Personalized Recommendation Method of Rural Tourism Routes Based on Mobile Social Network

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Abstract. The existing personalized recommendation methods for tourism routes have the problem of low tourist satisfaction, so a personalized recommendation method for rural tourism routes based on mobile social networks is proposed. According to the mobile social network model, calculate the number of mobile message hops and define a set of social information paths to complete the processing of travel route data based on mobile social networks. On this basis, implement denoising of tourism route data, determine personalized route recommendation schemes by deriving route sequences, and complete the design of personalized rural tourism route recommendation methods based on mobile social networks. The experimental results show that under the influence of the above methods, the number of tourists choosing fixed tourism routes significantly increases, and the satisfaction level of tourists with the recommended routes also increases, which meets the practical application needs of personalized recommendation of rural tourism routes.

Keywords: Mobile Social Network · Rural Tourism Routes · Personalized Recommendation · Message Hops · Geographical Factor Characteristics · Vectorization · Data Denoising · Route Sequence

1 Introduction

As the main carrier of mobile intelligent devices, human's social attributes have also been given to mobile intelligent devices. The social attributes of nodes are one of the factors that must be considered. Therefore, the concept of mobile social network has also been proposed on the basis of opportunity network. Mobile social network is an opportunity network that considers the social attributes of nodes. It also transmits data among nodes in the mode of "store carry forward". This network fully considers the social attributes of nodes, and uses this as a basis to help select appropriate intermediate nodes to help forward messages. Mobile social networks have broad research prospects in the future. With the rapid change of intelligent devices and the concept of smart city and smart home, many intelligent devices have entered thousands of households, and the popularity of intelligent devices has also increased rapidly; The development of communication technology also makes mobile social network have a broader development prospect under 5G network. At the same time, with the improvement of the performance of mobile

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intelligent devices, their computing power and storage capacity are bound to continue to increase. Communication technology, node storage capacity and node computing capacity are the key technologies of mobile social network. The development of these three will also provide a broader development platform for mobile social network. "Store carry forward" is the most basic mode of mobile social network data transmission [1]. The main research content of mobile social network is also around these three points. In the "storage" direction, it mainly focuses on the cache space management of nodes, and uses appropriate cache management strategies to improve the network performance; In the "carrying" direction, whether the node's mobility model is practical is also an important research direction. On this basis, the research on the social attributes of nodes is also one of the research directions.

In recent years, more and more intelligent mobile terminals are equipped with positioning function. With intelligent mobile devices becoming a necessity in public life, people's demand for location-based services has shown explosive growth, and location-based social networks have attracted a large number of users. Users share their travel photos or "check-in" data through social networks to record access history and share life experience, thus accumulating a large number of access footprints or "check-in" record data with geographical markers. These users' historical access data provide an opportunity to understand people's behavior, which can be effectively applied to personalized travel recommendations based on social networks, including that with the continuous growth of self-help tourism groups, more and more users can organize their travel materials from the network [2]. However, with the rapid increase of social network users, the rapid growth of network information has resulted. When users face massive network data, they cannot quickly select information.Users prefer to automatically obtain personalized travel recommendations that meet their specific needs, help users quickly filter useless information from a large number of travel information, and improve the efficiency and comfort of users in integrating information. The hybrid tourism route recommendation algorithm based on DGKDK determines the value range of forgetting coefficient according to the prediction results of user preferences, and then recommends tourist attractions with the help of preference model. Tourism route recommendation method based on potential interest spots of users plans the starting point and end point of the tourism route by analyzing the historical tourism footprint, and on this basis, realizes the on-demand planning of the route track. However, in rural tourism, the number of tourists attracted by the tourist routes recommended by the above two methods is relatively limited, which cannot effectively improve the tourist satisfaction and does not meet the personalized recommendation needs.

To address the above issues, design a new personalized recommendation method for rural tourism routes based on mobile social networks. Based on the mobile social network model, the data processing of tourism routes has improved the quality of the data. Based on the processing results of tourism route data, denoise it and recommend personalized routes by deriving route sequences.

