Advanced Computer Graphics
CS 525M: Identifying the Activities Supported by Locations with Community-Authored Content

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OUTLINE

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Introduction

- Context-aware applications require knowledge of a person’s location and activity.
- These methods for sensing and inferring context lack *generality*.
Context-Awareness
Problem

● How to determine types of activities which are available at a given location?
Motivation

- The set of *activities* a person can perform at a *location changes* depending on the situations that arise and the people who experience them.
- Yelp’s offers community-authored content by locations.
Goal

- Identify a set of *potential activities* that are supported by a person’s location. Not to infer *what* activity a person is *currently* performing.
Related Works

- Infer activities by analyzing physical manifestations. [Home, RFID’s]
- Detect activities with on-body sensing. [accelerometers, compass] 2005-2007
- Sense activities within the home.
- Detect infrastructure activities by deploying small number of sensors.
Contribution

- Show that the majority of common results per location are actual activities supported by their respective locations, with a mean precision of up to 79.3%.
Contribution

- Developed and Present two context-aware services that leverage location-based activity information on a city scale that is accessible through a Web service supporting multiple cities in North America.
Methodology

- Community-authored content
  = review texts on locations in Yelp.com

- Potential user activities
  = verb-noun pairs
  - E.g. “check zoo”, “take rowboat”, “play chess” for Central Park
  - “play tennis”, “sit hill”, “drink beer” for Dolores Park
  - “ride bike”, “walk dog”, “walk paths” in common

- 14 test locations
Methodology

1) *Harvesting* the review texts and related attributes (e.g., date authored) for each unique location
   ✓ Review texts + name, URL, latitude, longitude, #reviews

2) *Parsing* the review texts to identify each sentence
   ✓ Stanford Part-Of-Speech Tagger → individual sentences
Methodology
Methodology

3) **Tagging** each word of a sentence with its part-of-speech and **extracting** local verb-noun pairs to form activities

- Stanford Part-Of-Speech Tagger → part-of-speech of each word
- Pairs of **valid** verb + nearest **local** noun

4) **Populating** and **updating** the activity database with the identified verb-noun pairs

- WordNet → respective base-word of verbs and nouns
Methodology
Methodology: experimental set-up

- Participants
  - provide activities performed/experienced at locations
  - validate 40 most common verb-noun pairs
  - True Positive (TP) – participant validated
  - False Positive (FP) – participant rejected
  - False Negative (FN) – not in most common
Methodology: Measurements tools

- Precision = TP / FP & TP
- Recall = TP / FN & TP
- Filter applied to noun-verb pairs to reduce number of false positives
  - None, 1st Person, Frequency > 1
- Known activity to identified verb-noun pairs
  - Exact Terms
  - Similar Terms
  - Synonyms
Methodology: Precision

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<th>Provided</th>
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<th>Average Precision</th>
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<td>1st person</td>
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</tr>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
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<td>31.6</td>
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</tbody>
</table>

The precision and average precision; averaged across the 14 locations.
Mean Precision across locations

- Precision: 88%
- Recall: 55.9%

Verb-noun pairs
Participants provided activities across locations

Figure 3. The percentage of participant-provided activities that are identified in the set of verb-noun pairs grouped by method of comparison and filter, averaged across the 14 locations. The error bars represent one standard deviation.
Mean Precision of common verb-nouns

Number of processed reviews

Precision (%)
Participant provided activities
No-filter

Number of processed reviews

69.8%
Interesting...

Community-derived activities

<table>
<thead>
<tr>
<th>ID</th>
<th>Activity Category</th>
<th>Example</th>
<th>n</th>
<th>%</th>
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<tbody>
<tr>
<td>C1</td>
<td>Physical</td>
<td>buy book</td>
<td>685</td>
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<td>C2</td>
<td>Cognitive</td>
<td>appreciate art</td>
<td>101</td>
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<td>C3</td>
<td>Perceptual</td>
<td>watch people</td>
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<tr>
<td></td>
<td>Unclassified</td>
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<td>16</td>
<td>1.8%</td>
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Applications

Activity Compass and Better Errands
Conclusions

- Validated the use of community-authored content as a source to identify activities supported by location.
- Showed that the community-authored reviews provided a diverse and comprehensive data source.
- 40 most common verb-noun pairs identified from the reviews for a location achieve a mean precision of up to 79.3% and recall of up to 55.9%.
- Presented two context-aware services that leverage location-based activity information on a city scale.
Limitations and Future work

- Do not evaluate alternate location-based review communities.
- In 2011 the authors developed a context-aware place discovery application called Opportunities Exist to assist in the acquisition of spatial knowledge and meaning [2].
- SocialTelescope: A location-based service that leverages user interactions in location-based social networks to learn people's preference for places. [3].
References


Thanks!

Questions?