Ubiquitous and Mobile Computing
CS 403x: Tapping into the Vibe of the City Using VibN

Ben Bianchi
Yao Chow
Alonso Martinez

Computer Science Dept.
Worcester Polytechnic Institute (WPI)
Using What is Available

- Most people possess smartphones
- People carry their phones everywhere
- Modern smartphones contain various sensors
- App utilizes this knowledge
Introduction/Motivation

- VibN - continuous sensing applications
- Platform to collect information-rich data
- Characterization of human activity and context
Introduction/Motivation

Goal
- Collect data
- Make inferences
- Present as visual data about Live Points of Interest (LPOI)
- Engage the user in events around their area
Related Work

- CenceMe - application infers a person’s daily activities and context through sensor use, allows characterization of locations based on sensor data.

- Foursquare - application recommends areas to visit based on location and user reviews.
Sensor Data Conveys Strong Keys

- Strong Data
  - Location Data
  - Short Audio Clips
- Difficulty
  - Accelerometer Implementation
  - Resource Consumption
Location’s Meaning Derived by App

- Duty Cycling Manager
- User Bio Statistics
- Reconcile Data with Criteria
  - Interval Pinging
  - Change in position
  - Length of Stay
Summation of Individual Datum

- Numerous Requests from Individual
- Crowd-sourced information
- Individual Points of Interest
- Prevention of false positives
  - $K = 5$ test
  - Epsilon = 0.2
- POI Bounding Box
Security

- Phone security is a big topic right now
  - Lots of issues surrounding the topic
- SSL Encryption
- Filters to remove user identification
Results

System Performance

- Duty-cycle time - 30 minutes
- Minimize Battery usage
  - Apple IPhone 4 - 24 hours
  - Nexus 1 - 40 hours
Results

Personal Points of Interest

- Generated by application and users records *Vibe it!*
- Use dampening region of 11 meters
  - Prevents localization error
  - Optimal for indoor locations

Figure 3. VibN live and historical views on the iPhone.
Machine Learning

Backend Clustering

- Computes LPOI through DBScan technique
- Two Parameters
  - Scope of clustering - eps
  - Minimum number of data points - k

Figure 4. Backend clustering algorithm performance: a) raw location data from seven different places; b) result of the clustering algorithm with k=1 and eps=0.1; c) result of the clustering algorithm with k=1 and eps=0.02; d) result of the clustering algorithm with k=5 and eps=0.002
VibN Usage Characterization

- Age Distribution
- Pattern Usage - Responsiveness
- Slower user base growth and data collection
  - Android and Apple Users - 25% participating
Conclusions

- Allows the user to view active hotspots around the city
- Introduces the user to historic points of interest around them
- Provides the user with a diary of locations that they actively visit
Future Work

- Allow users to personalize aspects of the app, such as what is determined as “significant”.
- Automatically infer demographic information, so as to limit manual input.
References