2 Travel Route Data Processing Based on Mobile Social Network

Rural tourism route data processing is based on the mobile social network model to solve the vectorization characteristics of geographical factors. This chapter will carry out in-depth research on the above contents.

2.1 Mobile Social Network Model

The mobile social network model is a mathematical model used to describe and analyze people's social interactions in a mobile environment. This model is usually based on graph theory and Complex network theory, which can help us understand people's behaviors and relationships in mobile social networks.

In the mobile social network model, people are viewed as nodes, and their social connections are represented as edges connecting these nodes. These edges can represent actual social connections between people, such as friends or family relationships, or virtual social connections, such as relationships of mutual interest or mutual interest.

The mobile social network model can also consider people's location information during the movement process. By integrating location information and social relationships, one can understand people's social behavior at different times and spaces, such as the frequency of social activities at different locations, and the social distance between people.

(1) Mobile message hop count

The number of hops of a message refers to the number of intermediate nodes through which the message is delivered from the source node to the destination node. The smaller the hops of a successfully delivered message, the higher the accuracy of each node selected for forwarding the message.The formula for calculating the average hops of messages is as follows:

$$\overline{p} = \frac{1}{\beta \hat{O}} \sum_{\substack{\alpha=1 \\ \chi=1 \\ \delta=1}} \frac{p_\alpha + p_\chi + p_\delta}{3} \quad (1)$$

Among them, $\hat{O}$ represents the delivery characteristics of data messages at the intermediate node, β represents the message delivery parameters between the source node and the intermediate node, α, χ, and δ represent three randomly selected data message labeling coefficients, and the inequality value condition of $\alpha \neq \chi \neq \delta$ remains true. p_α represents the data message jump vector based on parameter α, p_χ represents the data message jump vector based on parameter χ, and p_δ represents the data message jump vector based on parameter δ.

In mobile social networks, unnecessary or inefficient message forwarding results in a waste of network resources. However, setting a small limit on the number of message hops can lead to a limited number of preferred paths and other shortcomings, such as a lack of references. Therefore, it is crucial to impose an appropriate limit on the number of message hops.

The theory of "six degrees of separation", also known as "small world phenomenon", stipulates that if any two strange individuals want to establish a connection, they need at most five intermediate individuals to achieve the goal. It is reflected in the mobile social network. If the message spreads to the destination node with all efforts, it can reach the destination node [3] through up to five intermediate nodes.

Therefore, when the average hops are known, the mobile messages at the five intermediate nodes should be sampled separately to achieve accurate calculation of mobile message hops.

The calculation formula of mobile message hops of mobile social network is as follows:

$$O = \tilde{I}\frac{\hat{o}}{\overline{p}} \times \left(1 - \sqrt{\frac{P_1}{i_1} \cdot \frac{P_2}{i_2} \cdot \frac{P_3}{i_3} \cdot \frac{P_4}{i_4} \cdot \frac{P_5}{i_5}}\right) \tag{2}$$

In the equation, P_1, P_2, P_3, P_4, and P_5 represent the sampling results of mobile messages at the five intermediate nodes, i_1 represents the sampling parameters of mobile messages at the P_1 node, i_2 represents the sampling parameters of mobile messages at the P_2 node, i_3 represents the sampling parameters of mobile messages at the P_3 node, i_4 represents the sampling parameters of mobile messages at the P_4 node, i_5 represents the sampling parameters of mobile messages at the P_5 node, and the inequality sampling condition of $i_1 \neq i_2 \neq i_3 \neq i_4 \neq i_5 \neq 0$ remains true, $\hat{o}$ represents the real-time forwarding characteristics of data messages in mobile social networks, and $\tilde{I}$ represents the node diffusion vector in mobile social networks.

For the processing of travel route data by mobile social network, the value of message hop index must belong to (0, 1) Within the range of "0" It means that the operation stability of mobile social network is weaker; On the contrary, the closer the jump value is "1", which means that the operation stability of mobile social networks is stronger.

