Urban scenic spot interest space research based on transportation junction buffer

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Abstract. According to city tourism features, this paper studies the urban scenic spot interest space based on transportation junction buffer. City tourism features and the transportation junction radiation impact on scenic spots are studied. Take Zhengzhou city as an example, urban scenic spots are sampled and classified. Research range and objects are confirmed. By setting up buffer model and interest field data model, tourists’ interests on scenic spots within buffers are studied quantitatively. Scenic spot interest space is studied and analyzed. Meanwhile, tourism decision support projects relying on scenic spot interest space are provided for tourists to refer to.

1. Introduction
Urban scenic spot spatial distribution plays an important role on attracting tourists to visit the city. Not all the scenic spots have the same appeal on different tourist groups. Usually, the first destinations are bus stations, railway stations and airport, etc[1]. There is a close relationship between transportation junction and scenic spots. Tourists visit scenic spots relying on their interests. Thus, scenic spot spatial distribution within transportation junction buffer has a great impact on the tourist motive[2]. In this paper, interest field of three tourist groups is set up. The geographic spatial analysis model set up on the basis of transportation junction buffer is brought forward and used to study scenic spot interest space, and then decision support projects are provided for tourists.

2. Research objects sampling
In Zhengzhou, there are Zhengzhou railway station and Zhengzhou east railway station, Central bus station, Long-distance central bus station, East bus station, North bus station and West bus station. They are set as research objects I. Relying on attribute features, scenic spots can be divided into Park and green field, Amusement, Venue and Shopping center, labelled by A, B, C and D and set as research objects II.
A={A1: Zhengzhou botanic garden; A2: Bishagang park; A3: Renmin park; A4: Zijingshan park; A5: Lvcheng square; A6: Forest park; A7: Zhengzhou zoo; A8: Lvying park; A9: Wenhua park; A10: Yueji park; A11: Xilihu park};
B={B1: Century play yard; B2: Water park; B3: Fount world; B4: Bar street};
C={C1: Henan museum; C2: Zhengzhou museum; C3: Zhengzhou science and technology museum; C4: Erqi memorial; C5: Zhongyuan tower; C6: Zhengzhou aquarium};
D={D1: Wangfujing mall; D2: Erqi Uanda; D3: Zhongyuan Uanda; D4: International trade 360; D5: CC mall; D6: Erqi Dehua; D7: Big Shanghai city; D8: Renminlu Dennis}.
Arcgis9.0 software is used to draw the spatial distribution of transportation junctions and scenic spots as Figure.1 shows. Class A is rectangle, Class B is triangle, Class C is diamond and Class D is roundness. Railway station is texture roundness while bus station is texture rectangle.

![Figure.1 Transportation junctions and scenic spots spatial distribution](image1)

![Figure.2 Transportation junction buffer topology net and buffer radiation impact model](image2)

3. Buffer and interest field modeling

Buffer model is used to research spatial relationship. Three-level buffers are founded. Questionnaire survey is used to obtain data to set up three groups’ interest field and study the relationship between tourist interests and transportation junction radiation impact as well as scenic spots distribution.

3.1 Buffer modeling

Point buffer research method is used. As to a certain object $W_i$, its buffer area is defined as follows.

$$ P = \{ x | d(x, W_i) \leq R \} \quad (1) $$

Object $W_i$ buffer area with neighborhood radius $R$ is the collection of points whose distance $d$ to object $W_i$ are less than $R$ [3]. Objects I are set as center, $R_1 = 3 \text{ km}$, $R_2 = 5 \text{ km}$ and $R_3 = 8 \text{ km}$ are taken as radius to found buffer model. Two railway stations are set as $P_1$ and $P_2$. Bus stations as $Q_1$, $Q_2$, $Q_3$, $Q_4$ and $Q_5$. Transportation junction buffer topology net and buffer radiation impact model are set as Figure.2 shows. The thickest inner ring is $R_1$, imaginary line is $R_2$ and the outer ring is $R_3$.

