**Understanding urban development and transport in Indian cities**

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**Abstract**

Initiatives to plan for sustainable transportation and identify infrastructure challenges require access to meaningful, dynamic, and timely datasets regarding urban development and transportation systems. Yet, there are key information gaps in rapidly urbanizing countries like India. This project addresses these challenges by leveraging multiple urban data sources, ranging from conventional data source such as socioeconomic data and satellite images to emerging “urban big data” sources such as geo-tagged social media data, citizen-created maps, and real-time traffic data. The objective for this project is the innovative and effective integration of these available data together to capture urban development and transport in fast-growing Indian cities.

**Motivation**

Urgent need for developing more sustainable transport and land use
• Moving people instead of cars
• Encouraging integrated land use and transport planning
• Encouraging greater use of public transport and non-motorized modes

Huge uncertainties in estimating urban transport activities in India due to lack of reliable and detailed data
• National-level studies point to the magnitude of transport problem, but all rely on scarce data and generous assumptions.
• Very few city-level studies used household surveys to look at travel behavior and the influence of urban form.

Emerging urban data sources that reflect city spatial-temporal dynamics about people, their movement, and activities e.g. public transit smart card data, mobile phone data, location-based social media data, real-time information

**Urban development: Landsat satellite imageries**

**Research questions**
1. Does urban development take place in substantially different form?
2. How do transport and land use policies shape these trends?
3. What are the impacts of different urban development patterns on urban travel?

**Urban congestion: Google traffic images**

**Research questions**
When and where does congestion happen in different Indian cities?

**Urban data sources we collect**

<table>
<thead>
<tr>
<th>decades</th>
<th>urban data sources</th>
<th>applications</th>
<th>limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>annual</td>
<td>remote sensing</td>
<td>track urban growth and expansion</td>
<td>coarse spatial resolution</td>
</tr>
<tr>
<td></td>
<td>census, government documents, travel survey</td>
<td>socioeconomic indicators</td>
<td>not timely updated, time consuming, costly, extensive labor work</td>
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<tr>
<td>daily</td>
<td>openstreetmap (osm)</td>
<td>road network and points of interest (poi)</td>
<td>may not be representative, digital divide</td>
</tr>
<tr>
<td>hourly</td>
<td>real-time traffic (google traffic)</td>
<td>visualize traffic information</td>
<td>no specific information about the flow, no specific information about the number of vehicles on the roads and, speeds.</td>
</tr>
<tr>
<td>minute</td>
<td>social media data (twitter)</td>
<td>mapping urban activity and mobility</td>
<td>may not be representative if information is biased by self-selection</td>
</tr>
</tbody>
</table>

**Population pyramid in 2011: Chennai**

- Chennai 2001: 6.7 million
- Chennai 2011: 8.7 million

**Population pyramid in 2011: Jaipur**

- Jaipur 2001: 2.3 million
- Jaipur 2011: 3.1 million

**Population pyramid in 2011: Mumbai**

- Mumbai 2001: 7.6 million
- Mumbai 2011: 10.3 million

**Population pyramid in 2011: Delhi**

- Delhi 2001: 10.3 million
- Delhi 2011: 13.2 million

**Research questions**
1. Mapping large scale human mobility patterns
2. Understanding the sentiment and attitude on urban issues

**Applications**

- Urban congestion: Google traffic images
- Mobility pattern and travel attitude: geotagged tweets

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