(2) Collection of social information paths

The mobile social network determines the preferred path for a message based on the path with a high average encounter intensity. The construction of the preferred path set is the core aspect of the mobile social network model. Traversal is used to ensure that the optimal path in the network is filtered, but it is only suitable for networks with a small number of nodes. In networks with a large number of nodes, filtering through traversal becomes unrealistic. The extensive calculation of optimal paths would consume significant network resources, thereby impacting the overall network performance. To address this, the construction process of the preferred path in the mobile social network is divided into the following steps:

(1) Define the encounter strength $\tilde{u}$ for the number of mobile message hops.
(2) Calculate the processed encounter strength u' based on the hop count O and encounter strength $\tilde{u}$ of the joint mobile message.

$$u' = |O \cdot \tilde{u}|^{-1} \Big/ \left(\frac{\gamma^2 - \gamma}{2}\right) \cdot |\Delta U|^2 \tag{3}$$

where, ΔU represents the unit Cumulant of data message samples in mobile social network, and γ represents the data message recognition coefficient based on mobile social network model.

(3) The construction process of the optimal path in the mobile social network model is essentially the process of adding intermediate nodes in the two nodes. For example, if there is a 1-hop path ① → ⑦, the construction process of the 2-hop path is essentially to select an appropriate intermediate node to serve as a bridge from node ① to node ⑦; If there is a 2-hop path ① → ⑤ → ⑦, the construction process of the 3-hop path is to select a suitable intermediate node as the bridge from node ① to node ⑤.
(4) Construction of hop preferred path. There is only one path from the message to the destination node after only one hop, namely ① → ⑦. And node ⑦ is the destination node of the message. Regardless of the average strength of each hop of the path, it should be included in the preferred path set, so ① → ⑦ is the 1-hop preferred path of the network.
(5) The construction of a 2-hop optimal path. Traverse the encounter intensity of node ⑦ and select nodes with an encounter intensity of no less than u' as the preset intermediate nodes, including nodes ④ and ⑧.

Based on formula (3), the solution result of the social information path set Δ can be expressed as:

$$\Delta = \left\{ y | y = \left(\frac{u'}{\varphi \overline{Y}} + 1 \right) \cdot \frac{\sum_{-\infty}^{+\infty} \vec{\varepsilon}}{\sqrt{Y_1 \cdot Y_2 \cdot Y_3}} \right\} \tag{4}$$

Among them, y represents a random variable in the set of social information paths, $\overline{Y}$ represents the preset mean of mobile social information in the preferred path, φ represents the data sample optimization parameter in the traversal path, Y_1 represents the preset parameter value of mobile social information in the 1-hop preferred path, Y_2 represents the preset parameter value of mobile social information in the 2-hop preferred path, and Y_3 represents the preset parameter value of mobile social information in the 3-hop preferred path, $\vec{\varepsilon}$ represents the traversal filtering vector of social information within the mobile network path.

It is worth mentioning that due to the randomness of the movement of nodes in mobile social networks and the unpredictability of the future, the path in the optimal path set cannot be guaranteed to be the most correct path. There are many paths for messages from the source node to the destination node, and other paths with lower average strength per hop may deliver messages to the destination node faster [4]. In short, as the reference basis for message forwarding, the preferred path can only select the relatively excellent path, not necessarily the most correct path. As a means to reduce this impact, in the construction of the preferred path set, the more preferred paths, the smaller the impact, and the most correct path is easier to appear in the preferred path set.

2.2 Geo Factor Feature Vectorization Solution

Mobile social networks stipulate that geographical distance affects the choice of human access. The closer to the center of the frequent activity area, the greater the possibility of user selection. Therefore, geographical factor feature is an effective feature to be extracted. It can be seen from the data that each geographic factor feature vector has an independent longitude and latitude [5]. Longitude and latitude can not only calculate the distance between factor parameters, but also reflect the geographical preference of users for tourism. However, the longitude and latitude of geographical factor characteristics belong to singular data in mobile social networks, that is, compared with other characteristic data, the longitude and latitude value is far greater than other data, which not only makes the recommendation model unable to effectively learn the geographical factor characteristics of users. It also affects the model's effective learning of other features, leading to the decline of the model's learning ability.

The following table records the topic vector distribution structure of tourism users.