3.2 Interest field data modeling

Enough samples are used to do questionnaire survey. Each group contains 100 samples and the ages are averaged. Each sample has certain tourism interest and all samples take part in[4,5]. Data is shown in Table 1. Interest field is shown in Figure.3. Each scenic spot data is arranged from left to right. Red is the middle and old group. Blue is young adults group. Brown is children group.

| Scenic spots      | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | B1 | B2 | B3 | B4 |
|-------------------|----|----|----|----|----|----|----|----|----|-----|-----|----|----|----|----|
| The middle and old| 86 | 75 | 91 | 79 | 56 | 23 | 78 | 43 | 33 | 36  | 47  | 23 | 25 | 19 | 11 |
| Young adult       | 45 | 52 | 58 | 66 | 34 | 10 | 70 | 26 | 19 | 29  | 33  | 44 | 65 | 50 | 46 |
| Children          | 22 | 46 | 32 | 31 | 20 | 11 | 80 | 12 | 10 | 19  | 27  | 96 | 93 | 86 | —  |
| Scenic spots      | C1 | C2 | C3 | C4 | C5 | C6 | D1 | D2 | D3 | D4  | D5  | D6 | D7 | D8 | —  |
| The middle and old| 66 | 58 | 24 | 76 | 26 | 37 | 34 | 45 | 39 | 50  | 29  | 61 | 50 | 34 | —  |
| Young adult       | 54 | 49 | 32 | 74 | 34 | 55 | 87 | 86 | 93 | 81  | 70  | 95 | 88 | 79 | —  |
| Children          | 30 | 38 | 88 | 34 | 31 | 65 | 45 | 50 | 44 | 39  | 31  | 45 | 25 | 33 | —  |
Relying on the data, park and green field attracts the middle and old most, and then attracts the young adults; it attracts children least. Playground yard attracts children most except Bar Street, and then attracts young adults; it attracts the middle and old least. Each venue attracts three groups fairly. Zhengzhou science and technology museum and Zhengzhou aquarium attract children most. Erqi memorial attracts the middle and old and young adults most. Transportation junction buffer’s impact on each scenic spot is greatly related to tourist group’s interest field.

4. Decision support of scenic spot interest space

4.1 Scenic spot interest space analysis

Scenic spots spatial structure within buffer in the range of transportation junction radiation impact is analyzed and Table.2 scenic spot spatial distribution data within three-level buffers is obtained.

| $0 < r \leq 3km$ | $3 < r \leq 5km$ | $5 < r \leq 8km$ |
|------------------|------------------|------------------|
| $P_1$            | $P_2$            | $Q_1$            | $Q_2$            | $Q_3$            | $Q_4$            | $Q_5$            |
| $A_1, C, D_6$    | $A_4$            | $C_6$            | $D_6$            | $A_7, A_8$       | $A_2, A_9, D_1$ |
|                  | $D_6, D_7$       | $C_6, D_6$       | $C_6, D_6$       | $A_7, A_8$       | $A_2, A_9, D_1$ |
| $A_2, A_5$       | $A_2, A_5$       | $A_2, A_5, C_2$  | $A_2, A_5, C_2$  | $A_1, A_6$       | $A_2, A_5, C_2$  |
| $B_1, C_3$       | $A_2, A_5, C_2$  | $B_1, C_3$       | $B_1, C_3$       | $A_2, A_5, C_2$  | $A_2, A_5, C_2$  |
| $A_5, A_9$       | $A_7, A_9, A_10$ | $A_1, A_6, C_3$  | $A_1, A_6, C_3$  | $A_2, A_5, C_2$  | $A_2, A_5, C_2$  |
| $A_{10}, B_1, D_3$ | $B_1, C_3$       | $A_2, A_5, C_2$  | $A_1, A_6, C_3$  | $A_2, A_5, C_2$  | $A_2, A_5, C_2$  |
| $D_7$            | $B_1, C_3$       | $A_2, A_5, C_2$  | $A_1, A_6, C_3$  | $A_2, A_5, C_2$  | $A_2, A_5, C_2$  |

Main scenic spots and transportation junctions’ spatial relationship in urban Zhengzhou as well as impact on scenic spots are shown in table.2. The following conclusion is obtained.

