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TDIVis: visual analysis of tourism destination images

Key words: Tourism user-generated content; Information visualization; Destination image; Sentiment visualization; Sequence visualization

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Motivation

1. The research on construction and analysis of the destination image using questionnaire survey is limited by time and questionnaire design.
2. It is difficult for tourism researchers to obtain a relatively complete and intuitive destination image due to the unintuitive destination image display, the significant variance in departure time and data length, and the destination type in UGC data.
3. Few tourism UGC text visualization studies focus on visual design.

Contribution

1. We design a keyword-based sentiment visualization method to correlate the cognitive image and the emotional image of the destination.
2. We propose a multi-attribute association double sequence visualization method correlating two different types of text sequences, aimed at discovering the similarities and differences between destination images, which are mined from travel blogs and comments.
3. We design and implement an interactive visualization system to help users build an overall image, time sequence, and classification of the tourism destination image.

Requirement analysis

1. Cognitive image analysis, including analysis of the overall cognitive image and the cognitive image category
2. Emotional image analysis, including detailed analysis of a single category and comparative analysis of different categories
3. Temporal analysis of the cognitive image and emotional image
4. Comparative analysis of image text
5. Original text analysis

Method

1. Keyword-based sentiment visualization method

   Visual encoding: color, position, shape, and length

   Layout: basic layout, sequential evolution layout, and classification comparison layout

   Interaction design: filtering, associating, and adding layer

2. Multi-attribute association double sequence method

   Visual encoding: position, color, and area markers

   Layout: time-aggregated text sequence layout and the original text sequence layout

   Interaction design: “levitation+highlighting” and dynamic encoding

System overview

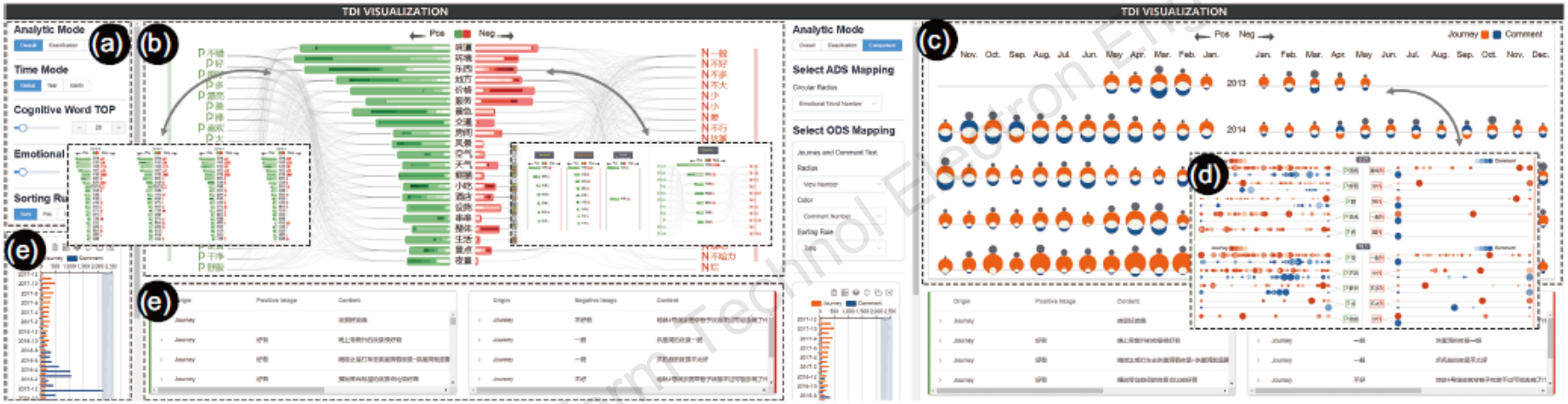

Fig. 1 User interface of TDIVis: (a) the control panel allows users to filter the data and update other views; (b) the overall view shows the cognitive and emotional images of the destination, which can switch between classification analysis and sequence evolution analysis modes; (c) the association double sequence view provides summary information for each attribute of text aggregated over time; (d) based on the selection of view (c), the original double sequence view shows the image distribution of the travel blog sequence and the comment sequence of a certain time node; (e) auxiliary views help users better understand the destination image, including a bar chart for viewing the amount of text over time and an original text view. References to color refer to the online version of this figure

Evaluation

1. Case study

Table 1 Correspondence between visualization tasks and case analysis

Case name	Experiment detail	Visualization task
Overall image analysis	Cognitive and emotional images	T1.1, T2.1, and T5
Classification comparison image analysis	Attraction, facility service, and social environment	T1.2 and T2.2
Time sequence image analysis	Annual granularity and monthly granularity	T3.1, T3.2, and T5
Text comparison image analysis	Comparative analysis of travel blogs and comments	T4 and T5

Evaluation (Cont'd)

2. User study

Questionnaire (to verify the effectiveness of TDIVis):

Q1: Is it convenient for you to construct the image of Chengdu, including the cognitive image and emotional image?

