INFERRING MODAL SPLIT FROM MOBILE PHONES

Principles, Issues and Policy Recommendations

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OVERVIEW DISCUSSION PAPER + ●THIS TALK
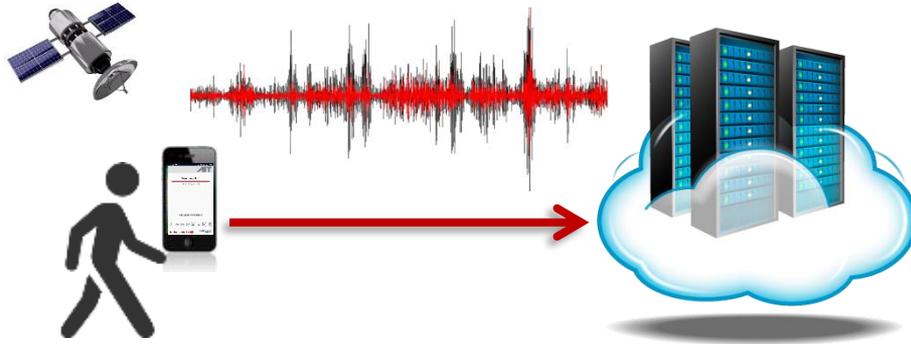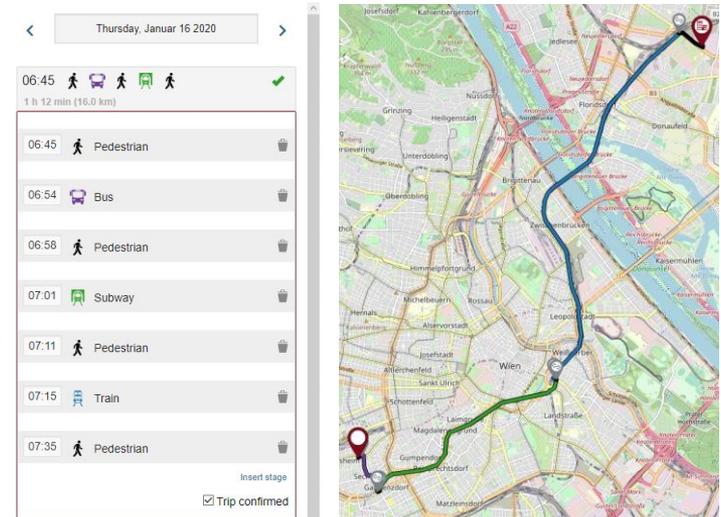
ACTIVE TRAVEL MODE INFERENCE WITH SMARTPHONES

Infer travel mode (foot, bike, car, bus, train, subway, …) from recorded **location and sensor data**

GPS

Location   +
- GPS
- WiFi
- Cell Data

Sensor data
- Accelerometer
- Gyroscope
- Magenotometer
- …

Automatic Travel Diary (Source: AIT Smart Survey)

EXAMPLE: VELOCITY AND ACCELERATION
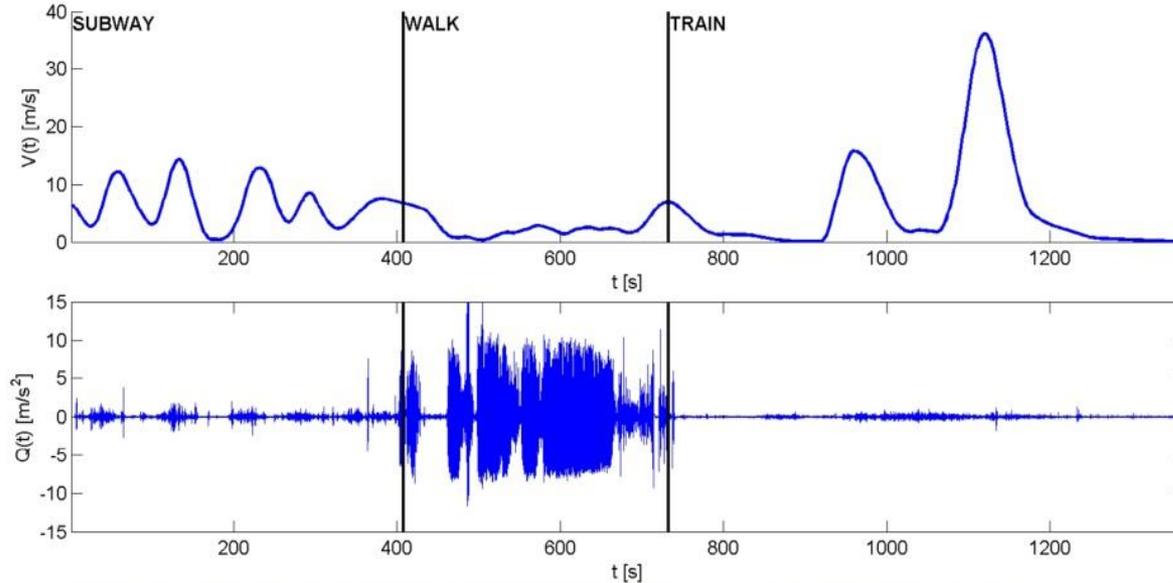
- **Travel mode inference is a very hard pattern classification problem!**

