Urban Mobility Evaluation Using Small-Area Geography and High-Resolution Population Data (P15-5698)

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Summary
- High-resolution and big data resources have brought challenges and opportunities in urban mobility modeling.
- Volunteered geographic information and high-resolution population data, together with Census Transportation Planning Products (CTPP) data, can help modeling and evaluating urban mobility scenarios on a unified platform.
- We developed the Toolbox for Urban Mobility Simulation (TUMS) system to simulate urban transportation systems with microscopic approach at global level.
- The major features of the TUMS are:
  - Open-source and independent platform
  - Open data and unified data structure
  - Large-scale microscopic traffic simulation
  - Two levels of visualization

Urban Mobility Modeling

The Toolbox for Urban Mobility Simulations (TUMS) system consists of three major modules, as shown in Figure 1. It runs on different operation systems.

Data Processing
- Volunteered geographic information, OpenStreetMap, provides road network data. Figure 2 shows an example in Alexandria city.
- High-resolution population data, LandScan, estimate mobility dynamics and trip numbers. Figure 3 shows both data time and time population distributions.
- Open data, such as CTPP, provides TAZ zones (Figure 2) and helps building the travel demand models.

Web-based Visualization
- National and global study for large-scale geospatial area.
- Link-based macroscopic visualization for network performance analysis, as Figure 5.
- Vehicle-based microscopic visualization for driving behavior monitoring, as Figure 6.

Traffic Simulation Models
- Travel demand modeling: the number of trips (VPC ratio) and travelers departure time choices (S curve)
- Trip distribution modeling: origin-destination matrix for emergency evacuation scenarios.
- Traffic Assignment modeling: road network access and routing issues. Comparing the impacts of spatial and temporal resolutions. The results is show in Figure 4.
- Small-area geography data improve simulation accuracy.
- Use TRANSIMS as traffic engine for large-scale macroscopic and microscopic simulations.

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Discussions
- The TUMS can simulate world-wide transportation and mobility scenarios with open data, unified data preparation, and two levels of visualization
- CTPP provides high-resolution level (TAZ) origin-destination traffic flows to benefit microscopic traffic simulation.
- The large margin errors for small area geography can use high-resolution population distribution data as adjustment.

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