EXPERIMENTS WITH MODEL-DRIVEN DATA ACQUISITION FOR CROWDSENSING

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Socially Relevant REU Program 2013

Air Pollution

- You are concerned about air pollution in your city
- Finding the causes of the pollution
  - Traditional Setup
    - Fixed Sensors
  - Crowdsensing Solution?
- You could start a crowdsensing campaign
  - Recruit friends, family, and strangers
  - Collect particulates per million

Crowdsensing

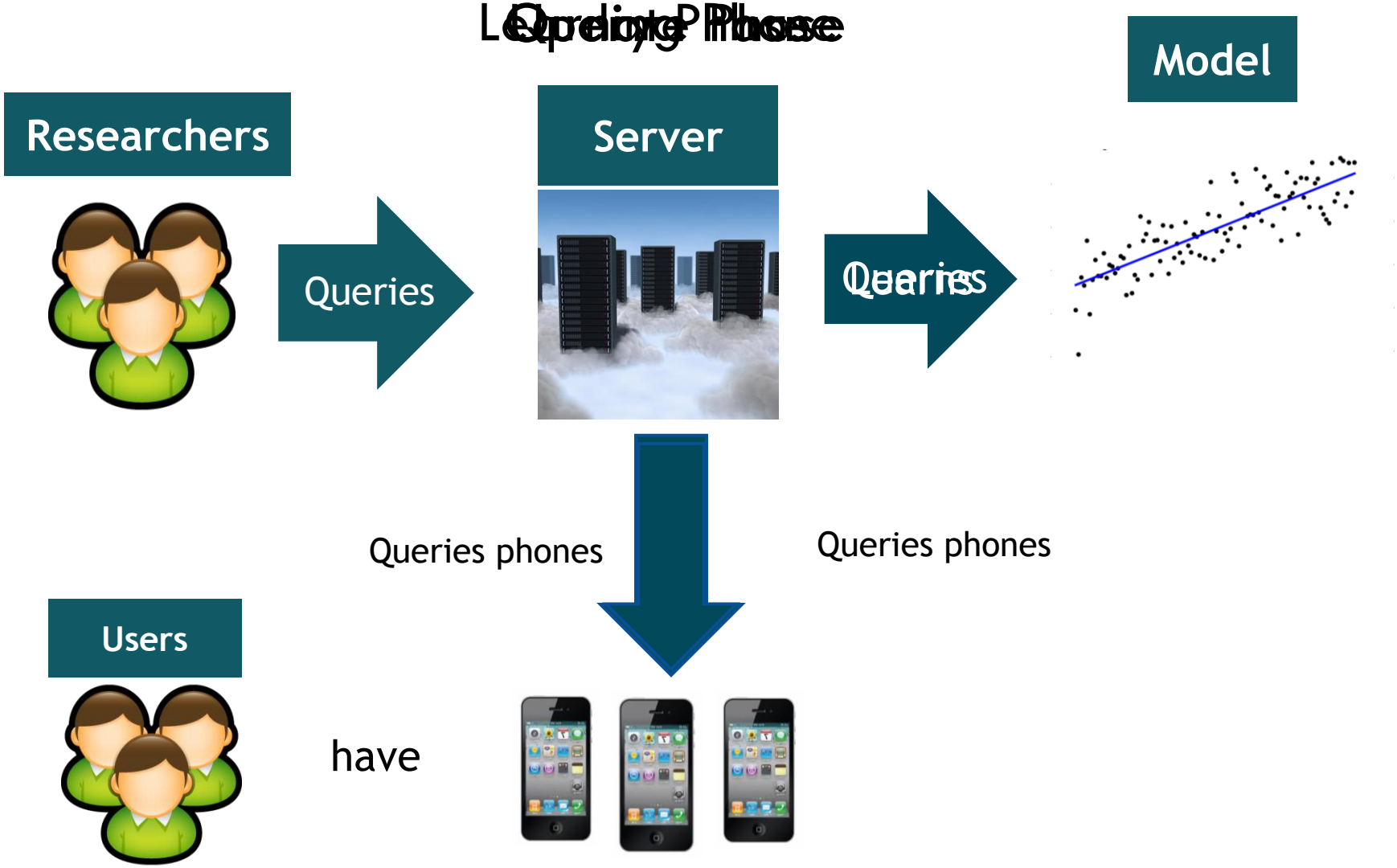
- Volunteers collect data with smartphones
- Variety of sensors
  - Accelerometer
  - GPS
  - Light Sensor
  - Microphone
  - Cameras