PHENOMEN 1: MULTIPLE INFLUENCE FACTORS

- **Person** (driving style, gait)
- **Travel route** (pavement, functional road class…)
- **Traffic State**
- **Type of vehicle** (sports car, SUV, …, type of public transport vehicle)
- **Tracking device, sensors** (range, precision, sampling frequency, GPS availability
- **Position of the device** (pocket, bag, in the hand, smart phone holder)
- **Interactions with the device** (phone calls, …)
- **Sitting, standing, walking in public transport**
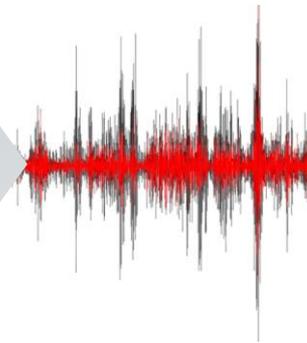
Travel mode

DANGER OF SPURIOUS CORRELATIONS

Per capita consumption of mozzarella cheese
correlates with
Civil engineering doctorates awarded
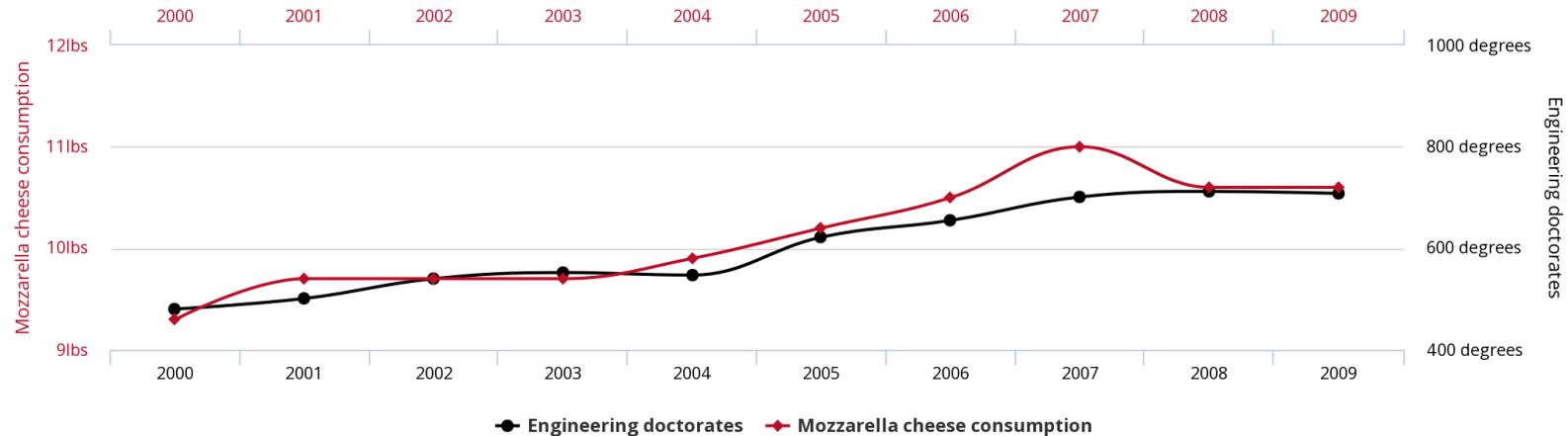
Source: www.spuriouscorrelations.com

