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A Navigation Engine for Ubiquitous Computing Environments

Dikaios Papadogkonas
Birkbeck College
University of London

dikaios@dcs.bbk.ac.uk

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Overview

- What is navigation
- Navigation in ubiquitous computing
- What is the navigation engine
- How it works
- Case Studies
- Future Work

Introduction

- What is navigation
- Navigation in physical space
  - Maps, signs, compasses, GPS
- Navigation in virtual/information space
  - Database, virtual environments, WWW
    - Search Engines
- Navigation in Ubiquitous computing environments
  - Physical and Virtual Combined

Types of Navigation - British Museum Example

- Physical Navigation
  - Find an exhibit
- Information Navigation (Museum's web site)
  - E.g. Find video related to Parthenon marbles
  - Historical information
- Ubiquitous computing scenario
  - Provide navigation guidance and adapt the ubicomp environment on the user

Scenario - British Museum

- Visitor
  - After visiting a couple of landmarks the system recognizes the user interests.
  - Displays attached at the exhibits gives personalized information for this user
    - Information about the exhibit that is of particular interest for the visitor e.g. for Egyptian artifact: comic for children, art info for the artist
    - Recommend where to continue his museum experience
  - Return the user experience in a CD or museum's web site
- Museum Manager
  - Improve the physical navigation and update accordingly information about the exhibits

Aims

- Understand space usage and improve physical navigation system
  - What do people do when they visit an exhibition area?
  - What exhibits are they interested in?
- Recommend significant trails
  - A tool for navigation assistance
  - Recommendations

Model of Navigation

- Identify users
- Landmarks
  - Physical or information object that you interact during a visit
- Record interactions between users and landmarks
  - Sequence of interactions = trail
- Use the interaction record to create navigation tools

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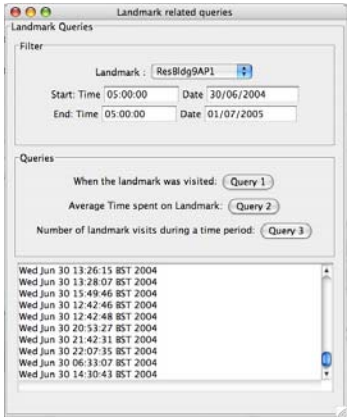
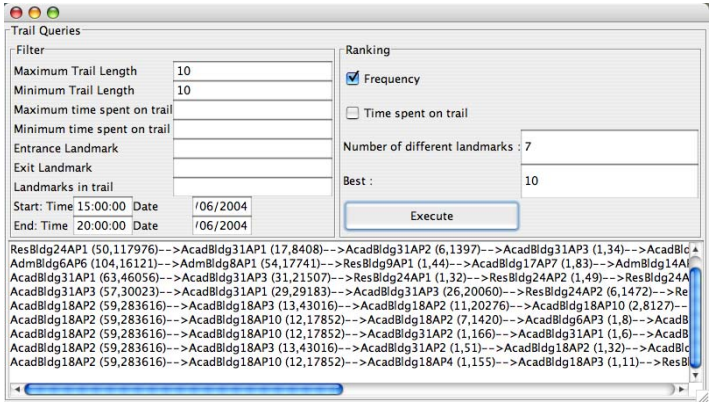
Navigation Engine

- Previously collected trails
- Definition of metrics for calculating best routes
- Mechanisms for calculating best routes
- Output
  - Significant Trails
  - Landmark usage information