Challenges of crowdsensing

- Energy consumption
  - Sensors require energy
  - Communication is one of the biggest energy drains
- Monetary Costs
  - Mobile data plans are not free nor “unlimited”
- Both of these could decrease participation

Traditional Crowdsensing

Model-Driven Data Acquisition



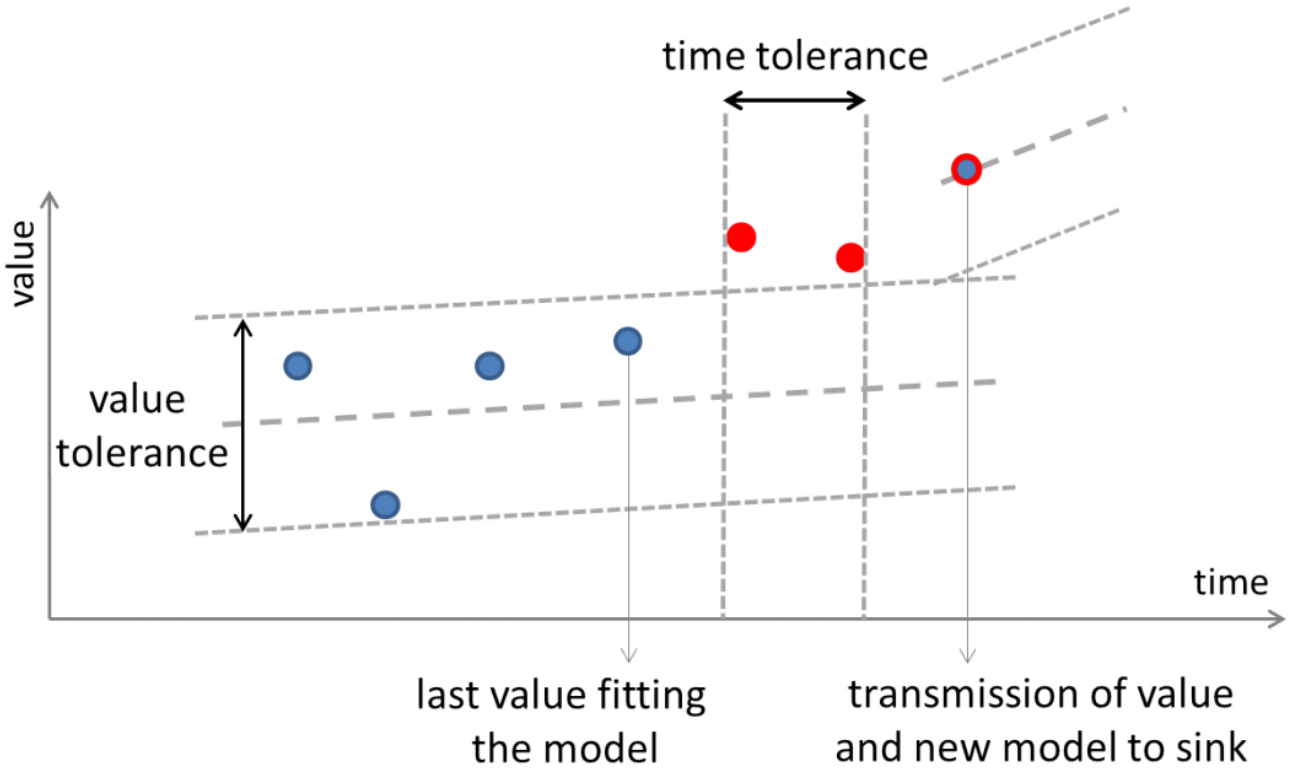
Experimenting with Models

- Implemented a simulator in Java that can be used to experiment with models and implementations
- Experimental Variables:
  - Degree of mobility
  - Density of network
  - Type of data
  - Length of learning phase
- Evaluation of Metrics
  - Length of learning
  - Accuracy of model
  - Number of Updates

DBP (Derivative Based Predictions) [Raza 2012]

