**SEQ: Example-based Query for Spatial Objects**

Siqiang Luo, Jiafeng Hu, Reynold Cheng, Jing Yan, Ben Kao
The University of Hong Kong

**Motivation**

**Question:** when we are searching multiple spatial objects with complex requirements, what are we going to do?

- **Option 1:** SQL?
  - Difficult for non-expert users

- **Option 2:** Keyword search?
  - Hard to describe spatial layout characteristics

Hence, we are promoting more user-friendly search: **example-based spatial search**

**SEQ: Spatial Exemplar Query**

Consider renting a house:
Find an apartment which is close to a gym, and there is a café between them.

**Input:** mark an apartment, a gym and a café as a desired example

**Output:** A list of similar results

**Interface view**

**Analytical view**

---

**Query Definition**

**Definition (SEQ)** Given a spatial range R, an integer k, an example tuple t. The SEQ returns top-k similar tuples t₁, t₂, ..., tₖ with respect to the tuple similarity to t, such that all objects in t are located in R, and tᵢ is of the same category as t.

**Tuple Similarity:** \( \alpha \times \text{Spatial Similarity} + (1-\alpha) \times \text{Attribute Similarity} \)

**User input example**  
**Attribute Spatial**  
**Attribute Spatial**

**Algorithms**

1. Find all candidates, e.g., find all (Apartment, Gym, Café)
2. Object-wise ranking based on attribute similarity
3. Depth first search and prefix-based pruning

**Experiments**

Yelp dataset ([https://www.yelp.com/dataset_challenge](https://www.yelp.com/dataset_challenge))

**POI information:** location, category, rating, review count

- **α:** weight of spatial similarity  
- **k:** #returned results  
- **r:** the radius of search region (km)

**Pruning effectiveness:** the percentage of pruned candidates by prefix-based pruning

<table>
<thead>
<tr>
<th>α</th>
<th>0.1</th>
<th>0.3</th>
<th>0.5</th>
<th>0.7</th>
<th>0.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (ms)</td>
<td>316</td>
<td>336</td>
<td>338</td>
<td>349</td>
<td>380</td>
</tr>
<tr>
<td>Pruning effectiveness (%)</td>
<td>98.8</td>
<td>98.7</td>
<td>98.5</td>
<td>98.1</td>
<td>97.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>k</th>
<th>1</th>
<th>5</th>
<th>10</th>
<th>20</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (ms)</td>
<td>32</td>
<td>338</td>
<td>349</td>
<td>363</td>
<td>403</td>
</tr>
<tr>
<td>Pruning effectiveness (%)</td>
<td>99.8</td>
<td>98.5</td>
<td>98.1</td>
<td>97.5</td>
<td>96.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>r</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (ms)</td>
<td>68</td>
<td>161</td>
<td>338</td>
<td>586</td>
<td>847</td>
</tr>
<tr>
<td>Pruning effectiveness (%)</td>
<td>97.6</td>
<td>98.3</td>
<td>98.5</td>
<td>99.5</td>
<td>99.5</td>
</tr>
</tbody>
</table>

**Future Work**

1. Integrate SEQ into real spatial services
2. human-in-the-loop SEQ
3. Different ways of inputting examples

**References**