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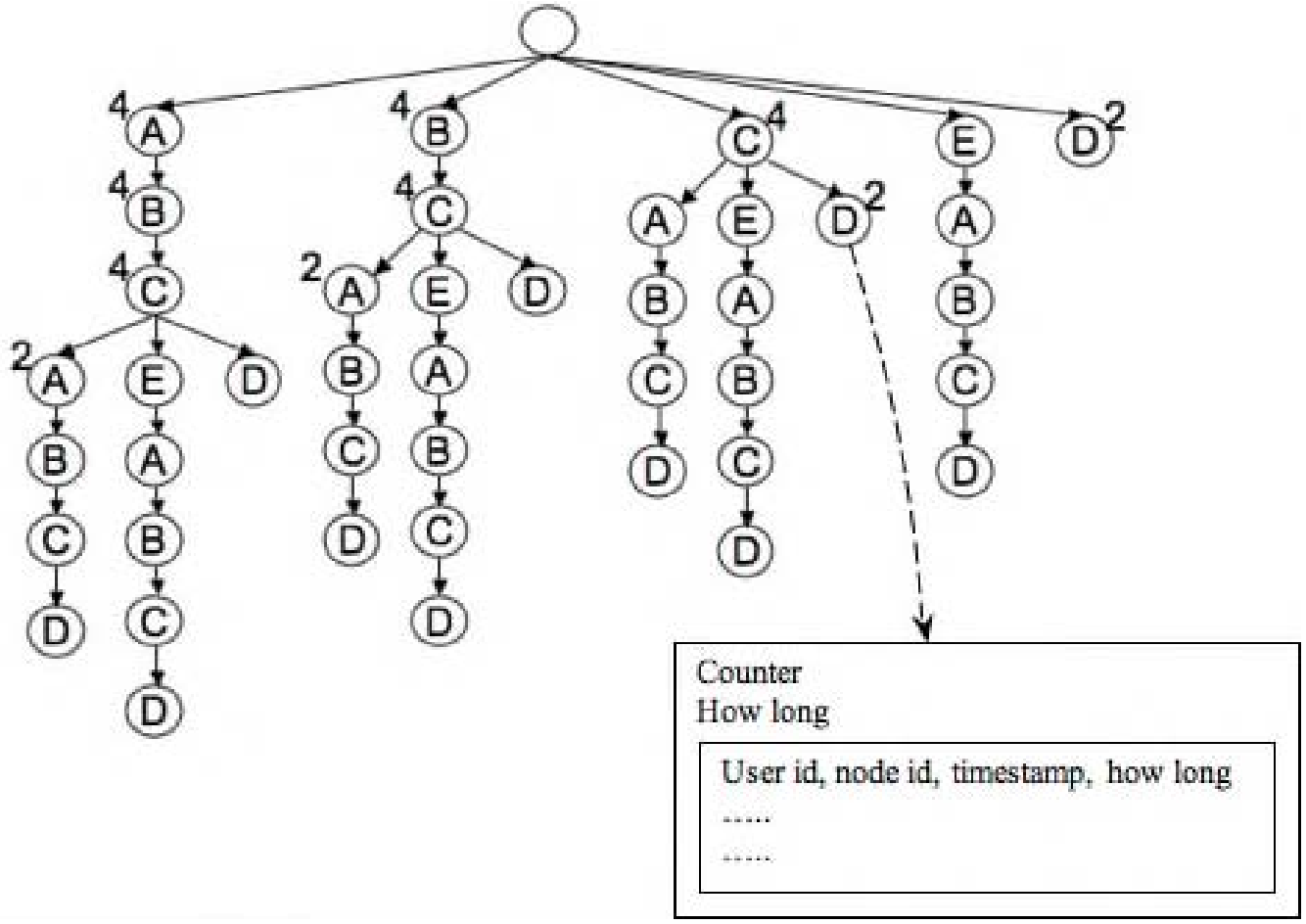
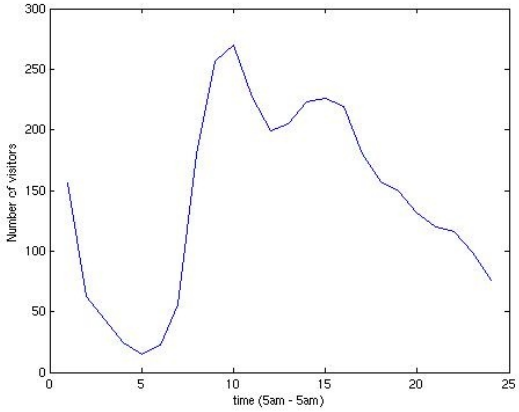
Trail Representation