Table 1. Theme vector distribution structure of tourism users

Tourism users	Food	Park	College	History	Shopping
User-01	0.43	0.05	0.32	0.03	0.21
User-02	0.06	0.51	0.08	0.07	0.17
User-03	0.03	0.05	0.77	0.06	0.13
User-04	0.22	0.25	0.07	0.12	0.30
User-05	0.55	0.07	0.17	0.07	0.04
User-06	0.41	0.03	0.15	0.14	0.28

According to Table 1, different tourism users focus on different themes in the process of rural tourism. The recommended directions of common rural tourism routes generally include food, parks, schools, history and shopping. In mobile social networks, these recommended items will affect the quantitative solution results of geographical factor characteristics.

On the basis of formula (4), calculate the longitude and latitude vectors of rural tourism geographical factor characteristics respectively. The specific calculation formula is as follows:

$$\begin{cases} R_1 = \iota_1\left(\sqrt{\left|r_1 \cdot r_2 \cdot \cdots \cdot r_n \big/ t_{\max} - t_{\min}\right|}\right) \\ R_2 = \sqrt{\iota_2 \cdot \frac{(t_{\max} - t_{\min})}{r_1^2 + r_2^2 + \cdots + r_n^2}} \end{cases} \tag{5}$$

Among them, R_1 represents the longitude vector of rural tourism geographical factor features, R_2 represents the dimension vector of rural tourism geographical factor features, $r_1, r_2, \ldots, r_n$ is the sampling parameter of n rural tourism routes that meet the conditions of the mobile social network model, and the sampling condition of $r_1, r_2, \cdots, r_n \in \Omega$ is constant. ι_1 represents the longitude value sampling parameter, ι_2 represents the dimension value sampling parameter, and $t_{\max}$ represents the maximum value result of the user's tourism geographical preference weight, $t_{\min}$ represents the minimum value result of the user's travel geographical preference weight.

Assuming e represents the initial value of the vectorization parameter, λ represents the personalized arrangement parameter of geographical factor features, T represents the average value of the personal theme vector of tourism users, κ represents the geographical distance sampling conditions of rural tourism attractions, and the simultaneous formula (5) can be used to express the vectorization solution results of geographical factor features of rural tourism routes based on mobile social networks as follows:

$$T = \left|\frac{1}{\kappa} \times \overline{E}\right| \cdot \int_{e=1}^{+\infty} \lambda \cdot (R_1 \times R_2)^2 \tag{6}$$

The vectorization solution condition is used to vectorize the travel user's sign in data. After matrix decomposition, the user's sign in record matrix is transformed from high-dimensional sparse data to low-dimensional user potential vector. For users with similar check-in records, the user potential vector obtained through matrix decomposition is closer in the vector space. That is, the closer the user vector is, the higher the access similarity between users.

3 Design of Personalized Recommendation Method for Rural Tourism Routes

According to the application requirements of the mobile social network model, the tourism route data is denoised, and then the route sequence expression is combined to achieve personalized recommendation of rural tourism routes.

3.1 Data Denoising of Tourism Routes

Location information (longitude and latitude) in mobile social networks is an important feature to determine the specific location of tourism users and calculate the distance between geographical factors.

First of all, the data items with missing location information in the data set are removed. The loss of location information makes it impossible to determine the location of the user's clock in record, and thus the travel route visited by the user cannot be determined. In the field of personalized recommendation, location information can effectively mine users' access preferences, and then recommend travel routes that meet users' preferences when recommending to users.

Secondly, the travel route visited by the user is determined according to the location information of the check-in record. When the user visits a place, multiple check-in records will be generated. For example, when the user is at a point of interest or a mall, multiple record data will be generated, but multiple check-in records belong to the same place. Match the route of user access according to the location information of the check-in record, as shown in Fig. 1. Using the location information of the travel user, set the location of the route as the center, and determine the coverage of the complete travel route with a radius of 200 m. By calculating the European distance between the longitude and latitude of the two, determine whether the user sign in place belongs to the route track [6]. If the sign in record is within the coverage range of the route track, confirm that the user's sign in place belongs to the tourism route, otherwise the user's sign in place does not belong to the tourism route.