Expectation: Performance will drop with mobility

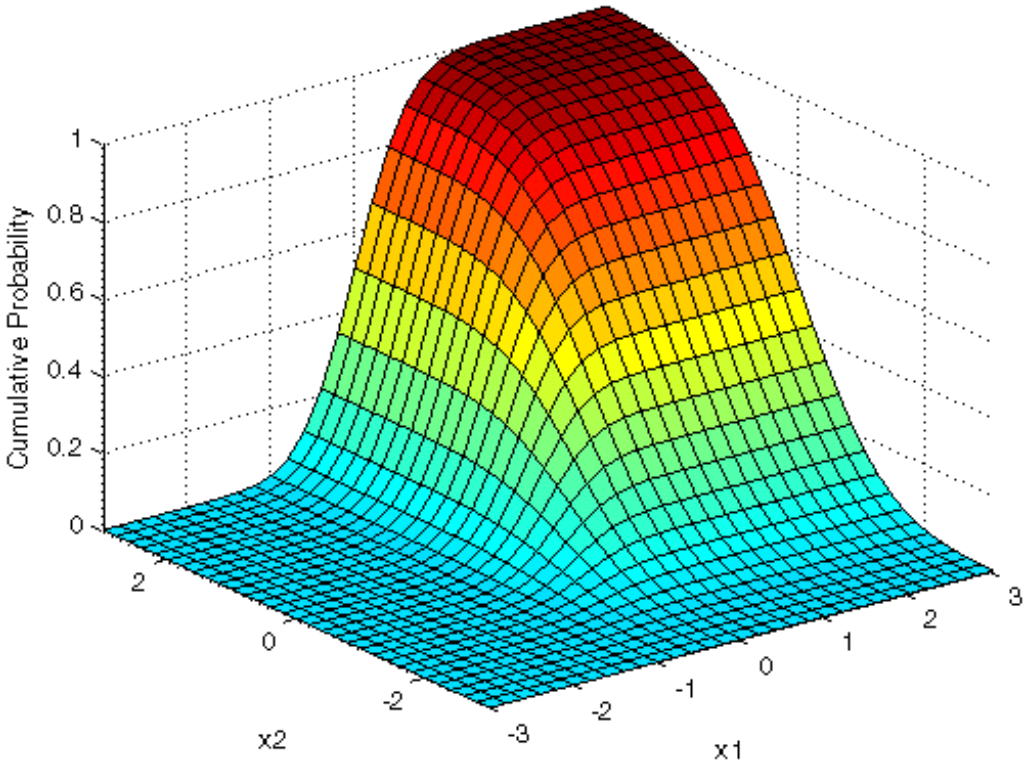
- Simple Time Series Model
- Simpler Calculations
- Less data needed



DrOPS (model-*Dr*iven *O*ptimizations for *P*ublic *S*ensing)[Philipp 2013]

Expectation: Model will perform well, but will consume more energy than DBP

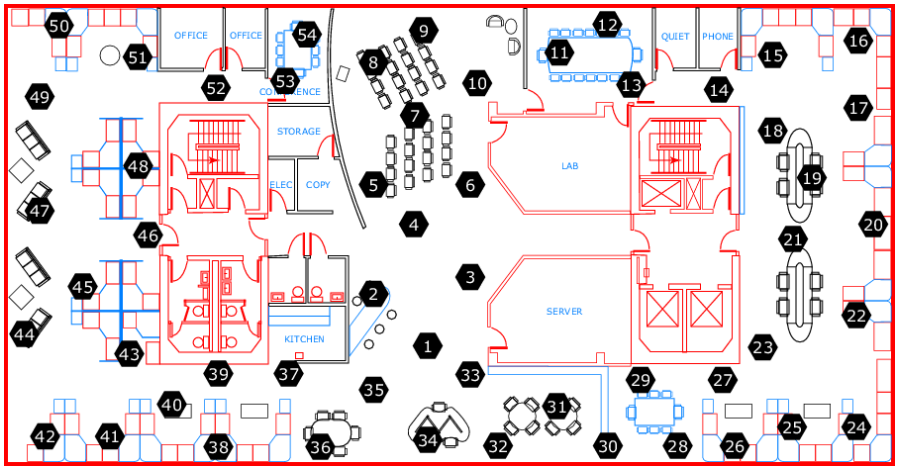
- Multivariate Gaussian Distribution Model
- More Complex Calculations
- More data needed



Experimental Setup

- Simulator built in Java
  - Estimates Energy usage
    - Communication
    - Sensors
- Datasets
  - Intel Lab
  - Lausanne Urban

    Canopy Experiment
- Mobility Traces
  - Cab spotting data from Crawdad



Intel sensor lab

Conclusions

- Model-Driven Data Acquisition
  - Building a model rather than constantly sending data
  - It can help reduce communication
- The simulator is still under development
- Looking for additional data sets to use

Questions?

References

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