Travel Scheduling System based on Spot Evaluation

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Outline of presentation

Introduction
  * Background and Objectives

Outline of the Travel Scheduling System based on Spot Evaluation

Example of Implementation
  * Creating a prototype of our system

Conclusion
Will you become feelings that you want to go on a trip suddenly?

Afterwards, what action do you take when thinking about the travel scheduling?
Rapid growth of the Internet

Collecting information about travel spots that oneself wants to go.

I want to travel. But it is troublesome to make a schedule.

Offering a package tour

Expensive!
No desired tour

Not found information
Need much time

Travel agency

User
We propose the system which makes a travel schedule

**Input data**

First image and Interest for the destination

**Travel Scheduling System**

User

Output schedules

Retrieving detailed information about travel destinations.
Related work

Information recommendation

- Multiagent interact with a user through a character, and recommends information to a user competitively [Sakamoto 03]
- System recommends a destination by showing the user's desired phrase. [Fujimoto 02]

Travel scheduling system

- Travel scheduling system using the agent [Ohama 96],
- Personal navigation system P-Tour [Shiraishi 05],
  - travel scheduling function and travel navigation function
In P-Tour, the user has to get the knowledge of the destination in advance.

User

I do not want to collect information about a destination in advance.

User has first image and interest for the destination

we propose the system which makes a travel schedule by using the first image and interest for the destination as input data.
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**Conclusion**
The content of 2nd section is as follows.

- Database
- User Input Data
- Schedule-making Process
- Schedule Evaluation Value
- Schedule Tree
- Schedule decision by user
System that we propose

First image and Interest for the destination

User

Retrieving detailed information about travel destinations.

Travel Scheduling System

Input data

Output schedules

Database

Other users
The set of spots in the destination $D$ is defined as

$$S = \{s_k \mid 0 < k \leq n, \ k \in \mathbb{N}\}$$

A spot $s_k$ consists of components:

- $P_k$ : Property Value
- $To_k$ : Opening Time
- $Tc_k$ : Closing Time
- $st_k$ : Staying Time
- $b_k$ : Budget
- $Eob_k$ : Objective Evaluation
- $g_k$ : Geolocation

An example of property values:

- Culture
- History
- Nature
- Local Specialty
- Traditional Craft
- Marine Spots
- Hotel
- Drinking and Eating
The set of spots in the destination $D$ is defined as

$$S = \{ s_k \mid 0 < k \leq n, \ k \in N \}$$

A spot $s_k$ consists of components as follows.

- $P_k$ : Property Value
- $T_{O_k}$ : Opening Time
- $E_{ob_k}$ : Objective Evaluation Value
- $g_k$ : Geolocation

We make it based on information provided through the grapevine of tourists and local persons.
II. Travel Scheduling System based on Spot Evaluation

System that we propose

Input data

First image and Interest for the destination

Travel Scheduling System

Database

Other users

User

Retrieving detailed information about travel destinations.

Output schedules

Other users

User Input data
A user answers the following questions.

\( Q_1 \): In a trip to destination \( D \), please arrange from \( a \) to \( c \) in high order of the importance.
   \( a. \) hotel, \( b. \) drinking and eating,
   \( c. \) sightseeing (except drinking and eating)

\( Q_2 \): Please select your image for destination \( D \) among the following alternatives.
   (multiple answers allowed).
   \( p_1, p_2, \ldots, p_{m-2} \)

\( Q_{31} \): Are you interested in \( p_1 \) of destination \( D \) ? (Yes/No)
\( \vdots \)
\( Q_{3(m-2)} \): Are you interested in \( p_{m-2} \) of destination \( D \) ? (Yes/No)

\( Q_4 \): How much is the budget for your tour to destination \( D \)?
   However, an airfare and a car rental fare are excluded.

\( Q_5 \): Please answer on the arrival date and hour to destination \( D \)
   and the departure date and hour from destination \( D \).
The content of 2\textsuperscript{nd} section is as follows.

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II. Travel Scheduling System based on Spot Evaluation

User’s answers to questions + Database

Subjective evaluation value $E_{sb_k}$ of a spot $s_k$

Set $C$

Elements of $C$ are spots which are $E_{sb_k} > 0$.

$$C = \{c_1, c_2, K, c_q\}$$

These spots are used to make a schedule.
II. Travel Scheduling System based on Spot Evaluation

$s_{ij} \in C$ is $j$th spot on $i$th day.

