Mitch Negus and Dayton Thorpe

CS 289A Final Project Proposal

According to the US Department of Transportation Federal Highway Administration’s Urban Congestion report for 2015, San Francisco traffic ranked fourth worst among US major metropolitan areas in terms of congestion time [1]. Bay Area roads are jammed for nearly seven hours of the day. Alleviating this traffic could provide a host of benefits: increased productivity, reduced fuel consumption, lower pollution rates, or just less frustrated commuters. While many potential solutions exist, the capability to accurately predict traffic jams could help drivers cut commute times or even offer valuable insight into optimal methods for eliminating congestion.

For our predictions, we propose using a long short-term memory (LSTM) neural network to forecast traffic on Bay Area freeways. The UC Irvine PEMS-SF Data Set [2] has measured values of the average lane occupancy – a number between 0 and 1 – averaged over 10 minute intervals for 440 days across 963 sensors. First, we’ll train on single time series. That is, just using the historical traffic for a given sensor, we will make a forecast of the lane occupancy at that same sensor over some time period, say 30 minutes. With that as a benchmark, we’ll train on multiple time series at once. By training on the historical traffic for a given sensor as well as the sensors immediately upstream and downstream along the freeway, we expect to make a more accurate forecast of the lane occupancy.

As a baseline, we will use the average lane occupancy for each sensor as a function of time of day. The typical sensor shows peaks in the average and standard deviation around the morning and evening rush hours. Two typical examples are shown below.

The scope of work for this project will primarily entail algorithm development. Our program will first need to demonstrate effective use of LSTM neural network methods, but then we must utilize dataset features to maximal effect so that our system can generate high-quality traffic predictions. Criteria for a successful algorithm could include predictions of traffic sufficiently far in advance (in either time or space), or accurate forecasts of traffic based on less obvious patterns in the PEMS-SF dataset.

[1] US Department of Transportation, Federal Highway Administration. Urban Congestion Report: June, 2015. [https://ops.fhwa.dot.gov/perf\_measurement/ucr/reports/fy2015\_q3.pdf]

[2] M. Cuturi. UCI Machine Learning Repository. Irvine, CA: University of California, School of Information and Computer Science. [https://archive.ics.uci.edu/ml/datasets/PEMS-SF]