Summary

- Mobility is an important measure to evaluate the efficiency and livability in urban areas.
- Volunteered geographic information and high-resolution population data, together with National Household Travel Survey (NHTS) data, can help modeling 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

The TUMS System

The 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 night time population distributions.
  - Open data, such as NHTS, helps the validation and calibration process for trip generation.

- Traffic Simulation Models
  - Travel demand modeling: the number of trips and travelers departure time choices
  - Trip distribution modeling: origin-destination matrix for both normal scenarios and emergency scenarios.
  - Traffic Assignment modeling: road network access and routing issues. High resolution population data need a revised activity-based assignment algorithm, as Figure 4.
  - Use TRANSIMS as traffic engine for large-scale macroscopic and microscopic simulations.

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

Discussion

- The TUMS can simulate world-wide transportation and mobility scenarios with open data, unified data preparation, and two levels of visualization.
- NHTS can improve the accuracy of microscopic traffic simulation with more available geo-location information.

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