$s_{ij}$ has three following data about the time.

\begin{align*}
t_{ij} & : \text{Traveling time} \\
l & : \text{Spare time} \\
st_{ij} & : \text{Staying time}
\end{align*}

Time to adjust it when a user cannot travel each spot on schedule.
Some schedules are made from spots of $C$ to satisfy the following conditional expression, the budget for the tour, and the constraints for each time zone.

$$\sum_{i=1}^{L} \sum_{j=1}^{M} (t_{ij} + \lambda + st_{ij}) \leq L \cdot M$$
The content of 2nd section is as follows.

- Database
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- Schedule Tree
- Schedule decision by user
For making the schedule tree

II. Travel Scheduling System based on Spot Evaluation

The user’s answers to questions + Database

Subjective evaluation value $E_{sb_k}$
Objective evaluation value $E_{ob_k}$

Summation $E_{sum_k}$ of Spot evaluation value $E_{s_i}$
Average $E_{ave_k}$ of Spot evaluation value $E_{s_i}$
Time evaluation value $E_{t_k}$

Schedule Evaluation Value $E_{sc_k}$

As $E_{sc_k}$ becomes higher, the line width becomes wider.
The spot evaluation value $E_{s_i}$ is calculated from the objective evaluation value $E_{sb_i}$ and the subjective evaluation value $E_{ob_i}$.

**Spot Evaluation Value**

$$E_{s_i} = E_{ob_i} + \frac{E_{ob_{\text{max}}}}{E_{sb_{\text{max}}}} E_{sb_i}$$

Spot evaluation value $E_{s_j}$ of spots in schedule $V_k$

**Summation of $E_{s_j}$**

$$E_{sum_k} = \sum_{j=1}^{w} E_{s_j}$$

**Average of $E_{s_j}$**

$$E_{ave_k} = \frac{E_{sum_k}}{\mathcal{W}}$$

The number of spots in $V_k$
II. Travel Scheduling System based on Spot Evaluation

Time Evaluation Value

\[ Et_k = \sum_{j=1}^{L} (Te - Th_j) \]

- \( Te \): Last arrival time to a hotel
- \( Th_j \): Arrival time to a hotel of \( j \)th day in schedule \( V_k \)

Time zone of arrival to the hotel

\[ Te - Th \]
Schedule Evaluation Value

II. Travel Scheduling System based on Spot Evaluation

\[
\text{Schedule Evaluation Value } E_{sc_k} \]

\[
\begin{align*}
\text{Summation } & E_{sum_k} \text{ of Spot evaluation value } E_{si} \\
\text{Average } & E_{ave_k} \text{ of Spot evaluation value } E_{si} \\
\text{Time evaluation value } & E_{t_k}
\end{align*}
\]

Schedule Tree

As \( E_{sc_k} \) becomes higher, the line width becomes wider.

This value decides the branch width of the schedule tree.
The content of 2nd section is as follows.

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To let a user select a schedule, a tree (called schedule tree) is created from spots of schedule $V_k$.
On selection screen, each spot of the schedule tree is shown to a user in turn.
A process to construct the schedule tree is given below.

**Step 1:** If any schedule has the totally same spot element and turns tourist spots are different, a schedule with the minimum time evaluation value is selected from them.

**Step 2:** As shown Fig. 3, each spot of $V_k$ is classified in a hotel, drinking and eating, sightseeing (except drinking and eating). The classified groups are sorted according to the important order of answers for the question $Q_I$. Spots in each group are sorted in high order based on each spot evaluation value, too.

**Step 3:** As shown Fig. 4, the schedule tree is built based on a result of step 2.
Step 1: If any schedule turns to have the totally same spot element but turns touring those spots are different, a schedule with the minimum time evaluation value is selected from them.

Step 2: As shown Fig. 3, each spot of \( V_k \) is classified in a hotel, drinking and eating, sightseeing (except drinking and eating). The classified groups are sorted according to the important order of answers for the question \( Q_1 \). Spots in each group are sorted in high order based on each spot evaluation value, too.

Step 3: As shown Fig. 4, the schedule tree is built based on a result of step 2.

User’s answers for the question \( Q_1 \)

Important  Unimportant

Sightseeing  >  Drinking and eating  >  Hotel
A process to construct the schedule tree is shown below.

**Step 1:** If any schedule has the totally same spot element and turns touring those spots are different, a schedule with the minimum time evaluation value is selected from them.

