11.522 – Research Seminar on Urban Information Systems

Instructor: Joe Ferreira, jf@mit.edu

Monday, 6-8 PM in **Room** 9-451

- Opportunity for students to build on basic skills in GIS and urban analytics in order to explore urban planning implications of improved urban information systems
- Students present structured discussion of journal articles and undertake small research projects
- Helpful in formulating research project, thesis exploration, …

Class homepage: http://mit.edu/11.522

11.522 – Research Seminar on Urban Information Systems

- Modern information and communication technologies (ICT) provide new opportunities for **urban sensing and analytics** that can impact all aspects of urban planning.

- 11.522 provides a setting in which to discuss and investigate **urban modeling** and the **urban planning and policy implications of ICT** advances.

- Much of this research involves geographic information systems (GIS), location-based computing, visualization methods, and the design and prototyping of urban planning tools and metrics for **accumulating and using 'city knowledge.'**

- Some of the work also involves institutional analysis, new theories about planning strategies, collaborative urban design, the economics of place, urban information infrastructure, and land use and transportation interactions.

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11.522 – Research Seminar on Urban Information Systems

- Seminar topics are usually tied to ongoing Urban Information Systems (UIS) research in DUSP.
  - Urban analytics, urban indicators and performance measures
  - Urban modeling: from back-of-the envelope to complex land use and transportation models
  - PSS, PPGIS, VGI, urban information infrastructure
  - Not always highly quantitative: e.g., technology adoption, comparative study of 'smart city' efforts, …
- Examples from recent theses and student papers

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Examples from Recent Theses & Projects

- Vehicle miles travelled patterns:
  - Mi Diao, PhD dissertation (2010), "Sustainable Metropolitan Growth Strategies: Exploring the Role of the Built Environment"
  - Jingsi Xu, Mi Diao,et al.: class project + **Transactions in GIS** paper (2013)
- 'Smart City' strategies
  - Tuan Yee Ching, MCP thesis (2013), "Smart Cities: Concepts, Perceptions and Lessons for Planners"
- Implementing planning support systems
  - Rob Goodspeed, PhD dissertation (2013), "Planning Support Systems for Spatial Planning Through Social Learning"
- 'Big Data' analyses
  - Yi Zhu, PhD dissertation (2014), "Spatio-temporal Learning and Geo-visualization Methods for Constructing Activity-travel Patterns from Transit Card Transaction Data
  - Shan Jiang, PhD dissertation (2015), "Deciphering Human Activities in Complex Urban Systems - Mining Big Data for Sustainable Urban Future"

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Estimated VMT per Vehicle per Year

- VMT *per vehicle* average for each 250x250m grid cell
  - Grid cells with 12+ "good" cars
    - Average annual mileage of all "good" cars in grid cell.
  - Grid cells with few/no vehicles
    - Spatial interpolation
    - Inverse distance weighted average of the VMT of 12 closest "good" cars

