)	page view (0.30)					
	average time on site (0.20)					
	Cite (0.30)					
	API (0.20)					

Table 2. Comprehensive evaluation index system

3.2 The mathematical model of fuzzy comprehensive evaluation

Fuzzy Comprehensive evaluation method is a good way to solve the problem of which evaluating indexes are difficult to quantify and evaluating factors bear the fuzzy quality. For some simple issues, a reasonable result can be got with the first-grade comprehensive evaluation. But many more factors must be considered in some complicated issues, the weight of every factor may be very tiny, and for this reason some information will lost which leads to the invalidation of the model. The multiple-grades comprehensive

evaluation model and the improved generalized fuzzy operator were used in this paper.

3.2.1 Evaluation indexes: An evaluation factors set could be got from the evaluation index system as shown in equation 1

$$U = \{U_1, U_2, U_3, U_4\} \quad (1)$$

where U represented all the sets of the 2nd evaluation factors.

The subset of $U_i (i = 1, 2, 3, 4)$ is

$$U_i = \{U_{i1}, U_{i2}, U_{i3}, U_{i4}, U_{i5}\} \quad (2)$$

where U_i represented the 2nd set of evaluation factors.

Each grade comments set V is

$$V = \{V_1, V_2, V_3, V_4, V_5\} \quad (3)$$

$V1$: excellent

$V2$: good

$V3$: middle

$V4$: qualified

$V5$: unqualified

3.2.2 The weights set of evaluation factors: It is very important to assign each factor's weight, and there are two ways to assign the weights such as expert's method and comparison method. The former method was used in this paper.

The weights set A was built in \bar{U} where A :

$$A = \{a_1, a_2, \dots, a_s\}, \sum_{i=1}^s a_i = 1 (a_i \geq 0) \quad (4)$$

And the weights set A_i was built in U_i where

A_i :

$$A_i = \{a_{i1}, a_{i2}, \dots, a_{is}\}, (i=1, 2, \dots, s) \quad (5)$$

$$\sum_{i=1}^s a_i = 1 (a_i \geq 0)$$

Then the fuzzy evaluation matrix of each factors $R_{i(i=1,2,3,4)}$ was constructed through evaluated every single factor $u_i \in U$.

$$R_i = \begin{bmatrix} r_{11} & r_{12} \dots & r_{1m} \\ r_{21} & r_{22} \dots & r_{2m} \\ \dots & \dots & \dots \\ r_{n1} & r_{n2} \dots & r_{nm} \end{bmatrix} \quad (6)$$

In the above matrix, r_{ij} ($i=1, 2, n; j=1, 2, \dots, m$) represented the degree of membership, and R_i was the fuzzy relation from U_i to V . Similarly, each factor's comprehensive evaluation translation matrix could be got.

3.2.3 Fuzzy comprehensive evaluation: The fuzzy comprehensive evaluation decision matrix R in U could be computed through matrix multiplication.

$$R = \begin{bmatrix} B_1 \\ B_2 \\ B_3 \\ B_4 \end{bmatrix} = \begin{bmatrix} A_1 \cdot R_1 \\ A_2 \cdot R_2 \\ A_3 \cdot R_3 \\ A_4 \cdot R_4 \end{bmatrix} \quad (7)$$

Then, the fuzzy comprehensive evaluation result B of one website could be computed through composed computation according the weights subset which was from matrix 7.

$$B = A \circ R \quad (8)$$

Among the results through Expression 8, if

$$b_j = \max\{b_1, b_2, \dots, b_m\} \quad (9)$$

the evaluation object was considered as to belong to v_j . The membership degree of other websites could be got as the same, and the scores represented the evaluation results from high to low clearly.

3.3 Experiment

The Map World website was taken as an example, and firstly, the objective evaluation groups should be selected which contained university students, specialized members in the online map service companies and common users. After scoring, the evaluation matrix of every subset U_i ($i=1, 2, 3, 4$)

could be got.

