Tourism Route Plan Algorithm Based on Sight Spot Buffer Motive Iteration

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Abstract—Currently, tourism plan cannot fully consider tourists’ individual interests. And routes planned cannot meet tourists’ best motive benefits. As to the problems, this paper brings forward tourism route plan algorithm basing on sight spot buffer motive iteration. Firstly, sight spot buffer model is set up and sight attracting factors and indexes are confirmed, on which basis, sight spot interval iteration model is set up. Through test example, optimal and suboptimal tourism routes which meet individual interests and best motive benefits are obtained. Example proves that this algorithm model can fully consider tourists’ interests and output tourism routes to meet tourists’ motive benefits, which is feasible and practical.

Keywords—sight spot buffer; tourism motive; motive iteration; route plan

I. INTRODUCTION

Tourists need to plan their tourism routes before visiting a city. Currently, urban tourism route plan has many limitations. Generally, tourists obtain tourism information and route information by purchasing books, visiting websites or travel agencies passively. It is difficult to extract valuable information which can satisfy tourists’ motive benefits from mass information. Tourism routes are mainly based on the interest of the mainstream, which has a great blindness and can hardly meet the interests of individuals. As to the existing problems, this paper brings forward tourism route plan algorithm based on sight spot buffer motive iteration to meet the individualized needs of tourists. Based on the individualized needs of tourists, firstly, this algorithm sets up a sight spot buffer model. Then, taking advantage of sight spot interval motive factor, this algorithm calculates the output value of the motive benefits iteratively and views the route which has the highest motive benefits as the optimal tourism route. The algorithm can reasonably output the tourism route which meets the individualized needs of tourists, which is feasible and practical.

II. SIGHT SPOT BUFFER AND SIGHT SPOT INTERVAL MOTIVE ITERATION MODEL

Urban sight spots are concentrated holistically and independent individually, and located in different geographical locations. The attraction of urban sight spots is determined by many factors, such as, star level, comprehensive evaluation index, accommodation convenience, traffic convenience, consumption convenience and so on. Tourists’ motivation to visit a spot results from multiple factors.

• Definition 1. Sight attracting factors $\delta$. The attraction index of a sight spot determined by the star level, comprehensive evaluation index, accommodation convenience, traffic convenience and consumption convenience.

Sight attracting factors are determined in a certain buffer. A buffer is a certain object’s spatial neighborhood. The size of the neighborhood is determined by the radius or the conditions. Thus, as to a certain object $K$, its buffer can be defined as follows:

$$P = \{x \mid d(x,K) \leq r\}$$

(1)

That is, the buffer of the object $K$ whose radius is $r$, is the set of all the points whose distance $d$ to $K$ is less than $r$. Generally, $d$ is the smallest Euclidean distance, but it also can be another defined distance.

Taking the sight spot as the center and $r$ as the radius, a sight spot buffer is set up. In the buffer, we can search for the number of hotel $t_1$, the number of the bus and subway station $t_2$, and the number of store and mall $t_3$. By combining star level $k_1$, and comprehensive evaluation index $k_2$, sight attracting factors $\delta$ and indexes $I_{\delta}$ are confirmed.

$$t_1 \in [0, \infty] \in \mathbb{R}^+, \ k_1 \in (0,5] \in \mathbb{Z}^+, \ k_2 \in (0,10] \in \mathbb{R}^+.$$

$$I_{\delta} = \sum_{i=1}^{3} 0.01t_i + \sum_{j=1}^{3} 0.01k_j$$

(2)

After choosing $n$ sight spots $N_n$ according to their own interests and hobbies, usually, tourists do one-way and non-repeated browse in a certain order during a limited time. That is, one sight spot is only browsed once. Theoretically, there are $A_n^n$ tourism routes, however, not all tourism routes are the best. From the beginning spot to the ending spot, tourism routes are different, which influence the satisfaction of tourists.
• **Definition 2.** Sight spot interval motive influence factor \( z_u \). Factors affecting the motivation of tourists during the tourism, \( u \in (0, \max u] \in Z^+ \). It mainly includes the interval distance \( s \), the number of the routes of the bus and the subway \( q \), the cost of taxi \( c \) and the number of traffic lights \( l \).

