MINING DATA FROM MOBILE DEVICES

Introduction

Spiros Papadimitriou, Tina Eliassi-Rad

Tutorial plan

Introduction (Spiros)
- Overview
- Mobile technology overview

Algorithms & Applications I (Spiros)
- Mobile sensing
- Urban sensing
- Healthcare

Break (15 minutes)

Algorithms & Applications II (Tina)
- Location
- Context
- Ads
- Privacy

Conclusions (Spiros)

Mobile devices

Smartphones

Network
- Cellular
- WiFi
- Bluetooth

Embedded sensors:
- GPS & compass
- Accelerometer & gyro
- Proximity
- Camera
- Speech recognition
- (Humidity, Temperature, Barometer/altimeter)
- ...

So what?

So what?

...you have a pretty powerful computer in your pocket!
...and it’s connected!

‘It’s what I and many others have worked towards our entire careers. It’s just happening now.’
– Eric Schmidt (on cloud computing)

- The same could be said about mobile sensing and mining
  - Sensing & sensor networks
  - Ubiquitous computing
  - Mobility tracking
  - ...
- But all are becoming mainstream now!
Example applications

- Geo-location
- Urban computing
- Quantified self
- Healthcare
- Security
- …many more!

Geo-location

Example applications

What most people think (mainstream applications):

- Maps
- Navigation
- Local search (+ social)

Example applications

- Context-based:
  - Locale: e.g., “if I’m within 0.5mi of work address and I have a meeting on my calendar, then set my phone to silent”
  - Google Now: “if I have a dentist appointment on my calendar, notify me when I need to leave, based on current traffic conditions, to be on time” or “if my email contains records of a booked flight, show flight status”
  - Location reporting and sharing: Glympse, Google Latitude, etc.

Urban computing

Use broadly collected data for:

- Zoning and planning
- Traffic monitoring and management
- Public transportation planning
- Crisis detection and management
- Energy consumption sensing
- Air quality monitoring

Much of this data comes from traces of mobile activity!

Quantified self

Example applications

- Measure “self”, visualize, and correlate
- Idea dates back to 70s; term coined ~2007 by Kevin Kelly
- Both peripheral sensors as well as just apps; e.g.
  - Heart rate, Sleep quality
  - Weight, Activity
  - …

Healthcare

Quantified self: log everything

- Related to quantified self
  - Many of these services can send data to your doctor
  - Our distinction: specific goal vs. “log everything” approach

Medical applications: glucose, asthma, ECG, …
Healthcare

Micro level / personal; e.g.
- Fall detection
- Activity detection
- Mood detection

Macro level / population; e.g.
- Disease propagation (mobile, Twitter & Foursquare, ...)

Privacy Examples

- Vast data that allows quite accurate activity tracking or inferences
- Clearly raises privacy concerns
- Policy ( & technology ?)

Security & Malware Examples

- Mobile malware: 6x [Juniper]
- E.g., BadNews: malware on Google Play (30+ apps, 2M downloads, fake app update prompts, mobile “pickpocketing”)

Some challenges:
- Role mining: characterize groups of permissions more meaningfully
- Unusual activity detection

Mobile mining

- The mobile “revolution” (like the “PC revolution”) brings together many disciplines and touches many areas
- So, we had to draw some (occasionally arbitrary) divisions, and leave several things out

This tutorial focuses on:
- Work with a substantial inference / analytics component
- Data collected via smartphones (although we’ll touch on others sensors briefly, but we won’t go into sensing or ubiquitous computing territories—much)

The rest of this tutorial

Algorithms & Applications I:
- Mobile sensing
  - Focus: low-level activity detection and localization
- Urban computing
- Healthcare

Algorithms & Applications II:
- Location and context
- Advertising
- Social

MINING DATA FROM MOBILE DEVICES

Introduction

Spiros Papadimitriou, Tina Eliassi-Rad
These slides are made available under a Creative Commons Attribution-ShareAlike license (CC BY-SA 3.0): http://creativecommons.org/licenses/by-sa/3.0/

You can share and remix this work, provided that you keep the attribution to the original authors intact, and that, if you alter, transform, or build upon this work, you may distribute the resulting work only under the same or similar license to this one.

© 2013 Spiros Papadimitriou, Tina Eliassi-Rad