

Traffic Accident Duration and Impact Prediction Artur Grigorev (Artur.Grigorev@student.uts.edu.au) Supervisors: Dr. Adriana-Simona Mihaita, Dr. Seunghyeon Lee

INTRODUCTION

Predicting the duration of traffic accidents is a challenging task due to the stochastic nature of these events. The ability to accurately predict how long accidents will last and which impact it will cause on traffic flow can provide a significant benefits to both end-users (by providing better routes mitigating accident effects) and traffic operation managers (to determine how many resources needs to be allocated in accident management).

AIMS

Aim 1: to evaluate the best and state-of-the-art methods of Deep Learning and Machine Learning, different data analysis approaches on the task of traffic incident analysis to build a framework (see 1 and 2) with the goal to improve the traffic accident duration prediction accuracy.

Aim 2: to develop a system for the spatial-temporal accident impact prediction, which incorporates multiple tasks: traffic speed and traffic flow prediction, traffic accident detection and spatial-temporal impact estimation (using modelling and simulation).



METHODS

There is a large variety of methods developed in recent years and used in the research (see Fig. Results):

- a) Various Machine Learning models allow to classify accidents using duration threshold between short-term and long-term or predict their duration based on the data available at the moment the accident reported [1].
- b) Feature importance estimation algorithms allow to determine the impact of each reported accident characteristic on the incident duration prediction accuracy.
- c) The impact of traffic accidents on traffic flow studied and analysed using modern modelling techniques, which allow to detect their impact. By having the road network graph, marked up accidents and their impact, it is possible to perform the spatialtemporal traffic accident impact prediction [2].
- d) Each accident has a textual description, which very rarely been analysed before with the focus on accident impact and duration prediction [3]. Textual accident descriptions are analysed for words which have the highest impact (associated with shorter or longer accident) on the prediction accuracy.

References

[1] R. Li, F. C. Pereira, and M. E. Ben-Akiva, "Overview of traffic incident duration analysis and prediction," European transport research review, 2018. [2] S. Fukuda, H. Uchida, H. Fujii, and T. Yamada, "Short-term prediction of traffic flow under incident conditions using graph convolutional recurrent neural network and traffic simulation," IET Intelligent Transport Systems, 2020.

[3] Z. Zhang, Q. He, J. Gao, and M. Ni, "A deep learning approach for detecting traffic accidents from social media data," Transportation research part C: emerging technologies, 2018.

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the disruptions in traffic flow more selectively and precisely to segment and markup accidents for the modelling and analysis of

RESULTS



Traffic authorities can integrate the accident duration prediction models into decision-making system, estimate its potential accuracy and to understand how the collected data (features and textual descriptions) can improve their predictions. Traffic network end-users could have a route planning recommendation system which considers how traffic accidents appearing in real-time could affect speeds on various streets throughout their tour, which will allow them to plan a route the least affected by accidents both now and across the future accident effect propagation.



SOCIAL IMPACT

FUTURE RESEARCH

Traffic accidents can have an impact throughout the whole traffic network. And the accident impact can propagate differently through various road structures (dissipate or even cause secondary accidents).

By mapping the traffic accident impact to the road structure, traffic accident characteristics to the impact on traffic flow we will be able to simulate the impact of different potential accidents on various road structures, which will allow us to find the most accident-resilient traffic networks, which will allow us to build better cities.