Q2: Is it easy for you to understand the evolution of the image at different times of granularity?

Q3: By classifying images, is it easy for you to compare the images of different categories?

Q4: Is it easy for you to find the difference between the image descriptions of travel blogs and comments at different time points?

Q5: Overall, is it easy for you to construct a relatively complete destination image?

Evaluation (Cont'd)

2. User study

Questionnaire (to verify the usability of TDIVis):

Q6: Is it easy for you to learn and use TDIVis?

Q7: Is it easy for you to understand the overall visual designs of TDIVis?

Participants: 11 participants (4 females and 7 males)

Evaluation (Cont'd)

2. User study

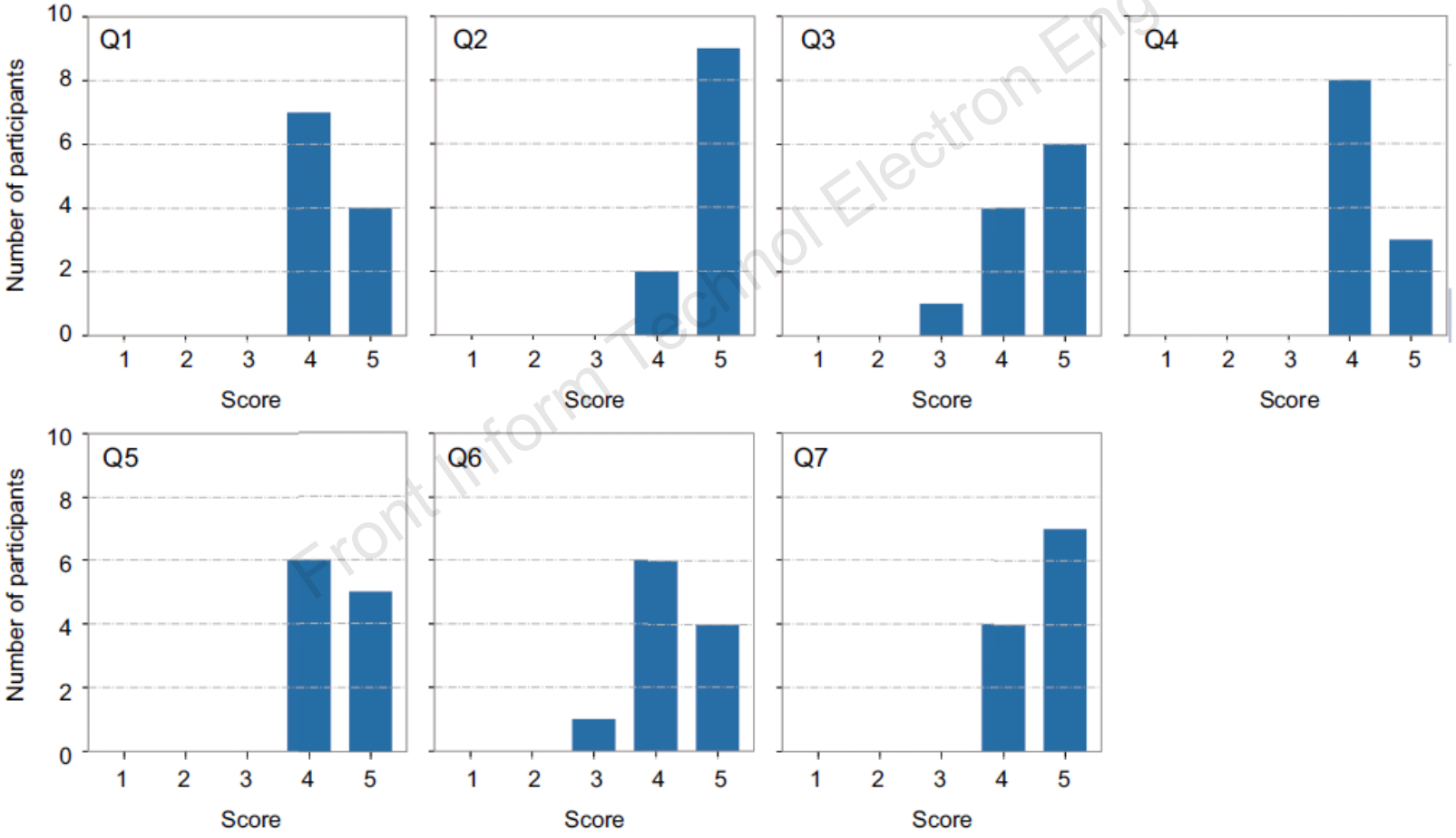

Fig. 12 Results from the user study. The users responded to questions 1–7 on a five-point Likert scale, with responses 1–5 representing the difficulty scale ranging from "very difficult" to "very easy"

Conclusions

1. We have proposed a system to help users build a relatively complete destination image.
2. We have proposed a keyword-based emotion visualization method and a multi-attribute association double sequence visualization method.
3. We have used the UGC on Chengdu City to conduct four case studies and a user study to verify the effectiveness and usability of our visualization system.