# Personalized Travel Recommendation System Based on Data Mining Technology

Xiang NAN [a,1], Rajamohan Parthasarathy [a,2] and Chu WANG [b,3]

a*Faculty of Engineering, Built Environment and Information Technology,*
*SeGi University, Kota Damansara, Malaysia*
b*School of Microelectronics Xidian University, Xi'an, China*

**Abstract.** With the continuous improvement of people's living standards, tourism has been a rapid development. In the past, people's biggest need for life was to have enough food and clothing, but now people have more time and money to relax through travel. The tourism industry has developed into a pillar industry chain supporting the national economy. The development of tourism can affect the gross domestic product (GDP) of a whole region, thus driving the development of regional economy, population and culture. However, with the improvement of people's living quality, the demand is gradually expanding. In the past, if people could have the time and money to spend on travel, they would feel physically and mentally happy. Now people have been used to a high-quality lifestyle, so the pursuit of tourism has become diversified, some people pursue the process of tourism, some pursue the results of tourism, which also leads to the endless types of tourism industry, so in order to meet people's increasingly personalized demand for tourism, it is necessary to use data mining technology to design a set of personalized tourism recommendation system. The system can provide users with personalized recommendations and services according to the data information of users' browsing and collection of tourism pages, as well as other customer information with similar preferences. A questionnaire survey was designed based on the feelings before and after the use of the system. The survey results show that 399 people think scenic spot service is more personalized. Before the system was used, only 181 people thought scenic spots were personalized, and 392 people thought tourist spots were convenient, up from 169. Therefore, it can be shown that people have a high satisfaction index for this personalized travel recommendation system. This study provides reference value for tourism.

**Keywords.** Data mining technology，Personalized tourism，Tourism recommendation system，Big data

## 1. Introduction

With the increasingly rich tourism resources, the data of the tourism resource database is also gradually huge. Major tourist attractions compete to appear in the competition, trying to stand out from the fierce competition. In the past, it took a lot of time and energy for people to choose tourism information, but now intelligent tourism gives tourists more

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[1] Corresponding Author: Xiang NAN, PhD Research Scholar, SeGi University;
e-mail: 446717589@qq.com
[2] Assoc.Prof.Ts.Dr. Rajamohan Parthasarathy, PhD Research Supervisor, SeGi University;
e-mail: prajamohan@segi.edu.my
[3] Chu WANG, Undergraduate, Xidian University; e-mail: 1641506383@qq.com

space to choose. Traditional tourism ignores the psychological needs of users, and tourists are in a passive position, but now consumers are more willing to respect their own inner needs to choose tourist attractions, so the tourism industry must provide personalized services for tourists in order to win the favor of users in the numerous competitions. It is a reliable way to solve the current problem to analyze users' tourism-related data through data mining technology and develop personalized tourism plans for them. Therefore, based on data mining technology, this paper studies personalized tourism recommendation system and designs relevant questionnaires to provide inspiration for improving the core competitiveness and influence of the tourism industry.

The development of tourism industry can effectively promote the total economic value of tourism areas, and plays an important role in the construction of society. Therefore, most scholars have expressed their research on it. Sarkar Sudipta Kiran attempts to study the evolving dynamics of social media in promoting sustainable tourism development, and how modern tourism enterprises grow into so-called sustainable corporate citizenship behavior [1]. Sofronov Bogdan believes that tourism can effectively promote economic growth and social development [2]. Ben-Shaul Michal investigated the relationship among the motivation, participation mode and loyalty intention of consumers of travel brand page [3]. Xu Xu believes that celebrity endorsement is an effective marketing strategy, which can also be popular in the field of tourism [4]. Tarantino Ernesto proposed to automatically plan travel itinerary by selecting potential attractions of interest based on user preference, available visiting time considered every day, opening date and time, visiting time, accessibility of scenic spots and weather forecast [5]. Creevey Dean proposed a new stage in the travel process [6]. With the continuous development of the tourism industry, consumers have higher and higher requirements for tourism. In order to meet the personalized needs of tourists, a tourism recommendation system has been developed.