**Step 2:** As shown Fig. 3, each spot of $V_k$ is classified in a hotel, drinking and eating, sightseeing (except drinking and eating). The classified groups are sorted according to the important order of answers for the question $Q_I$. Spots in each group are sorted in high order based on each spot evaluation value, too.

**Step 3:** As shown Fig. 4, the schedule tree is built based on a result of step 2.

Spot evaluation value

Spot 9 > Spot 2 > Spot 3 , Spot 22 > Spot 23

User's answers for the question $Q_1$

Important Unimportant

Sightseeing > Drinking and eating > Hotel

Spot evaluation value

Spot 9 > Spot 2 > Spot 3 , Spot 22 > Spot 23
II. Travel Scheduling System based on Spot Evaluation

Result of applying step 2 to 12 schedules.

An example of schedule tree built based on the left figure.
The content of 2nd section is as follows.

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- Schedule decision by user
On the following selection screen, a user decides a schedule by selecting spots sequentially.

Spots alternative is displayed around a center point.

1st day:
Please select a spot which you are interested in most.
There is correspondence relation between a line width and a schedule evaluation value.

As the evaluation value becomes higher, the line width becomes heavier.

1st day:
Please select a spot which you are interested in most.
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As a prototype of our system, we implemented the system that destination is OKINAWA.
Example of Implementation

Database

21 places of sightseeing spots (No.1-21) and
10 places of drinking and eating spots (No.22-31),
6 places of hotels (No.32-37)

Time zone

Activity time zone of a day  9:00 - 21:00 (M=12 hours)
Lunch time zone  11:00 - 13:00
Dinner time zone  17:00 - 19:00
Time zone of arrival to the hotel  19:00 - 21:00
A user answers the following questions.

\( Q_1 \) : In a trip to OKINAWA, please arrange from \( a \) to \( c \) in high order of the importance.
   - \( a \). hotel,
   - \( b \). drinking and eating,
   - \( c \). sightseeing (except drinking and eating)

\( Q_2 \) : Please select your image for OKINAWA among the following alternatives. (multiple answers allowed).

\( Q_{31} \) : Are you interested in culture of OKINAWA? (Yes/No)

\( Q_{34} \) : Are you interested in Local Specialty of OKINAWA? (Yes/No)

\( Q_4 \) : How much is the budget for your tour to OKINAWA? However, an airfare and a car rental fare are excluded.

\( Q_5 \) : Please answer on the arrival date and hour to OKINAWA and the departure date and hour from OKINAWA?
Example of Implementation

A user answers the following questions.

\( Q_1 \): In a trip to OKINAWA, please arrange from \( a \) to \( c \) in high order of the importance.
- \( a \). hotel,
- \( b \). drinking and eating,
- \( c \). sightseeing (except drinking and eating)
\( c > b > a \)

\( Q_2 \): Please select your image for OKINAWA among the following alternatives. (multiple answers allowed).
1. Culture,
2. History,
3. Nature,
4. Local Specialty,
5. Traditional Craft,
6. Marine Sports

\( Q_{31} \): Are you interested in culture of OKINAWA? (Yes/No)
\( Q_{32} \): Are you interested in History of OKINAWA? (Yes/No)
\( Q_{33} \): Are you interested in Nature of OKINAWA? (Yes/No)

\( Q_{34} \): Are you interested in Local Specialty of OKINAWA? (Yes/No)

\( Q_4 \): How much is the budget for your tour to OKINAWA? However, an airfare and a car rental fare are excluded. \( Q_4 \): No

\( Q_5 \): Please answer on the arrival date and hour to OKINAWA and the departure date and hour from OKINAWA? \( Q_5 \): No
Example of Implementation
Example of Implementation

1st day:
Please select a spot which you are interested in most.

15. 海洋博物公園
2. 首里城
11. 琉球村
3. 識名園
9. 東南植物園
5. 玉泉洞

Select Step (1)
Example of Implementation

1st day:
Please select a spot which you are interested in most.

- 9. 東南植物園
- 3. 識名園
- 4. 旧海軍司令部

Select Step (2)
Example of Implementation

1st day:
The recommended schedule to you is as follows.

22. キャプテンプラザ（ステーキ）
5. 玉泉洞
9. 東南植物園
23. 御殿山（そば）
35. サンセットヒル沖縄

Result
In conclusion, we proposed the system which makes the travel schedule by using the first image and interests for the destination as input data, without collecting detailed information about the destination.

As a prototype of our system, we implemented it for OKINAWA tour.

The future direction of this study

- Improvement of calculation efficiency in the schedule-making process.

- Implementation of other destinations