Taking \( \max u = 4 \) as an example, each sight spot interval motive influence factor index is shown in Table I.

<table>
<thead>
<tr>
<th>( z_u )</th>
<th>( u = 1 )</th>
<th>( u = 2 )</th>
<th>( u = 3 )</th>
<th>( u = 4 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Val.</td>
<td>( s^{-1} )</td>
<td>( 0.1q )</td>
<td>( c^{-1} )</td>
<td>( l^{-1} )</td>
</tr>
</tbody>
</table>

• **Definition 3.** Sight spot interval motive iteration value \( w_b \). The comprehensive index produced by the iteration of each motive factor between two sight spots, which has an influence on tourists’ motivation, from the previous sight spot to the next sight spot, and \( b \in (0, n-1] \in Z^+ \). Sight spot interval motive iteration model is shown in Formula 3 based on sight spot buffer model and sight attracting factors \( \delta \).

\[
w_b = \sum_{u=1}^{\max u} W_0 z_u + W_0 I_\delta \tag{3}
\]

• **Definition 4.** Tourism route motive iteration value \( W \). The total amount of iteration values which all the sight spots output from the beginning spot to the ending spot. Tourism route motive iteration model is shown in Formula 4 based on sight spot buffer model and sight attracting factors \( \delta \).

\[
W = \sum_{b=1}^{n-1} W_b \tag{4}
\]

III. ALGORITHM MODEL DESIGN

Firstly, tourists choose \( n \) sight spots according to their own interests and hobbies. Then, the system calculates the iteration value of the tourism motive index. Taking Zhengzhou city as an example, the algorithm has been given as follows.

A. **Set up Sight Spot Buffer Model**

Taking the main sight spots in the city as the center, a sight spot buffer model with a certain radius has been set up. At the same time, sight attracting factors \( \delta \) and indexes \( I_\delta \) are obtained. Figure 1 shows several representative sight spot buffer and interval distance. The distance between spot \( N_a \) and spot \( N_a \) is \( d_{\delta \delta} \). Table 2 shows sight attracting factors \( \delta \) and indexes \( I_\delta \).

![Figure 1. Several representative sight spot buffer and interval distance](image)

<table>
<thead>
<tr>
<th>( \delta )</th>
<th>( I_1 )</th>
<th>( I_2 )</th>
<th>( I_3 )</th>
<th>( I_4 )</th>
<th>( I_5 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( N_1 ) Water Park</td>
<td>8</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>( N_2 ) Henan Museum</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>( N_3 ) Chinese Redbud Mountain</td>
<td>12</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>( N_4 ) Memorial Hall</td>
<td>19</td>
<td>6</td>
<td>8</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>( N_5 ) Zhengzhou Science and Technology Museum</td>
<td>10</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>( N_6 ) WanDa plaza</td>
<td>9</td>
<td>3</td>
<td>6</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>( N_7 ) Zhongyuan Fortaleza</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

B. **Calculate Sight Spot Interval Motive Iteration Value and Tourism Route Motive Iteration Values**

As to the \( n \) selected sight spots, there are \( A_n^m \) tourism routes. As to the first tourism route, sight spot interval motive iteration value and tourism route motive iteration model \( W_1 \) are calculated. Similarly, the remaining \( A_n^m - 1 \) tourism route motive iteration values are calculated. The bubble sort algorithm is as follows:

• **Step.1** Construct the iteration value bubble vector \( \overline{W} \) with \( A_n^m \) elements numbers.

• **Step.2** Calculate the first route and get \( W_1 \), and \( count = 1 \).

• **Step.3** Calculate the second route and get \( W_2 \). If \( W_1 > W_2 \), place \( W_1 \) in the first elements number of \( \overline{W} \) and place \( W_2 \) in the second elements number of \( \overline{W} \); if \( W_2 > W_1 \), place \( W_2 \) in the first elements
number of $\overline{W}$ and place $w_j$ in the second elements number of $\overline{W}$, and $count = 2$.

