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Highway crash detection and risk estimation using deep learning

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Highlights

- Use deep learning on traffic data for crash detection and risk estimation.
- Explore different deep model structures and compare with shallow models.
- Discuss relationship of model capacity and data size for deep learning application.

Abstract

Crash Detection is essential in providing timely information to traffic management centers and the public to reduce its adverse effects. Prediction of crash risk is vital for avoiding secondary crashes and safeguarding highway traffic. For many years, researchers have explored several techniques for early and precise detection of crashes to aid in traffic incident management. With recent advancements in data collection techniques, abundant real-time traffic data is available for use. Big data infrastructure and machine learning algorithms can utilize this data to provide suitable solutions for the highway traffic safety system. This paper explores the feasibility of using deep learning models to detect crash occurrence and predict crash risk. Volume, Speed and Sensor Occupancy data collected from roadside radar sensors along Interstate 235 in Des Moines, IA is used for this study. This real-world traffic data is used to design feature set for the deep learning models for crash detection and crash risk prediction. The results show that a deep model has better crash detection performance and similar crash prediction performance than state of the art shallow models. Additionally, a sensitivity analysis was conducted for crash risk prediction using data 1-minute, 5-minutes and 10-minutes prior to crash occurrence. It was observed that is hard to predict the crash risk of a traffic condition, 10 min prior to a crash.

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Keywords

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