Fig. 1. Matching Diagram of Rural Tourism Routes

Rural tourism should have the following characteristics: 1. It has obvious regional characteristics; 2. "Rural" means rural resources, rural environment and rural industries; 3. Urban residents are the main tourist source market of rural tourism; 4. Rural tourism integrates economic benefits, leisure and entertainment functions, and can bring economic and other benefits to the local area; 5. Rural tourism has a multi-level product system and is a changing space-time concept. Rural landscape artistic conception tourism resources include corridor rural landscape artistic conception tourism resources and regional rural overall landscape artistic conception tourism resources. The rural landscape artistic conception tourism resources are the most easily damaged resources in the rural tourism resource system and the most difficult to maintain and develop in the process of rural tourism planning [7]. The rural landscape is characterized by large dispersion and small concentration. Each scenic spot is connected by corridors, such as rural traffic channels, rivers, rural landscape ecological corridors, etc. Corridor is an important component of landscape and an indispensable part of landscape planning and design.

The recommended rural tourism routes mine individual preference for tourism scenes according to the frequency of users' historical visits to different topics. The denoising expression for rural tourism route data is:

$$Q = (a + 1) \times \frac{\log \tilde{w} + \log \tilde{A}}{-\kappa \cdot T} \tag{7}$$

In the formula, $\tilde{w}$ represents the connection characteristics between rural tourism attractions, $\tilde{A}$ represents the historical visit frequency characteristics of rural tourism route data, and a represents the denoising weight.

The popularity of tourist routes and the activity of tourists are different and distributed.

Therefore, it is of great objective significance to consider the impact of both on the quality of recommendation results in the recommendation algorithm of tourism routes to improve the quality of tourism route recommendation.

3.2 Route Sequence

In the data construction layer, the mobile social network retrieves geotagged photos directly and utilizes the Haversine formula to calculate the distance between the user's shared photos and each point of interest along the rural tourism route. If the distance is less than 200 m, it is determined that the user's photo location belongs to the point of interest. This method allows for the calculation of places visited by users, thus creating a collection of users' historical access records.

Rural tourism planning is a kind of tourism planning. It is based on the environment of villages, countryside, and pastoral areas. It sets goals according to the development law of rural tourism and market characteristics, and makes overall planning to achieve this goal, forming a distinctive development direction [8]. The development of rural tourism first needs to investigate the types, existing conditions and characteristics of resources in order to protect and use resources efficiently and reasonably. Only on the premise of resource protection, the development and utilization of resources can realize the sustainable development of rural tourism. When the development of rural tourism destination is at a standstill stage, it shows that the resources have been seriously damaged and the situation is not optimistic. At this time, the development and utilization of resources should be limited, and more effective measures should be taken to increase the protection of resources. When rural tourism destination goes into decline, it shows that tourism resources are about to be exhausted, and the remaining rural tourism resources are not enough to support the development of rural tourism. New tourism resources must be developed to enhance the attraction of tourism destination in order to revive rural tourism.

The calculation results of the personalized characteristics of rural tourism routes are as follows:

$$\dot{D} = \frac{\sum_{-\infty}^{+\infty}\left(S_{\mu}^{2} - S_{\nu}^{2}\right)}{\sqrt{Q \cdot \left[1 - \left(d_{\mu} - d_{\nu}\right)^{2}\right]}} \tag{8}$$

Among them, μ and ν represent two randomly selected interest point labeling parameters for rural tourism routes, and the inequality value condition of $\mu \neq \nu$ remains true. S_{μ} represents the tourism route access record feature based on parameter μ, d_{μ} represents the related tourism route data occupation parameter, S_{ν} represents the tourism route access record feature based on parameter ν, and d_{ν} represents the related tourism route data occupation parameter.

Compared with other tourism projects, rural tourism projects are unique and pay more attention to the participation of tourists. It promotes tourism projects from exhibition viewing to participatory experience. Tourists can not only enjoy the beautiful pastoral scenery, but also participate in labor and rural folk culture activities. Experiential rural tourism helps tourists to experience their hometown, integrate into a healthy, simple and simple rural lifestyle, and improve their understanding of rural life and agricultural production [9]. The development of rural tourism has a clear tourist source orientation. Rural tourism uses rural unique resources as tourism attractions to attract urban residents living in a fast-paced, stressful life. Tourists mainly come from the surrounding urban markets.

