Data Infrastructure for Connected Vehicle Applications

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Introduction

• Connected vehicle (CV) technology can be used to significantly improve safety and mobility of urban traffic.
• Ann Arbor Connected Vehicle Test Environment is the world’s largest operational, real-world deployment of CVs.
• This work established a data infrastructure by aggregating and processing the CV trajectory data received by the AACVTE project.
• This data infrastructure can be used for different applications based on CV trajectory data including traffic state estimation, traffic control, and safety assessment.

AACVTE Project

• AACVTE project (http://www.aacvte.org/) has installed over 2,500 vehicles and 70 infrastructure locations with DSRC unit.

Data Processing

Trajectory data processing pipeline:
• Trajectory data map matching: map the trajectory data to the corresponding movement (through, left-turn, etc.).
• Signal phase mapping identification: map the traffic signal state with controlled movement.
• Convert the GPS coordinates to the distance to the intersection.
• Generate the performance measurement.

Performance Measurement

Fig: map-matching results of Maiden Lane and Fuller (phase 1-4)
Fig: time-space diagram of Maiden Lane and Fuller intersection

Data Visualization Interface

We developed a web-based interface to manage and visualize the real-time data (http://aacvlive.umtri.umich.edu/home.html).

Potential Applications

Potential applications based on the data infrastructure:
• Real-time traffic state estimation: use the trajectory data to estimate the real-time queue lengths, volumes, etc.
• Real-time traffic signal control and management.
• Safety assessment: use the trajectory data to evaluate the safety of the urban traffic.