Urban Data Analysis and Applications

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http://rtds.aueb.gr
• 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

<table>
<thead>
<tr>
<th>Data source</th>
<th>Sampling Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td>per 20sec</td>
</tr>
<tr>
<td>Bike Station</td>
<td>per 2min</td>
</tr>
<tr>
<td>Pollution</td>
<td>per 1h</td>
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</tbody>
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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?

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]