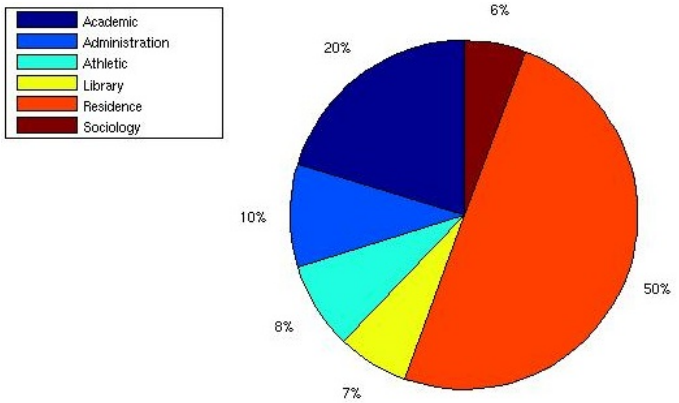


Suffix tree for ABCABCD and ABCEABCD

Simple Queries

- Landmarks
  - All questions answered from first level nodes
  - Queries
    - When a landmark was visited
    - Average time spent on the landmark
    - Number of visitors interacted with the landmark
    - The above information in specific period of time





Complex Queries

- Queries about significant user trails
- Significant Trails by:
  - Frequency
    - E.g. Most popular trails between two landmarks, lasting 20 minutes
  - Other metrics of significance
    - Time, Orientation. Exhibit Relevance
    - The above metrics combined

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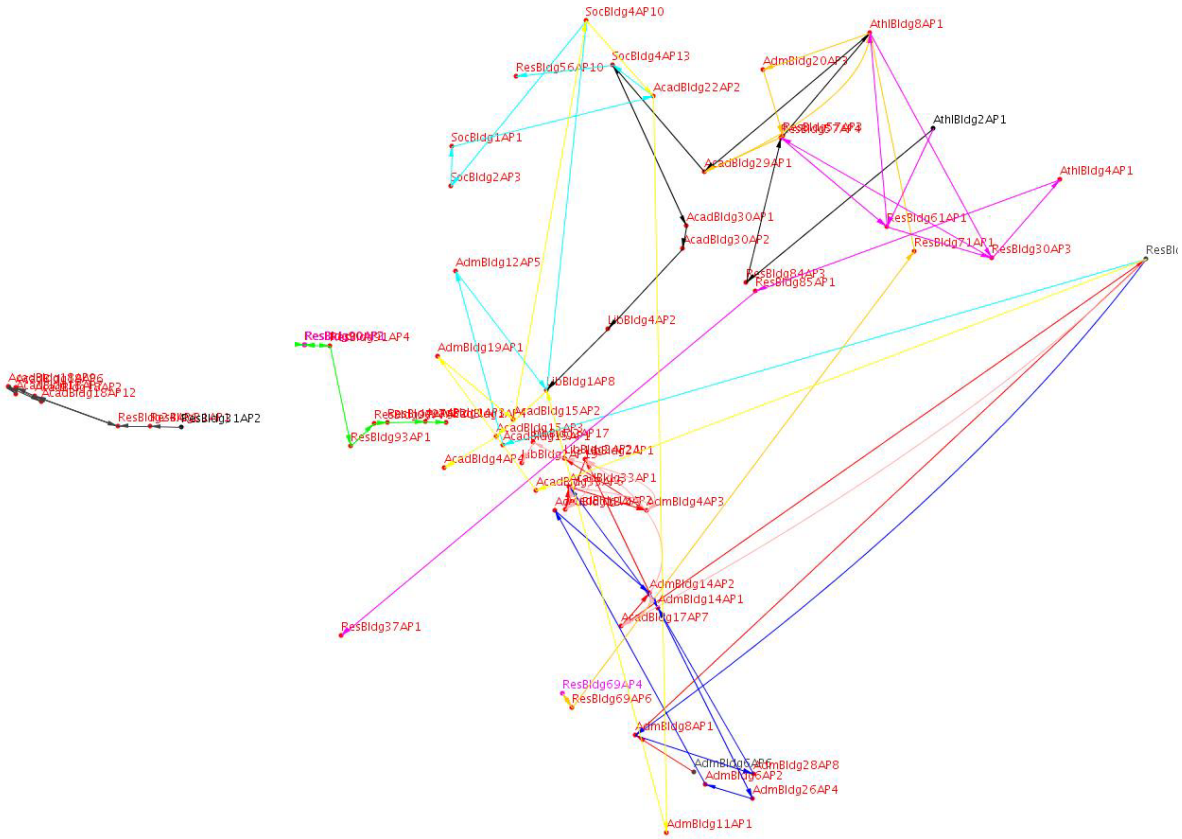
Example - Dartmouth



