Speed trajectory data from adaptive eco-driving applications Dataset

Dataset available at: https://doi.org/10.6086/D11H3P

(This dataset supports report **Developing an Adaptive Strategy for Connected Eco-Driving Under Uncertain Traffic and Signal Conditions,** https://doi.org/10.7922/G2F18WZ1)

This U.S. Department of Transportation-funded dataset is preserved by the University of California, Riverside in the digital repository Dryad (https://datadryad.org), and is available at https://doi.org/10.6086/D11H3P.

The related final report **Developing an Adaptive Strategy for Connected Eco-Driving Under Uncertain Traffic and Signal Conditions**, is available from the National Transportation Library's Digital Repository at https://rosap.ntl.bts.gov/view/dot/54551.

Metadata from the Dryad Repository record:

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Abstract:

The eco-approach and departure (EAD) application for signalized intersections has been proved to be environmentally efficient in a Connected and Automated Vehicles (CAVs) system. In the real-world traffic, the traffic-related information received from sensing or communication devices is highly uncertain due to the limited sensing range and varying driving behaviors of other vehicles. This uncertainty increases the difficulty to predict the actual queue length of the downstream intersection. It further brings great challenge to derive an energy efficient speed profile for vehicles to follow. This research proposes an adaptive strategy for connected eco-driving towards a signalized intersection under real world conditions including uncertain traffic condition. A graph-based model is created with nodes representing dynamic states of the host vehicle (distance to intersection and current speed) and indicator of queue status and directed edges with weight representing expected energy consumption between two connected states. Then a dynamic programing approach is applied to identify the optimal speed for each vehicle-queue-signal state iteratively from downstream to the upstream. The uncertainty can be addressed by formulating stochastic models when describing the transition of queue-signal state. For uncertain traffic conditions, numerical simulation results show an average energy saving of 9%. It also indicates that energy consumption of a vehicle equipped with adaptive EAD strategy and a 100m-range sensor is equivalent to a vehicle with conventional EAD strategy and a 190m-range sensor. To some extent, the proposed strategy could double the effective detection range in eco-driving.

Methods:

The trajectory data was collected from numerical simulation using three types of methods including the proposed method in this research, the ideal method and other baseline EAD methods. The proposed method corresponds to the adaptive strategy for connected eco-driving with known historical queue distribution. The ideal trajectory for absolute minimum energy consumption can be derived when the actual queue length is known (i.e. perfect information) at the beginning of the simulation. This strategy can only be achieved if all vehicles are connected to share their positions to the study vehicle. Besides the ideal method, couple of baseline EAD methods (Baselinek) are setup for comparison: Assuming the queue length to be Qk, the vehicle

first follows the ideal trajectory of the assumed Qk length, then change to the corresponding strategy after detecting the real queue length. These baselines are the methods given the same information as the proposed method except the historical queue distribution is missing. Note that if k is 0, Baseline0 corresponds to the scenario when the vehicle follows the existing EAD strategy with no-queue assumption until the sensor detects preceding traffic.

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Dataset description:
This dataset contains 1 .zip file collection described below.

doi_10.6086_D11H3P_v3.zip:
This collection contains 1 .zip file, 1 .txt file, and 2 .csv files listed below.

- RL-based_EAD_simulation_data.7z
    - Within this .zip file there are 30 folders labeled C(0, 10, 20, 30, 40, or 50)_S(10, 20, 30, 40, or 50), for example one of the folders is C40_S30. Each folder likely references a particular simulation with the supporting data found within it. In each folder, there are 6. csv files with the same titles across all folders. They are listed below.
        - Time-Instant_Speed_1episodes.csv
        - time-Instant_distance_1episodes.csv
        - our-Instant_Speed_1episodes.csv
        - our-Instant_distance_1episodes.csv
        - idm-Instant_Speed_1episodes.csv
        - idm-Instant_distance_1episodes.csv
- Readme.txt
- AdaptiveEAD_SPaT.csv
- AdaptiveEAD_Range.csv

The .csv, Comma Separated Value, file is a simple format that is designed for a database table and supported by many applications. The .csv file is often used for moving tabular data between two different computer programs, due to its open format. The most common software used to open .csv files are Microsoft Excel and RecordEditor, (for more information on .csv files and software, please visit https://www.file-extensions.org/csv-file-extension). The .txt file type is a common text file, which can be opened with a basic text editor. The most common software used to open .txt files are Microsoft Windows Notepad, Sublime Text, Atom, and TextEdit (for more information on .txt files and software, please visit https://www.file-extensions.org/txt-file-extension).

National Transportation Library (NTL) Curation Note:
As this dataset is preserved in a repository outside U.S. DOT control, as allowed by the U.S. DOT's Public Access Plan (https://doi.org/10.21949/1503647) Section 7.4.2 Data, the NTL staff has performed ***NO*** additional curation actions on this dataset.

NTL staff last accessed this dataset at https://doi.org/10.6086/D11H3P on 2021-02-01

If, in the future, you have trouble accessing this dataset at the host repository, please email NTLDataCurator@dot.gov describing your problem. NTL staff will do its best to assist you at that time.