As the existing forms of tourism are solidified, they cannot fully meet the growing demands of tourists, and the personalized travel recommendation system based on data mining technology plays a positive role in improving the form and accurately positioning the customer needs of the travel recommendation system, so it has been studied by many scholars. Christou Evangelos believes that innovation in online technology is changing the way tourism organizations serve [7]. Mohseni Shahriar provides a clear multi-dimensional picture of causality between underlying structures in the online travel buying environment [8]. Yuan Hui believes that tapping into consumers' feelings about products can yield valuable business information [9]. Sunhare Priyank reviews data mining techniques for building smart environments in both large and small iot applications [10]. Cui, Y believes that in the era of big data, one of the key technologies in the research field and business field is data mining [11]. Zhao and Zhenyi expressed that with the development of information technology, data is increasing every day, and data mining technology has been applied in various fields [12]. Thus, with the continuous development of the tourism industry, personalized tourism recommendation system based on data mining technology will gradually be introduced into the tourism industry.

In order to reflect the positive effect of personalized tourism recommendation system based on data mining technology on tourism communication, this paper conducted a questionnaire survey. The survey results showed that the number of people who think that tourist attractions are more real-time and accurate increased from 197 people and 235 people to 391 people and 394 people after using personalized tourism recommendation system. The number of people who think tourist attractions are smart has increased from 171 to 398. It can be seen that the personalized travel

recommendation system can improve the performance of tourism and bring more flexible and direct service experience to users.

## 2. Analysis of Personalized Travel Recommendation System

### 2.1. Data Mining Technology

Data mining technology is a kind of big data. It refers to extracting hidden data with significance and use value from massive and random actual data. These data usually contain useful knowledge and information. This information mining process is called data mining. The application of data mining technology is very extensive, which plays an important role in exploring user interests and preferences and mining customer satisfaction. Therefore, data mining technology has been applied in many aspects.

### 2.2. Design of Personalized Tourism Recommendation System

In this paper, according to the needs of tourism users, a personalized tourism recommendation system is designed based on data mining technology. The system can accurately recommend tourism resources suitable for users by mining users' previous data information, and meet users' personalized needs. Data mining mainly includes the analysis of users' browsing preferences, travel time, travel interests and other aspects. According to these information, customers can be guaranteed to have a real-time and convenient understanding of clear, accurate and in line with their own requirements of tourism resources.

### 2.3. Structure of Personalized Tourism Recommendation System

The structure of personalized tourism recommendation system is divided into three layers: logical layer, expression layer and data layer, each layer has its own module. After users log in to the tourism website, personalized tourism recommendation system will mine the user's past data information, recommend the user's favorite tourism resources according to the user's browsing preferences, and add if users want to search for tourism information by themselves. The personalized travel recommendation system will also analyze the keywords searched by users and obtain the travel pages that meet the needs of users through data mining. All modules of the system depend on each other and cooperate with each other, so that users can finally get satisfactory recommendation results. The structure diagram of personalized tourism recommendation system is shown in Figure 1.

Personalized tourism recommendation system can store the detailed information of tourist attractions, but also can automatically update the tourism resource database, and support the user's independent inquiry. Among them, user query can analyze user preferences based on users' previous browsing records, and can also analyze the tourism keywords entered by users through data mining technology to mine the personalized pages that users are interested in. In the structure of personalized tourism recommendation system, the most critical and the most difficult part is to preprocess the data during data mining. Preprocessing refers to the cleaning, integration, selection and transformation of the mined data, and the final data collection into a similar topic

