

Probabilistic Crash Prediction and Prevention of Vehicle Crash

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Abstract : Transportation brings immense benefits to society, but it also has its costs. Costs include such as the cost of infrastructure, personnel and equipment, but also the loss of life and property in traffic accidents on the road, delays in travel due to traffic congestion and various indirect costs in terms of air transport. More research has been done to identify the various factors that affect road accidents, such as road infrastructure, traffic, sociodemographic characteristics, land use, and the environment. The aim of this research is to predict the probabilistic crash prediction of vehicles using machine learning due to natural and structural reasons by excluding spontaneous reasons like overspeeding etc., in the United States. These factors range from weather factors, like weather conditions, precipitation, visibility, wind speed, wind direction, temperature, pressure, and humidity to human made structures like road structure factors like bump, roundabout, no exit, turning loop, give away, etc. Probabilities are dissected into ten different classes. All the predictions are based on multiclass classification techniques, which are supervised learning. This study considers all crashes that happened in all states collected by the US government. To calculate the probability, multinomial expected value was used and assigned a classification label as the crash probability. We applied three different classification models, including multiclass Logistic Regression, Random Forest and XGBoost. The numerical results show that XGBoost achieved a 75.2% accuracy rate which indicates the part that is being played by natural and structural reasons for the crash. The paper has provided in-deep insights through exploratory data analysis.

Keywords : road safety, crash prediction, exploratory analysis, machine learning

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