$$R_1 = \begin{bmatrix} 0.8 & 0.1 & 0.1 & 0 & 0 \\ 0.9 & 0.1 & 0 & 0 & 0 \\ 0.7 & 0.3 & 0 & 0 & 0 \\ 0.8 & 0.2 & 0 & 0 & 0 \\ 0.8 & 0.1 & 0.1 & 0 & 0 \end{bmatrix} \quad R_2 = \begin{bmatrix} 0.6 & 0.3 & 0.1 & 0 & 0 \\ 0.7 & 0.3 & 0 & 0 & 0 \\ 0.7 & 0.2 & 0.1 & 0 & 0 \\ 0.7 & 0.3 & 0 & 0 & 0 \\ 0.6 & 0.3 & 0.1 & 0 & 0 \end{bmatrix}$$

$$R_3 = \begin{bmatrix} 0.7 & 0.3 & 0 & 0 & 0 \\ 0.6 & 0.3 & 0.1 & 0 & 0 \\ 0.5 & 0.3 & 0.2 & 0 & 0 \end{bmatrix} \quad R_4 = \begin{bmatrix} 0.5 & 0.5 & 0 & 0 & 0 \\ 0.5 & 0.3 & 0.2 & 0 & 0 \\ 0.3 & 0.4 & 0.3 & 0 & 0 \\ 0.4 & 0.2 & 0.4 & 0 & 0 \end{bmatrix}$$

The weight vector of each subset was:

$$A = [0.3 \quad 0.2 \quad 0.3 \quad 0.2]$$

$$A_1 = [0.25 \quad 0.2 \quad 0.15 \quad 0.1 \quad 0.3]$$

$$A_2 = [0.15 \quad 0.15 \quad 0.2 \quad 0.2 \quad 0.3]$$

$$A_3 = [0.2 \quad 0.4 \quad 0.4]$$

$$A_4 = [0.3 \quad 0.2 \quad 0.3 \quad 0.2]$$

After matrix multiplication, the comprehensive decision matrix of each subset in U was as following:

$$R = \begin{bmatrix} 0.805 & 0.14 & 0.055 & 0 & 0 \\ 0.655 & 0.28 & 0.065 & 0 & 0 \\ 0.58 & 0.3 & 0.12 & 0 & 0 \\ 0.42 & 0.37 & 0.21 & 0 & 0 \end{bmatrix}$$

At last, the evaluation result of MapWorld website was:

$$B = A \circ R = [0.6305 \quad 0.262 \quad 0.1705 \quad 0 \quad 0]$$

The result indicated that the degree of membership to excellent is about 0.63(two decimal places).

The evaluation results of other websites could be compute as the same in Table 3.

Name	Max Membership degree	Rank
Google Map	0.90	2
Baidu MAP	0.94	1
MapBar	0.89	3
MapABC	0.81	6
51ditu	0.75	7
Sogo Map	0.84	5
Map World	0.63	10
SoSo Map	0.87	4
Aliyun	0.73	8
Bing Map	0.70	9

Table 3. Evaluation results

According to the evaluation results, there were two websites whose degree of membership was above 0.90 like Baidu Map and Google Map. The degree of membership between 0.80-0.90 was MapBar, SoSo Map, Sogou Map and MapABC, followed by 51ditu, Aliyun, Bing Map and MapWorld. A conclusion can be drawn from the evaluation that online map service market in China have reached a certain scale, and the websites were not weak to than foreign websites, even ahead of them in some areas. Baidu Map owns the largest amount group based on the on the brand influence in the whole searching market in China and its own technical advantage. Also, its interaction accords with the intellection habit mostly. Google Map has advantages in data, technology and interface, especially its image data and street view, but its service is not stable times to times, causing users lost because of slow response. As the traditional online map service supporters in China, MapBar, MapABC and Sogo Map integrated tourism, repast and entertainment, which is close to people's daily life. Based on the technical advantages in response and interaction, SoSo Map, as a rising star of the online map service market will have a bright future. Those website in the third grade are still in the development stage, such as Map World, which combines data authority and diversity, but its searching experience

performed poorly. But its vitality relies on application, and with the development of the civil high-definition survey satellite "ZY 3 ", the frequency of data updates and data quality will be further improved.

4 CONCLUSION AND DISCUSSION

The nature of online map is to digitalize the real world, and support more serialized information than it. Now, the industry of online map service is going along this route steadily, and has made great achievement. During the comprehensive evaluation of online map service, the multiple-grades and fuzzy comprehensive evaluation method was used, which can process the fuzziness between factors objectivity and decrease the subjectivity and blindness in the procedure, so as to ensure the reliability and accuracy of the evaluation results. The purpose of evaluation is not to rank all the websites, but to analyse the problems through the evaluation results, and a clearer direction for the next development step can be pointed out, which provides important practical and theoretical value to the competitive industry.

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