Abstract

Sydney Coordinated Adaptive Traffic System (SCATS) is an Intelligent Transportation System currently deployed in Adelaide, Australia, that is responsible for (amongst other tasks) controlling the sequences, cycles and timing at signalised road intersections, and collecting and storing a record of these operations and vehicle flow counts. Within the context of this SCATS data, the research presented in this thesis investigates:

- How traffic flows at specific intersections can be used to make predictions about future traffic volumes in the short term, specifically, in the next phase of traffic and on aggregate over the next 5/10/15 minutes.
- Whether outliers within these observations and predictions can indicate that traffic flow is indicative of an incident or otherwise anomalous traffic behaviour.

The task of answering these questions is of *global* significance, as the effectiveness of the tools that solve these problems has the potential to impact the safety and efficiency of travel for hundreds of millions of commuters every single day, as they travel through road networks monitored by ITS.

In this work, traffic data for the Adelaide metropolitan arterial road network are used to evaluate a variety of existing and novel models on their predictive performance. The dataset has two distinct road areas:

Central Business District: those monitored intersections within the CBD. Traffic flow in this area is not typical of that on arterial areas due to its unique traffic usage among other factors.

Arterial: those high flow intersections that are outside the CBD but are not freeways.

HTM, LSTM, ARIMA and Markov models are predictive evaluated for short term arterial traffic prediction in 5 minute aggregate and on a next-phase basis. HTM and LSTM models perform particularly well at both tasks. The practical implications of this finding allows for the development of traffic control systems that act in a proactive (rather than a reactive manner).

HTM is also evaluated for its ability to indicate the presence of an incident purely from prediction anomalies and compared to SHESD (a statistical time

series anomaly detection algorithm). While anomalous data exists in the SCATS dataset, these anomalies do not imply the presence of an incident and incidents do not necessarily cause anomalous vehicle flow counts. Practically, this means that anomalies in vehicle flows should not be used to infer the presence of an incident.