10 most popular trails of length 10 7 distinct landmarks

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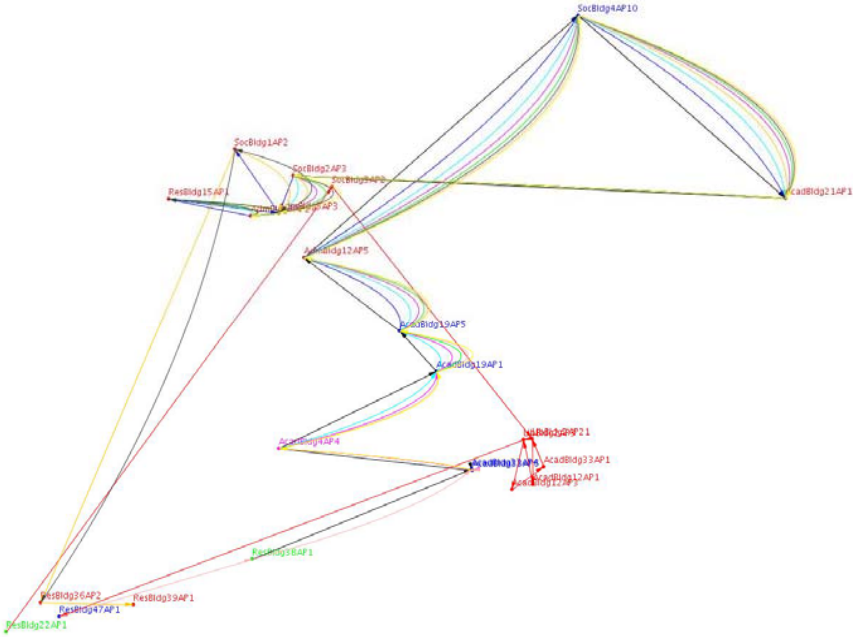
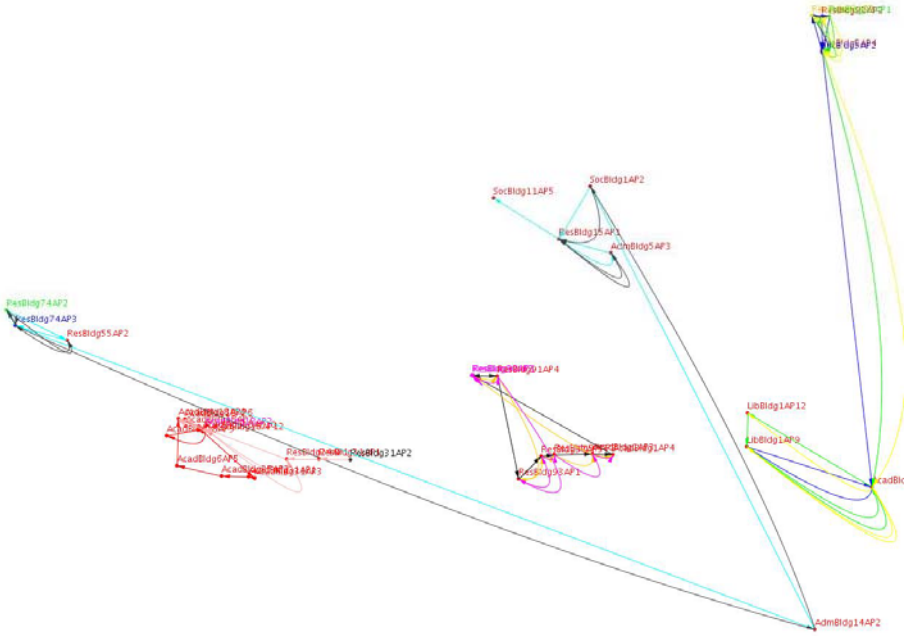
Example - Dartmouth



10 first by time spent



10 first by time and frequency combined

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Future Work

- Data Collection
  - London Zoo
  - Flexible network in the London Knowledge Lab
- Performance
  - Large data set
- Prediction
  - Recommended trails based on significant trails
  - Clustering / Classification
- Interface

Questions

- Questions?