On the basis of formula (8), the definition formula of rural tourism route sequence is derived as follows:

$$G = \frac{1}{2\varpi} \exp \sqrt{\frac{\left| f \times \dot{D} \right|^{-1}}{g}} \tag{9}$$

In the formula, ϖ represents the personalized scheduling parameter of rural tourism route data, f represents the real-time sharing coefficient of tourism route data, and g represents the attractiveness evaluation parameter of rural tourism resources to tourists.

There are different types of villages, with local culture, rural environment, clothing, eating habits and other rural characteristics caused by different history, culture, economic development and climate. Rural characteristics are the most essential attraction of rural tourism. It is necessary to select unique tourism resources for rural tourism planning on the basis of analyzing the tourist market.

3.3 Personalized Route Recommendation

$\vec{Z}$ represents the real-time recommendation vector of rural tourism route data in mobile social networks, whose value directly affects the adaptation relationship between personalized tourism route recommendation results and user personal behavior.

For the solution of real-time recommendation vector $\vec{Z}$, the following expression is satisfied:

$$\vec{Z} = \dot{X} \frac{1}{\sum_{-\infty}^{+\infty} b \times \tilde{M}} \tag{10}$$

In the formula, $\dot{X}$ represents the rural tourism search features selected based on personalized principles, $\tilde{M}$ represents the user's personal search behavior vector, and b represents the search parameters of tourism route data in mobile social networks.

The personalized tourism route recommendation problem is optimized according to the route sequence orientation problem. The personalized tourism route recommendation is expressed as the following integer planning problem. By maximizing the final score of the tourism route, the final recommended tourism route is determined, as shown in the following formula.

$$h = \left(l\vec{Z} \right) - \sqrt{\sum_{c=1}^{+\infty} \frac{1}{\vec{j}} \left(\dot{k} \times G \right)} \tag{11}$$

Among them, l represents the personalized corresponding parameters of travel users in mobile social networks, c represents the minimum value of the exported parameters of travel route data, $\vec{j}$ represents the execution vector of personalized recommendation behavior, and $\dot{k}$ represents the planning features of personalized recommendation behavior.

Villagers are the main body of the countryside. The main purpose of developing rural tourism is to excavate, protect and inherit rural culture, and make full use of rural tourism resources, adjust and optimize the rural industrial structure, expand agricultural functions, promote the employment rate of farmers, and increase farmers' income [10]. Tourists participating in rural tourism can visit and experience the villagers' lifestyle, but it is necessary to ensure the orderly development of the villagers' daily life. Therefore, when planning rural tourism, the design of tourism activities should conform to the villagers' lifestyle and habits, and fully respect the wishes of farmers.

In addition, due to the different search behaviors of user objects, before recommending rural tourism routes for them, mobile social networks will also summarize the user's search habits in the previous period of time, so as to achieve on-demand recommendation of tourism route data on the basis of ensuring personalized needs.

4 Example Analysis

To highlight the differences in the use of personalized rural tourism route recommendation methods based on mobile social networks, DGKDK based hybrid tourism route recommendation algorithms, and DGKDK based hybrid tourism route recommendation algorithms, the following comparative experiments are designed.

4.1 Experimental Environment

Define 6 scenic spots in a rural tourist attraction, as shown in Fig. 2.

Fig. 2. Planning of rural tourist attractions

Establish tourism routes with these six scenic spots as the core, and input these routes into the Internet platform for users to choose. For Internet hosts, their preference for each scenic spot is exactly the same when they make travel routes.

When a user logs into the Internet platform, he or she will retrieve the travel routes according to his or her personal preferences. At this time, the host component will recommend personalized routes for the user according to his or her search habits. In the later stage of the summary work, according to the user's choice of the recommended route, the tourist satisfaction can be determined (the more people choose the personalized route recommended by the Internet platform, the higher tourist satisfaction will be).

First, use the personalized recommendation method of rural tourism routes based on mobile social network to control the Internet platform, record the user's choice of recommended routes under the effect of this method, and the results are the experimental group data.