PHENONEMON 2: SPARSE AND NOISY LOCATION DATA

———— Intermodal journey in Vienna

○

○ Location reports + uncertainty

○

◯ Provided by operating system, increasingly restricitive („stalkerware")

- **Identifying most likely route through transportation network via map matching → costly in terms of memory and computation time**

EVALUATION OF ACCURACY

- **There is currently a lack of comprehensive (standard) reference datasets!**

- **Example: Sussex-Huawei Locomotion (SHL) Dataset**

- 750 hours of labelled locomotion data
- from 3 persons

Body-worn camera
Torso phone
Backpack phone
Hand phone
Pocket phone

(http://www.shl-dataset.org)

ISSUE: DATA QUALITY

Sussex-Huawei Locomotion (SHL) Challenge 2018, Ubicomp 2018 Singapore
(subset of 272 hours of data from, labels of 60 seconds segments)
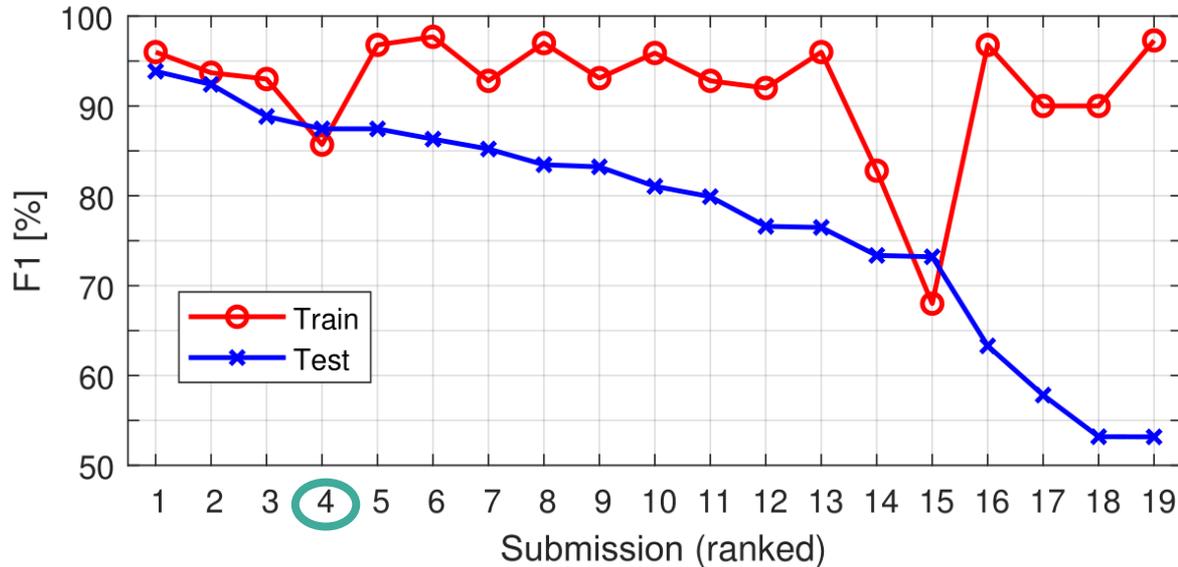
- **Only 5 submissions did not overfit to training data!**

- **… and only data from one person with one carrying position was used for the challenge**

POLICY RECOMMENDATIONS (1)

- **Fostering the collection of comprehensive reference datasets**
  - Data collection campaigns covering all travel modes, combinations of travel modes, vehicle types, …
  - Using ‚scripts' instead of daily routine to avoid spurious correlations

- **Companies** developing smartphone operating systems and controlling the smartphone app marketplace must **keep granting access to fine-grained smartphone location data**

- **Enabling the implementation of reference data exchange frameworks**
  - Collection of best practices and guideline, common data formats for intermodal trip data, …

THANK YOU!

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