

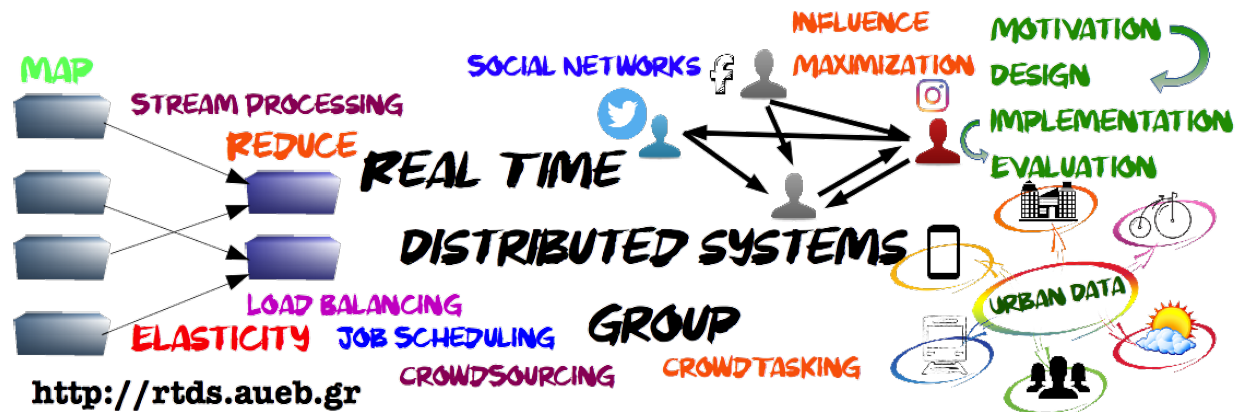


Urban Data Analysis and Applications

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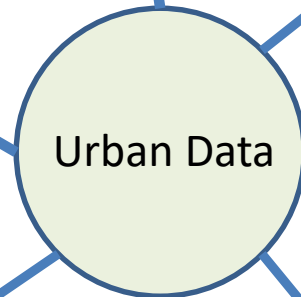
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Urban Data

Data source	Sampling Rate
Bus	per 20sec
Bike Station	per 2min
Pollution	per 1h



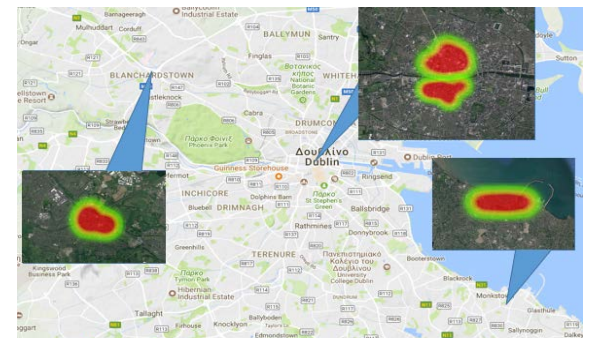
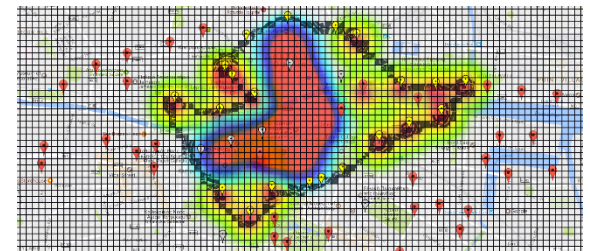
DCC Rowing Club
Rowing club close to the Phoenix Park. Local traffic contributes to sound levels.
Latest reading: **56dB(A)** on 8th March at 11:20
[View daily averages for this site](#)



- Urban infrastructure systems produce vast amounts of heterogeneous streams of urban data (traffic, pollution, bus, bikes, cameras, weather, etc.)
- Challenge:** How to deal with the 5V's of urban data: Volume, Velocity, Veracity, Variety, Value

Application Example: Event Detection

- **Large City Events**
 - Everyday, various events (traffic jams, accidents, festivals, parades, etc.) occur around the city
- **Strategically important for**
 - Traffic management
 - Risk assessment and public safety
- **Event Identification**
 - The impact of the events can be captured via different infrastructure means (such as traffic sensors and cameras)
 - Human mobility patterns are reflected in the usage of urban resources
 - The goal is to identify location and extent of large scale city events
- **Health Level Estimation**
 - Exploit correlations between pollution and traffic data
 - Detect and estimate the health levels of the urban environment across the city area
 - Is it possible to suggest environmental healthy routes in the urban environment?



[Tomaras Dimitrios, et al. "Evaluating the Health State of Urban Areas Using Multi-source Heterogeneous Data.", *WoWMoM*, IEEE, 2018]

[Tomaras Dimitrios, et al. "An efficient technique for event location identification using multiple sources of urban data.", *LocalRec*, ACM, 2017]

Application Example: Bike Sharing Systems

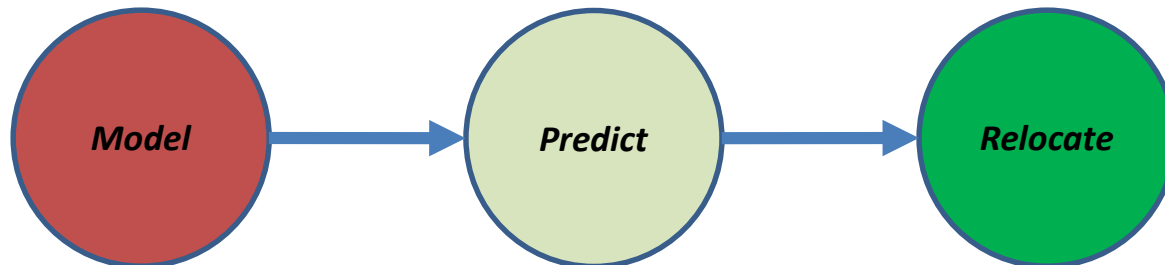
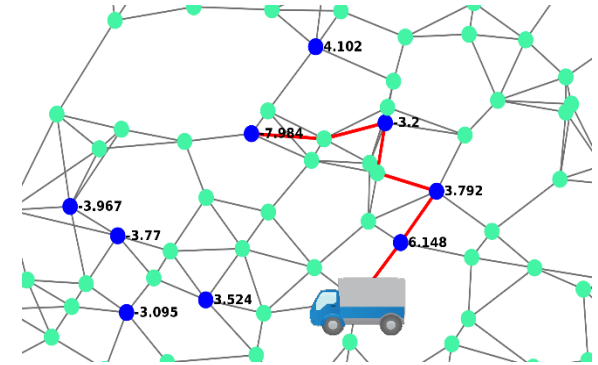
• Bike Sharing Systems

- People resort to bikes for daily commuting and for recreational purposes as a healthy and environmental friendly means of transportation
- City authorities sign contracts with bike operators to employ and set up bike stations in the city area which can be penalized financially when station outages occur
- When a city event occurs
 - Significant effect on bike demand at stations in the geographical proximity of the event



• How to sustain the bike sharing system operation under large city events?

- The challenge is to *capture changing trends* in bike data and *predict* bike demand
- Dual optimization problem
 - Minimize the relocation cost
 - Maximize the system utility



[Tomaras Dimitrios, Ioannis Boutsis, and Vana Kalogeraki. "Modeling and predicting bike demand in large city situations.", *PerCom*, IEEE, 2018]

[Tomaras Dimitrios, Ioannis Boutsis, and Vana Kalogeraki. "Lessons Learnt from the analysis of a bike sharing system.", *PETRA*, ACM, 2017]