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58893

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2017
MCM/ICM
Summary Sheet

Summary

Our team aims at studying the effects on traffic flow of the number of lanes, peak and average traffic volume, and percentage of self-driving, cooperating systems vehicles. In this report, we build a simulation model based on Cellular Automaton (CA), simulate the traffic data on Interstates 5, 90, 405 and State Route 520, analyze the criteria and define the Comprehensive Evaluation Index (CEI) with Fuzzy Synthetic Evaluation (FSE) and display comparison on plots with the controlled variable method.

CA is a typical discrete model in which we take cars as cells and roads as grids. Controlled by a set of rules, the traffic condition is simulated with programming in a cellular-automation-like model. This model is good at dealing with large number of vehicles and recording their behavior in a long time. With this model, we make full use of the data and simulate the traffic in the micro level.

FSE is a regular way to handle the situation that several factors may influence the event. In this problem, we have three criteria — traffic flow, average velocity and traffic density. FSE helps us develop a new parameter CEI to evaluating the effects on traffic. CEI is a weighed and comprehensive value shows the traffic condition. The larger the value, the better the traffic.

Three kinds of plots are shown in our report. The spatiotemporal patterns display the whole process we simulated in a vivid way. Histograms give a look at the difference between regular hours and peak hours. Line charts show how the self-driving, cooperating cars work in the busy traffic and a tipping point where performance changes markedly is obvious in such a plot.

Finally, basing on the comparison and analysis of the plots and the data, we propose several policies that will improve traffic.

In conclusion, this report provides a realistic model and a detailed analysis. The plots and data support our advice well that it may benefit the traffic condition in the United State.