database, data selection is through the algorithm to delete the redundant data in the data, unrelated to the topic of the data, and then through the data conversion will be deleted after the remaining data normalization, the formation of similar data related to the topic. In this way, the database is classified according to different topics, and the final collection is a huge data repository, which is also conducive to improving the time of data analysis and processing. Data preprocessing is a very important and indispensable stage in the process of data mining. After data preprocessing, the data quality is higher, and it brings more efficient and convenient analysis rate to the system. It can even be said that the results of data preprocessing are directly related to the effect and quality of the personalized travel recommendation system to users. Data collection should be done well in advance to provide a complete data source for data preprocessing, and do a good job for data mining processing.
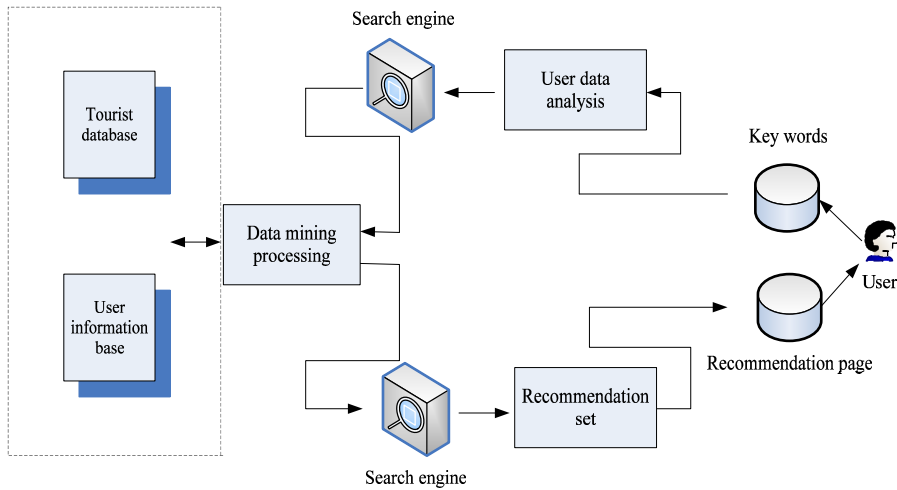


**Figure 1.** Structure diagram of personalized travel recommendation system

## 2.4. System Recommendation Result

Generally, two basic indicators, accuracy rate and recall rate, are used to measure the recommendation results of personalized travel recommendation system. Usually, the higher the accuracy rate A and recall rate R, the better the recommendation results will be. However, due to certain mutual exclusion between these two indicators, a new consideration indicator DI is introduced in this paper to measure the recommendation results of personalized travel recommendation system. It incorporates the accuracy and recall indicators, so the higher the DI value, the better the push results.

Then, the formula for defining the accuracy rate is：

$$P_A = Q_m / Q_n \tag{1}$$

Among them, Qn represents the number of recommended scenic spots, and Qm represents the number of scenic spots that users have actually visited.The formula for recall rate is defined as：

$$P_R = Q_m / Q_i \tag{2}$$

Among them, Qi represents the number of scenic spots in the classified scenic spots.It can be concluded that the definition formula of the indicator DI is：

$$P_{DI} = \frac{2 \times P_A \times P_R}{P_A + P_R} \tag{3}$$

## 3. Questionnaire Survey and Analysis on Personalized Travel Recommendation System

### 3.1. Questionnaire Reliability

In order to truly reflect the impact of personalized tourism recommendation system on tourism, this paper designs a questionnaire survey on the official website of a tourist attraction. A total of 400 users participated in the questionnaire survey twice. A total of 420 questionnaires were sent out and 400 were recovered, with a recovery rate of about 95.2%. There was no missing questions or wrong questions. SPSS software was used to analyze the questionnaire results, and Klonbach coefficient α was selected as the reliability coefficient. If the coefficient was greater than 0.85, it indicated that the questionnaire reliability was good. The questionnaire is designed to investigate the functions (intellectualization, convenience, personalization, accuracy and real-time) of the personalized travel recommendation system. The Klonbach coefficient α of the questionnaire is shown in Table 1.

**Table 1.** Questionnaire reliability table

| Reliability Statistics | |
| --- | --- |
| | Cronbach's Alpha |
| Intelligentization | 0.89 |
| Convenience | 0.93 |
| Individuation | 0.91 |
| Accuracy | 0.88 |
| Real-time | 0.89 |

### 3.2. Questionnaire survey results

This questionnaire investigates the changes of users' attitudes towards tourist attractions before and after using the personalized tourism recommendation system based on data mining technology, and the results are shown in Figure 2 (multiple choices can be made).

