SI²P: A Restaurant Recommendation System Using Preference Queries over Incomplete Information

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Outline

- Motivation
- Background
- System architecture
- Demonstration
Motivation

- **Preference query**
  - Offers more flexible answers
  - Provides a basis for rank-ordering objects

- **Incomplete data**
  - Universal in many applications
  - E.g., data integration, system failure
An example of missing data

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Avg. price</th>
<th>#Ratings</th>
<th>PositiveRate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>r₁</td>
<td>The Lobster Place</td>
<td>missing</td>
<td>1001</td>
<td>93.81</td>
</tr>
<tr>
<td>r₂</td>
<td>Colicchio &amp; Sons</td>
<td>missing</td>
<td>1367</td>
<td>91.22</td>
</tr>
<tr>
<td>r₃</td>
<td>Club A Steakhouse</td>
<td>40</td>
<td>2176</td>
<td>91.31</td>
</tr>
<tr>
<td>r₄</td>
<td>Keens Steakhouse</td>
<td>40</td>
<td>3474</td>
<td>90.50</td>
</tr>
<tr>
<td>r₅</td>
<td>Taim</td>
<td>missing</td>
<td>175</td>
<td>94.29</td>
</tr>
<tr>
<td>r₆</td>
<td>Dinosaur Bar-B-Que</td>
<td>20</td>
<td>688</td>
<td>91.72</td>
</tr>
<tr>
<td>r₇</td>
<td>Num Pang Sandwich Shop</td>
<td>missing</td>
<td>171</td>
<td>94.15</td>
</tr>
<tr>
<td>r₈</td>
<td>Market Table</td>
<td>30</td>
<td>295</td>
<td>92.54</td>
</tr>
<tr>
<td>r₉</td>
<td>Basso56</td>
<td>30</td>
<td>1608</td>
<td>89.99</td>
</tr>
<tr>
<td>r₁₀</td>
<td>The Little Owl</td>
<td>30</td>
<td>793</td>
<td>90.16</td>
</tr>
<tr>
<td>r₁₁</td>
<td>Gramercy Tavern</td>
<td>40</td>
<td>2201</td>
<td>90.23</td>
</tr>
<tr>
<td>r₁₂</td>
<td>Mighty Quinn’s</td>
<td>missing</td>
<td>298</td>
<td>90.94</td>
</tr>
</tbody>
</table>
Our goal

- Develop a restaurant recommendation system based on incomplete data
  - Support skyline and top-k dominating (TKD) queries over incomplete data
  - Support result explanation
- Demonstrate the effectiveness of the system over a real restaurant data set
Outline

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Background

- Dominance relationship on missing data
  - Given two objects $o_1$ and $o_2$, $o_1$ dominates $o_2$ iff $o_1$ is not worse than $o_2$ on every dimension, and better than $o_2$ on at least one dimension

- Skyline query on incomplete data
  - It finds all of the objects that are not dominated by any other object in the dataset

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<tr>
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<tr>
<td>$r_6$</td>
<td>Dinosaur Bar-B-Que</td>
<td>20</td>
<td>688</td>
<td>91.72</td>
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Top-$k$ dominating query (TKD) on incomplete data

- It retrieves the $k$ objects from the dataset with the highest scores

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<tr>
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</tr>
<tr>
<td>$r_8$</td>
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<td>295</td>
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<tr>
<td>$r_9$</td>
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<tr>
<td>$r_{12}$</td>
<td>Mighty Quinn’s</td>
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Browser side

- Provides interactions with a map using the Google Maps API
- Supports several functionality modules
  - Search target identification
  - Zoom in/out visualized search object
  - Flexible result ranking
  - Dataset re-visiting
Server side

- Built by using Flask
- Integrates skyline and TKD queries on incomplete data into PostgreSQL database
- When a new query request is coming, it invokes the functions of PostgreSQL
Server side (Cont.)

- **IkSB algorithm for skyline query**

- **UBB algorithm for TKD query**
Functions supported in PostgreSQL database

- **Skyline query**: SKYLINE(dataset)

  ```sql
  SKYLINE(SELECT restaurant_name, price[\text{min}],
           numer_of_ratings[\text{max}], positive_ratio[\text{max}]
      FROM restaurant)
  ```

- **TKD query**: TKD(dataset, parameter_k)
Server side (Cont.)

TKD((SELECT restaurant_name, price[\text{min}],
        numer_of_ratings[\text{max}], positive_ratio[\text{max}]
FROM restaurant
WHERE restaurant\_location is in New York), 12)

Table 1: A Real Dataset with \textit{Missing} Data

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Demonstration (1)
**Blue Ribbon Sushi**

258 Likes

Phone: 12123430404  Average Prices: $31 - 45
Address: 119 Sullivan St, Frnt A, New York City, NY 10012-3965

**Rating details**

- Excellent: 258
- Very good: 159
- Average: 38
- Poor: 8
- Terrible: 1

**Food**: ★★★★★
**Service**: ★★★★★
**Value**: ★★★★★
**Atmosphere**: ★★★★★

**Reviews**

Tucked under surprise  October 25, 2015

Tucked under street level this inconspicuous little restaurant was a real surprising find. Great ambiance and service in an authentic atmosphere. The sushi was extremely delicious.

---

**Search**

- **Queries**
  - Top-k dominance
  - Skyline
  - Range

- **Price**
  - 0
  - 50

- **Cuisines**
  - Seafood

**Sort by**: dominating score

**No result found matching your query**

There is no restaurant in the selected range. Below are the top 20 restaurants in the city.

1. The Lobster Place
   - Rating: ★★★★★ 1001 ratings

2. Colicchio & Sons
   - Rating: ★★★★★ 1367 ratings
Write a review for Blue Ribbon Sushi

Overall rating  Food rating  Service rating  Atmosphere rating  Value rating

Title

Summarize your visit

Your review

Tell people about your experience: your meal, atmosphere, service?

Submit
Any question?