- **Step.4** Calculate the third route and get $W_3$. Go through and compare $w_1$, $w_2$ and $w_3$. Place the maximum value in the first elements number of $\overline{W}$. Place the second maximum value in the second elements number. Place the minimum value in the third elements number and $count = 3$.

- **Step.5** And so on, when $count = A^*_{n}$, the algorithm ends. There are $A^*_{n}$ results are obtained by the bubble sort. Thus, the iteration value bubble vector is obtained.

According to results, the route which is placed in the first element number of the iteration value bubble vector $\overline{W}$ is the optimal route. The optimal route fully considers the individualized needs of tourists, and can maximize their motive benefits. The route which is placed in the second element number of the iteration value bubble vector $\overline{W}$ is the suboptimal route.

IV. EXAMPLE ANALYSIS

Take the representative sight spots in table 2 as an example, a tourist chooses to visit the Henan museum $N_2$, Zhengzhou science and technology museum $N_5$ and Wanda plaza $N_6$ in one day, according to his own interests. There are 6 visiting sequences. An iteration value bubble vector with six element numbers is constructed $\overline{W} = [w_1, w_2, w_3, w_4, w_5, w_6]$. Sight spot interval motive influence factor index is obtained according to the geographic information of sight spots interval. By combining sight attracting factors $\delta$ and indexes $I, \delta$, the system bubble output tourism route motive iteration values. The results are shown in Table 3.

<table>
<thead>
<tr>
<th>$N$</th>
<th>$z_1$</th>
<th>$z_2$</th>
<th>$z_3$</th>
<th>$z_4$</th>
<th>$w$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-5-6</td>
<td>0.122/0.222</td>
<td>0.500/0.500</td>
<td>0.063/0.091</td>
<td>0.067/0.111</td>
<td>2.156</td>
</tr>
<tr>
<td>2-6-5</td>
<td>0.102/0.222</td>
<td>0.500/0.500</td>
<td>0.053/0.091</td>
<td>0.050/0.111</td>
<td>2.109</td>
</tr>
<tr>
<td>5-2-6</td>
<td>0.122/0.102</td>
<td>0.500/0.500</td>
<td>0.063/0.053</td>
<td>0.067/0.050</td>
<td>1.917</td>
</tr>
<tr>
<td>5-6-2</td>
<td>0.222/0.102</td>
<td>0.500/0.500</td>
<td>0.091/0.053</td>
<td>0.111/0.050</td>
<td>2.089</td>
</tr>
<tr>
<td>6-2-5</td>
<td>0.102/0.122</td>
<td>0.500/0.500</td>
<td>0.053/0.063</td>
<td>0.050/0.067</td>
<td>1.937</td>
</tr>
<tr>
<td>6-5-2</td>
<td>0.222/0.122</td>
<td>0.500/0.500</td>
<td>0.091/0.063</td>
<td>0.111/0.067</td>
<td>2.156</td>
</tr>
</tbody>
</table>

Through calculating iteratively and bubble sort, we can find out that, both visiting sequence 2-5-6 and 6-5-2 have the highest motive iteration value of tourism routes. It is easier for tourists to obtain the greatest motive benefits satisfaction according to the two tourism routes. Next is the visiting sequence 2-6-5, which is the suboptimal route. Tourists can choose the tourism route which is the most suitable for themselves according to the schedule and their own interests.

Figure 2 is sequence of the two optimal routes and one suboptimal route. Figure 3 is the guide maps of the two optimal routes and one suboptimal route.

V. CONCLUSION

This paper brings forward tourism route plan algorithm based on sight spot buffer motive iteration, based on the existing problems of tourism route plan. Through setting up the sight spot buffer and sight spot interval motive iteration model, the system calculates iteratively and bubble output the optimal tourism route which has the best iteration value. Through the
analysis of the examples, this algorithm model can fully consider tourists’ interests and output tourism routes to meet tourists’ motive benefits, which is feasible and practical.

REFERENCES


