Towards understanding mobility in museums

Golnaz Elmamooz, Bettina Finzel, Daniela Nicklas

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How many feathers does this bird have?

A) Less than 1000

B) Between 1000 and 5000 😊

C) More than 5000
Outline

- Motivation
- Requirements
- Solution
  - Museum Graph Model
  - Mobility Model Management
  - Architecture Overview
- Conclusion and Outlook
Motivation

Museums as ecology:

- Exhibits
- Spaces
- People
- Sensors
- Data

Understanding mobility
Motivation

Understanding mobility

• Data mining techniques provide valuable insight
• Results of such techniques might not be understood

• Curators want to increase visitor experience in the museum
• How can we provide understandable knowledge for … ?
  • … Curators
  • … Visitors
Motivation

Museum with entrance hall and birds hall
Curators needs

- A model of whole museum (dynamic)
- Understand the mobility of visitors

Proposed applications

1. Museum graph editor
   - Based on graph database
2. Curator decision support
3. Mobile museum guide
   - Trajectory data mining
Main components of proposed architecture

- Museum graph model
- Mobility model management
- Model of museum
- Understanding the mobility of visitor
Sub-Graph representing the feather example (1)
Sub-Graph representing the feather example (2)

Museum Graph Model
Sub-Graph representing the feather example (3)
Museum Graph Model

Context information

Museum graph model

Mobility model management
Museum data management system

- Museum graph model
- Context information
- Mobility model management
- Trajectory pre-processing
- Preprocessed semantic trajectories
- Trajectory mining
- Mobility models
- Knowledge for Apps

- Mobility sensors
- Museum guide
- Primary routes
- Sub trajectories
- Stay points
- Patterns of movement
- Visiting styles
Trajectory mining task

Trajectory mining task in museum environment:

- Different mining tasks
  - Common stay points detection
  - Classification
  - Clustering
- Route-based trajectory mining
- Incremental techniques
  - Window
    - Time
    - Space
Current approach of curators in some museums:

Data sets we can learn from

Number of museum visitor

Number of visitors: 20
Spatial windows (to understand local effects)

Data sets we can learn from

Number of visitor per stay point (SP)

<table>
<thead>
<tr>
<th>Location name</th>
<th>SPs</th>
<th>t₁ --- t₂</th>
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<td>20</td>
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<td>Vitrine 1</td>
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<td>8</td>
</tr>
<tr>
<td>Vitrine 2</td>
<td></td>
<td>3</td>
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Spatio-temporal windows (to understand changes)

Data sets we can learn from

Number of visitor per stay point (SP)

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<tr>
<th>Location name</th>
<th>SPs $t_1$ --- $t_2$</th>
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Architecture Overview

Museum data management

- Mobility sensor
- Museum guide
- Museum model graph
- Trajectory preprocessing
- Trajectory mining tasks
- Data stream management
- Mobility model management
- Data storage
- Mobility museum guide
- Curator decision support
- Museum graph editor
Conclusion and outlook

- Proposed an architecture to support three applications which considers:
  - Dynamic graph model
  - Semantic trajectories
  - Different mobility models
  - Manage knowledge
  - Mining on a local level
    - Time
    - Space
- Evaluate and extend graph model
- Extend mobility model
- Ensure consistent knowledge across applications
Questions?