



Caltrans Division of Research,
Innovation and System Information

Research

Notes

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Project Title:
Large-scale and Long-term
Forecasting of Performance
Measurement of Public
Transportation Systems

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Large-scale and Long-term Forecasting of Performance Measurement of Public Transportation Systems

To develop a machine learning approach for large spatial scale and long-term performance measurement forecasting for public transportation systems.

WHAT IS THE NEED?

Reliable long-term forecasting of performance measurement for public transportation systems over a large area is essential for policymakers to achieve effective city planning as well as promotes ridership. For example, forecasting bus arrival time for the next day helps a rider to plan their commute early. Existing approaches typically rely on traffic simulation tools and models that require expert knowledge to execute and adjust parameters for various traffic scenarios.

Previously under a Caltrans funded project, the researchers developed a data-driven, deep learning approach for traffic flow prediction and bus arrival time estimation. The researchers also built a system that uses the traffic predictions for forecasting various performance metrics for public transportations in Los Angeles (e.g., bus arrival times). The system demonstrates the overall approach in an area near downtown Los Angeles and shows that incorporating traffic flow predictions can help to forecast short-term bus arrival times accurately (e.g., in the next few hours).



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knowledge that improves
California's transportation system

WHAT ARE WE DOING?

The researchers plan to build on their current approach and system to develop the capability for processing the entire Los Angeles Metropolitan Area (and extendable to the entire state) for long-term forecasting (e.g., days instead of hours) of a variety of public transportation system performance metrics. The major challenges include:

1. How to predict/infer traffic speed on a road segment when there is no traffic sensor at the road segment,
2. How to overcome the computational and memory bottlenecks of training a deep learning network for traffic flow forecasting over a large road network, and
3. How to deal with the large error propagation in the deep learning network for forecasting over a long-time span.

This research will explore both spatial statistical methods and machine learning methods for the estimation of traffic speed for the road segments that do not have a traffic sensor. The researchers will investigate methods to represent large road networks into a condensed graph or multiple subgraphs so that the deep learning network can scale to process large spatial areas. They will also study various training methods and network architectures (e.g., teacher forcing) to enable long-term forecasting of both traffic flows and the performance measurement of public transportation systems.

WHAT IS OUR GOAL?

To demonstrate the results from the proposed research, the researchers will develop a web application in which users can select the start time of a trip and access the predicted bus arrival times anywhere in the entire Los Angeles Metropolitan Area. This research will exploit real-world big traffic sensor data and California Highway Patrol accident logs collected from the Regional Integration of Intelligent Transportation Systems in the last nine years under the existing Archived Traffic Data Management System project.

WHAT IS THE BENEFIT?

Results from this project will help Caltrans' Transportation Planning Division and other policymakers by giving them a tool to improve transit planning. This tool will also assist Caltrans reaching its System Performance goals.

WHAT IS THE PROGRESS TO DATE?

Waiting for the revised final invoice to close this contract out.