- Railway transportation.
  Zhengzhou railway station $P_1$ is located in the center downtown and has great radiation impact. Within 3 km buffer, park and green field, venue and shopping center attract the middle and old and young adults. Within 3–5 km buffer, playground yard turns out to attract children. Within 5–8 km buffer, park and green field and shopping center take up a great quantity.

- Zhengzhou east railway station $P_2$ is far away from downtown. Only within 5–8 km buffer, a few scenic spots meet the interest needs. Its radiation impact is inferior to Zhengzhou railway station.

- Bus transportation.
  Central bus station $Q_1$ is close to Zhengzhou railway station and has the fair radiation impact. Long-distance central bus station $Q_2$ is located in south downtown and impacts south scenic spots. Within 3 km buffer, shopping center and venue meet the needs of the middle and old and young adults.
Within 3~5 km buffer, there exist park and green field and venue. Zhengzhou science and technology museum meets the needs of most children.

East bus station Q3 is located in the east downtown and impacts east scenic spots. Within 3 km buffer, only one venue and one shopping center meet interest needs. Within 3~5 km buffer, park and green field, venue and shopping center meet the needs of the middle and old and young adults. Within 5~8 km buffer, plenty of playground yard meet the needs of children while other scenic spots are also plentiful. It illustrates that East bus station has better and greater radiation impact.

North bus station Q4 is located in the north downtown and impacts north scenic spots. Within 3 km buffer, all kinds of scenic spots meet all groups’ needs. Within 3~5 km buffer and 5~8 km buffer, fewer scenic spots meet three groups’ interest needs.

West bus station Q5 is located in the west downtown and impacts west scenic spots. Within 3 km buffer, park and green field and shopping center meet the middle and old and young adults. Within 3~5 km buffer, venue turns out. Within 5~8 km buffer, plentiful scenic spots meet all groups’ needs.

4.2 Decision support analysis
Transportation junction and scenic spot geographic spatial distribution are studied. Relying on interest space model and analysis, decision support projects are provided as follows.

As to long-distance tourists, choosing Zhengzhou railway station or Central bus station can reach scenic spot in short time, which is convenient. If choosing Zhengzhou east railway station, tourists should spend more time and fee on taxi, subway or public bus to reach scenic spot.

Besides, short-distance tourists can choose other bus stations in downtown. These bus stations are far away from city center, which can avoid traffic jam as much as possible. Meanwhile, as to each station, within three-level buffer, there exist different scenic spots to meet tourists’ interest needs.

In order to get maximum motive benefit, tourists should rely on their own interests, transportation junction radiation impact and scenic spot spatial distribution to choose proper station and scenic spots.

5. Conclusion
This paper studies the urban scenic spot interest space distribution set up by transportation junction buffer. According to different tourist group interests, scenic spots are divided into four categories. It researches the transportation junction’s radiation impact on scenic spots. By studying scenic spot interest spatial distribution, decision support projects are provided for tourists. In order to get maximum tourist motive benefit, tourists should rely on their own interests, transportation junction radiation impact and scenic spot spatial distribution to choose proper station and scenic spots.

References
[1] WANG C Y, QU H L. Tourist motive, destination image and tourism expectation. Tourism Tribune, 2013, 28(6), p.26-34.
[2] LI X J, CUI S S, ZHANG K. Neural net method of best tourism route choice. Transportation and Computer, 2006, 24(5), p.103-106.
[3] Manuel V. Robertico R C( 2000) . Evaluation of demand US tourists to Aruba. Annals of Tourism Research’27(4), p.946-963.
[4] Vansteenwegen P, Van Oudheusden D( 2007) . The mobile tourist guide: an OR opportunity. OR Insight, 20( 3), p.21-27.
[5] Bosque I R, Martin H S. Tourist satisfaction: A cognitive affective model [J]. Annals of Tourism Research, 2008, 35(2), p.551-573.