- VMT is more sensitive to built environment than indicated in earlier studies

- VMT results were used to compare implications of alternative growth scenarios

From Mi Diao dissertation, TGIS paper, and forthcoming EP-A paper
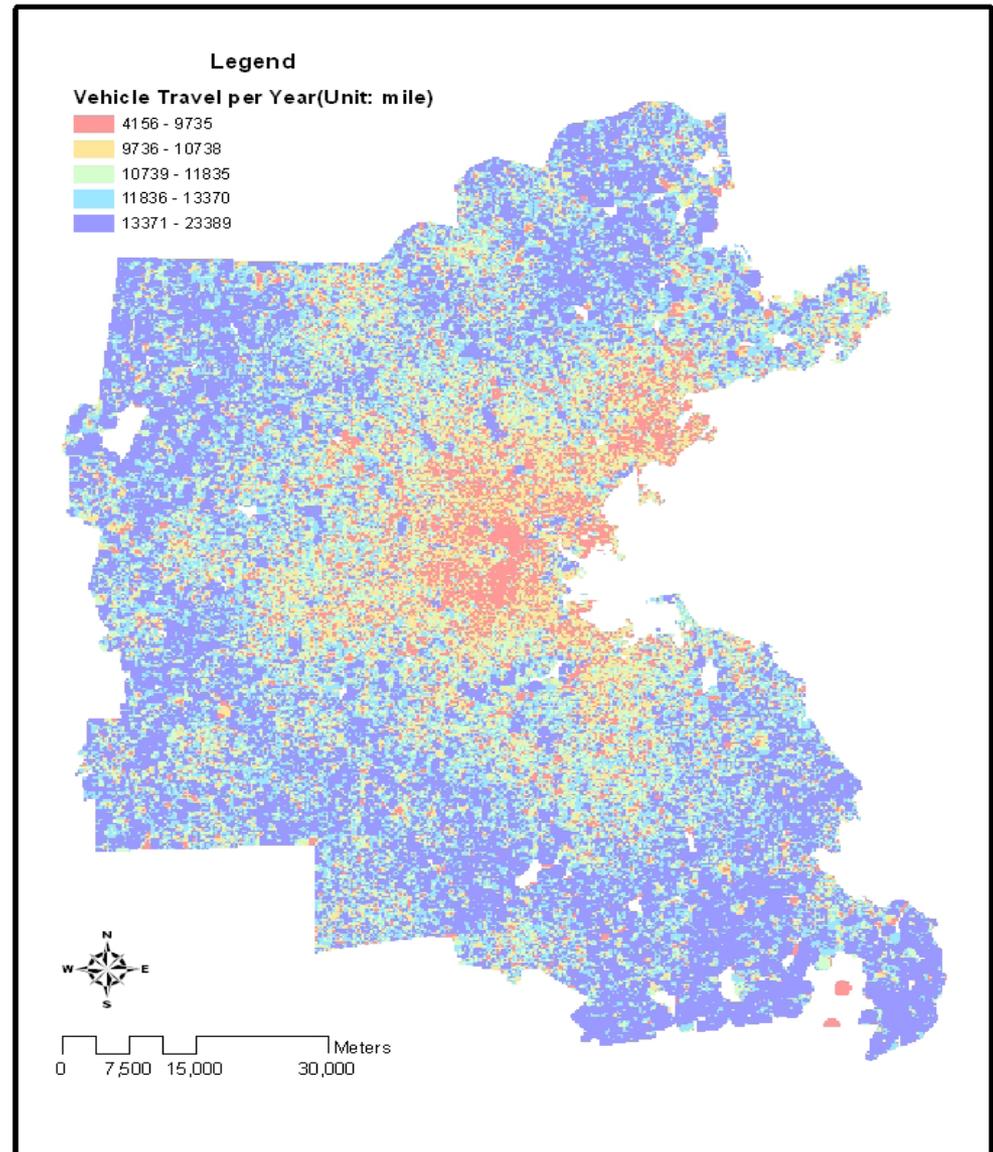
# One Day's Activities in Singapore (a weekday annimation)
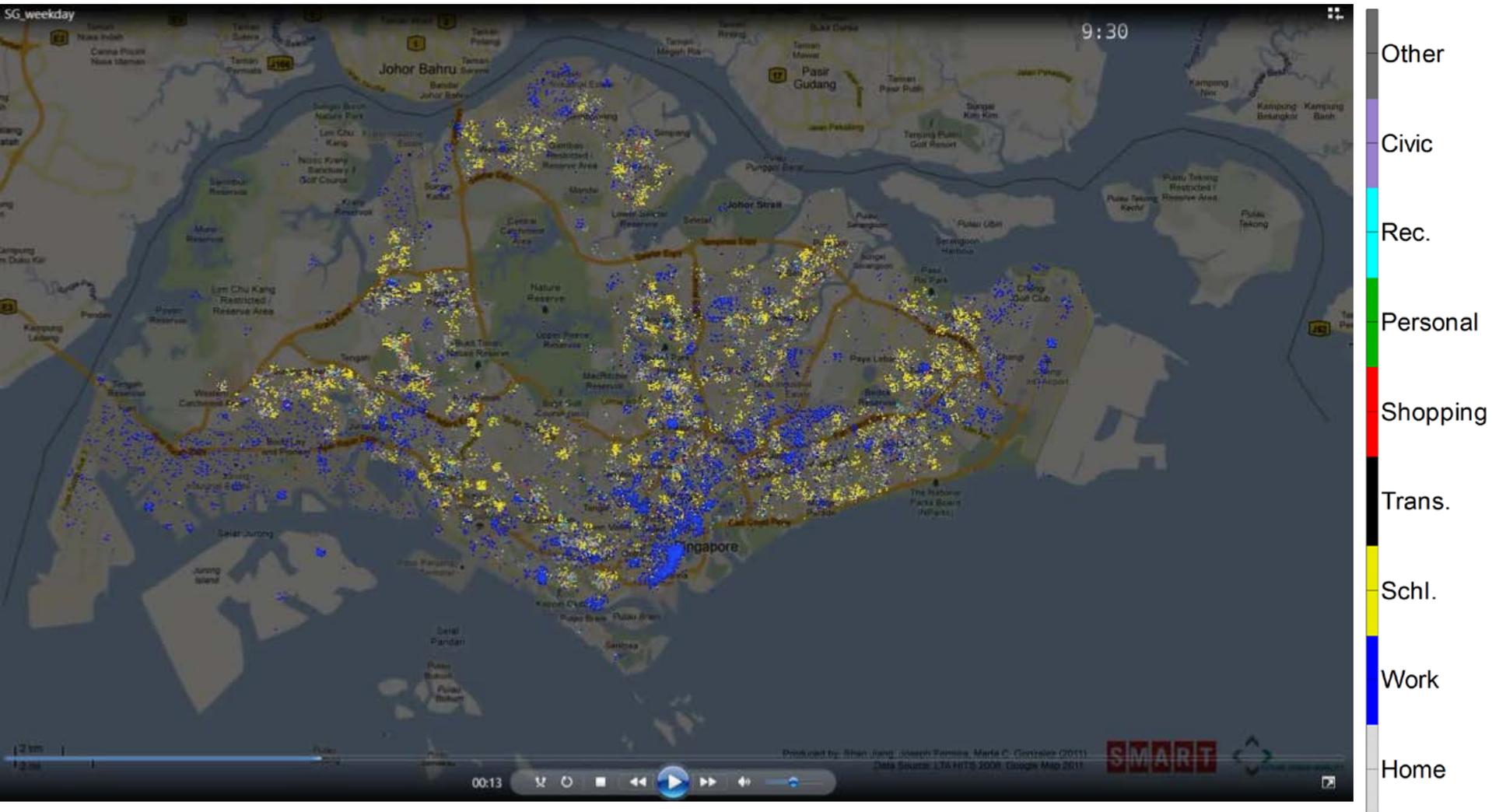
Source: S. Jiang, J. Ferreira, M. Gonzalez using LTA HITS 2008 travel survey & Google Map.
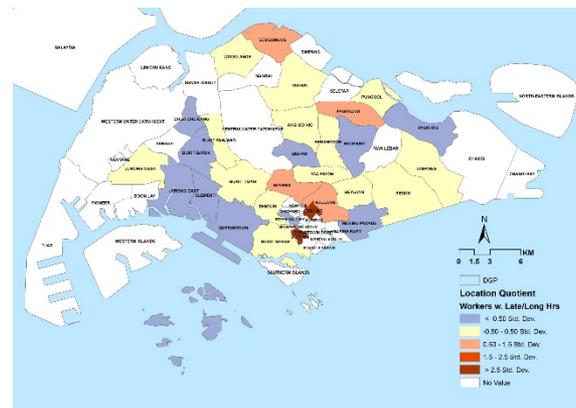
Urban Analytics: Interpreting 'One Singapore Day'

- ## Extracting activity patterns from travel surveys and cellphone data: *(from Shan Jiang's research)*
  - Eigenvector decomposition and k-mean clustering:
    - 8 prototypical patterns: regular worker, early-bird worker, long-day worker, …
  - Common 'tours' or 'motifs':

- ## Linking patterns to place-of-residence:
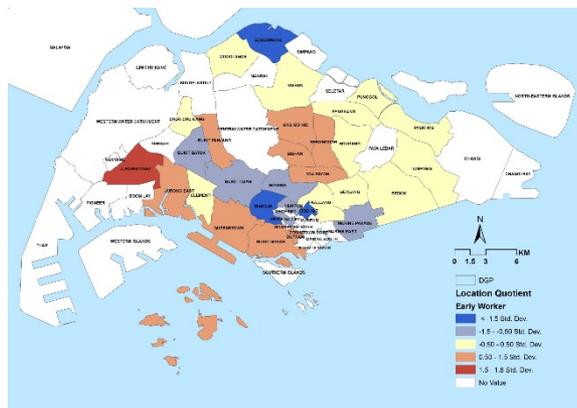
Regular Workers   Long-day Workers

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