Secondly, the mixed tourism route recommendation algorithm based on DGKDK is used to control the Internet platform, record the user's choice of the recommended route under the effect of this method, and the result is the first control group data.

Then, use the tourism route recommendation method based on the user's potential interest scenic spots to control the Internet platform, record the user's choice of the recommended route under the effect of this method, and the result is the data of the second control group.

Finally, the experimental data are collected and the experimental rules are summarized.

4.2 Data Processing

The figure below reflects the specific number of rural tourism routes recommended by the Internet hosts selected by the experimental group and the control group (Fig. 3).

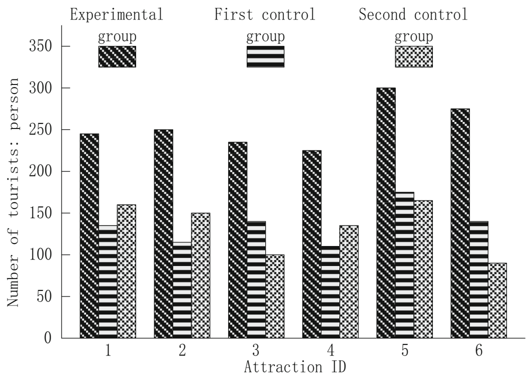

Fig. 3. Statistics of tourists

Experimental group: under the effect of the experimental group method, the number of people who chose the Internet host to recommend the tourist routes for No. 5 scenic spot reached 300; The number of people who chose the travel route recommended by the Internet host for No. 4 scenic spot was the smallest, but it also reached 225.

The first control group: under the effect of the first control group method, the number of people who choose the tourist routes recommended by the Internet host for No. 5 scenic spot is the largest, 175 people; The number of people who chose the travel route recommended by the Internet host for No. 4 scenic spot was the smallest, only 112.

The second control group: under the effect of the second control group method, the number of people who choose the tourist routes recommended by the Internet host for No. 5 scenic spot is the largest, 161 people; The number of people who chose the travel route recommended by the Internet host for No. 6 scenic spot was the smallest, only 88 people.

To sum up, during the whole experiment, the average number of tourists in the experimental group was the highest, the average number of tourists in the first control group was in the middle, and the average number of tourists in the second control group was the lowest.

4.3 Experimental Conclusion

The conclusion of this experiment is:

(1) The application ability of the hybrid tourism route recommendation algorithm based on DGKDK is weak. Under its recommendation, the number of tourists who choose fixed tourism routes is relatively small, which is not enough to improve tourists' tourism satisfaction.
(2) Compared with the hybrid tourism route recommendation algorithm based on DGKDK, the personalized rural tourism route recommendation method based on mobile social network has a slightly stronger application ability, but it still cannot maintain a high level of tourist satisfaction.
(3) The application of personalized recommendation methods for rural tourism routes based on mobile social networks can effectively solve the problem of fewer tourists choosing fixed tourism routes, improve tourists' tourism satisfaction, and thus set more personalized rural tourism routes in line with practical application needs.

5 Conclusion

With the increasing number of users of location-based social networks, the "check-in" record data and travel information shared by users have generated a large number of social network data containing geographical location information. These social network data contain a wealth of user travel time and space and context information, providing an excellent opportunity to understand user behavior and realize personalized travel recommendations. Although the traditional methods of personalized travel recommendation based on social networks have achieved some results, the personalized travel recommendation method based on mobile social networks proposed by the above research has great advantages in feature mining in social networks and extraction of users' personalized travel preferences.

The feature analysis and vectorization research of social network data. The theme features, geographical factor features and user access features are identified as the effective features that affect user preferences. In addition, in order to alleviate the problem of data sparsity, and enable discrete data in social networks to be sent into the deep learning model for effective training, the topic features, geographical factor features and user access features are vectorized.

Personalized travel route recommendation algorithm. On the basis of personalized recommendation of mobile social networks, users prefer to recommend a travel route composed of multiple points of interest that users are interested in. The similarity between the user interest vector and the context vector of interest points is taken as the feature of the tourism target area, and the dynamic interest preference of the user in the tourism process is determined by weighting these two aspects.

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