As can be seen from the survey results in Figure 2, the personalized travel recommendation system has improved the five performance indexes of the tourism website, and the number of people who think the intelligent and convenient tourist attractions has changed from 171 and 169 to 398 and 392. The number of people who said tourist attractions were more real-time increased from 197 to 391. In terms of accuracy, 235 people became 394 people; The number of people who think scenic spots are personalized reached 399 after the experiment, which is close to 100%. Thus, it can be seen that the personalized tourism recommendation system can improve the

performance of all aspects of tourist attractions and generate better and more comfortable browsing experience for users. Moreover, the vast majority of users say that after using the recommendation system, they can find their own needs more flexibly and meet their special requirements for tourism in a targeted way.
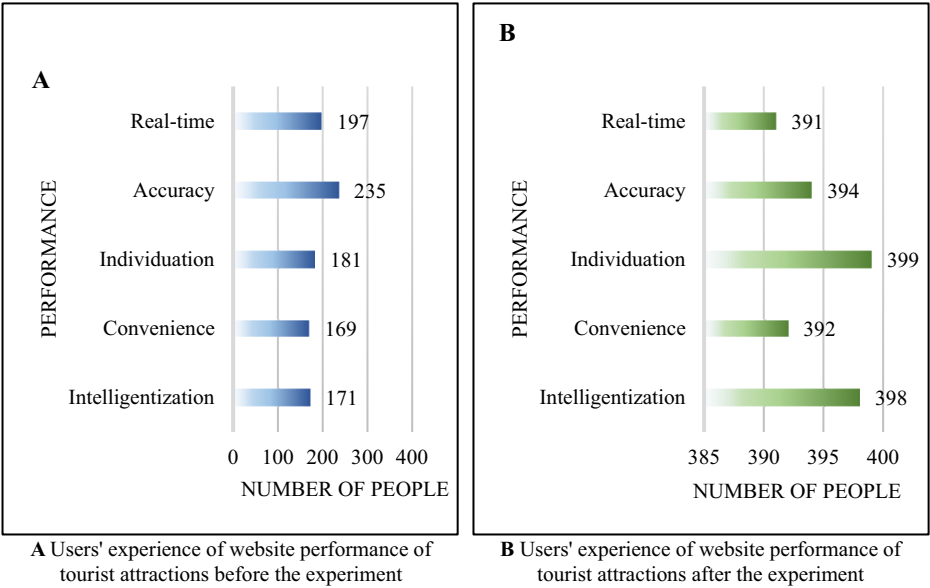


**A** Users' experience of website performance of tourist attractions before the experiment

**B** Users' experience of website performance of tourist attractions after the experiment

**Figure 2.** Questionnaire survey results

## 4. Conclusion

The tourism industry is getting better and better with constant updates, and the development of tourism also improves people's sense of happiness and existence. This paper studies the personalized travel recommendation system based on data mining technology, and proves through questionnaires that it has relatively positive and realistic significance for meeting user needs, providing users with personalized services, and driving the economy and development of tourist attractions. However, due to the urgency of time, there may be some errors in the results due to the large number of questionnaires. Secondly, this paper only integrates data mining technology to conduct a questionnaire survey on the application of personalized travel recommendation system in a tourist scenic spot, without quantitative data research on the specific implementation of the system, the paper lacks data support and is not representative. Moreover, the development of the tourism industry has gone through countless wind and frost, the tourism industry will also change with the development of the society, but with the continuous progress and development of the society, the tourism demand will be gradually satisfied, the user's happiness index is constantly improving, the solution of these problems will be in the near future. In order to have a deeper understanding of the impact of personalized travel recommendation system based on data mining technology on the tourism industry, the analysis results will be further improved from these perspectives in the subsequent research.

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