UNIVERSITY TRANSPORTATION CENTER

RESEARCH BRIEF

Using Machine Learning to Customize Traffic Prediction for High Performance Traffic Analysis and Optimization

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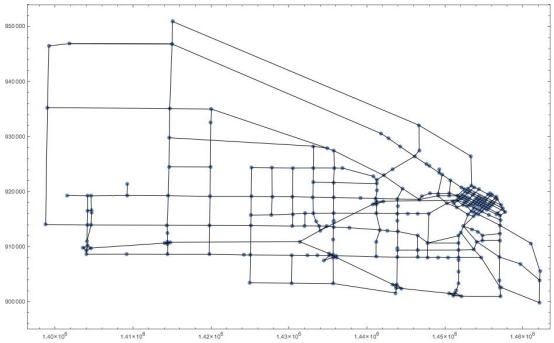
Background

Traffic optimization is a complex system without reliable and situation specific closed form formulas for optimization. This means a simulation plays a critical roll in any advancement in traffic optimization. Micro models rely on simulating car behavior in very small steps leading to extremely long computing times that are impractical for any in-depth optimization. Furthermore, the connection with real traffic behavior is tenuous in that the car behavior model is based on a few simple hard coded abstractions that apply everywhere. This effects the reliability in predicting traffic flow. On the other hand, macro simulation is much faster in that it only requires the ability to estimate arrival times at the ends of street segments. Unfortunately these estimations are difficult to make because they can be based on not only engineering parameters but road conditions including glare, physical condition of the road, congestion, and subjective influencers.

With the advent of specialized hardware and high performance bus and memory architectures, machine learning has shown near magical improvement in the last 10 years. Evidence of this is plainly visible on the cell phones we use everyday such as speech recognition and classification of your picture library by subject. We will apply this technology to learning and predicating the behavior of traffic on individual road segments allowing us to quickly assess the arrival times and create a fast simulator suitable for traffic optimization.

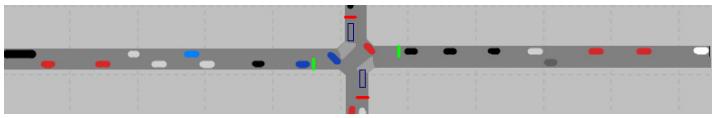


Research Project

This project explores using machine learning techniques to spatially and temporally customize predictive functions in queuing based macro simulations of traffic. Its objective is to replace much slower “one-size fits all” micro simulators so that reliable adaptive traffic control and optimization will be possible, which is a very practical end-goal.

Our first goal is to create machine learning algorithms for learning how to predict the travel time of a car on a specific segment which may include difficult segments which represent signaling such as intersections or toll booths. Data will ultimately come from car telemetry monitoring. The predictor functions will be further used in this project to make much more efficient, reliable, and location sensitive traffic simulator which is necessary for future optimization algorithms. Our initial experiments will attempt to reproduce VISSIM output but much more efficiently.

Our second goal is then to create traffic optimization algorithms using our simulator to estimate cost of a signaling strategy. We will be using several algorithms we have used in the past for evacuation planning as a starting point.



ABOUT THE AUTHORS

The research team consisted of Robert Heckendorn of the University of Idaho.

ABOUT THE FUNDERS

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EXPECTED DATE OF COMPLETION

March 2022

FOR MORE INFORMATION

https://depts.washington.edu/pactrans/research/projects/using-machine-learning-to-customize-traffic-prediction-for-high-performance-traffic-analysis-and-optimization/