A Survey on Methods used for Prediction of Road Accidents

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Abstract – In our country, more than one fifty thousand people die in traffic accidents. Twelve lakh people have died and over five crore people have been injured in accidents every year. Their injuries may first limit their abilities to work, take care of family and home, or even perform activities like walking or standing without pain. Missing work due to car accident injury may put the family's financial stability at risk , adding significant stress and worry to already difficult time. Medical bills, car repairs and other costs are even more daunting. This paper explains the different methods that are used to predict the road accidents. The paper analyzes the various techniques, the advantages and disadvantages in each method.

Keywords – Machine Learning, Data Analytics, Neural Networks, Linear Regression, Multiple Linear Regression, Data Mining, Decision Trees.

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1. INTRODUCTION

Causalities on road are undoubtedly the most common cause of damage. The reason for this is increasing automobiles growth rate, which leads to a heavy traffic and collision between them. Heavy good vehicles like Buses, Lorries, trucks are one of the major reasons for accidents leading to death of innocent people. Various weather conditions like rain, fog etc play a role in catalyzing the risk of accidents. By knowing the proper stats and knowing the accident zones and it will help reduce them. Providing current or live emergency support when accidents have occurred is needed, and to do that a detail analysis on accidents is required. In spite of having set regulations and the highway codes, negligence of people towards the rash driving of the vehicle, the bad state of vehicle and their ignorance towards traffic rules has caused a many accidents. These accidents wouldn't have turned fatal, and claimed innocent lives if people had governed by the rules. Models are created using accident data records which can help to understand the characteristics of many features like driver's behavior, roadway conditions, light conditions, weather conditions and so on.

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This can help the users to compute the safety measures which are useful to avoid accidents. It can be illustrated how statistical method based on directed graphs, by comparing two scenarios based on out-of-sample forecasts. The model is performed to identify statistically significant factors which can be able to predict the probabilities of crashes and injury that can be used to perform a risk factor and reduce it.

Here the road accident study is done by analyzing some data by giving some queries which is relevant to study. The queries like what is the most dangerous time to drive, what fractions of accidents occur in rural, urban and other areas? What is the trend in the number of accidents that occur each year, do accidents in high speed limit areas have more casualties and so on…. These data can be accessed using Microsoft excel sheet and the required answer can be obtained. This analysis aims to highlight the data of the most importance in road traffic accident and allow predictions to be made. The results from this methodology can be seen in the next section of the report.

2. LITERATURE SURVEY

Sachin Kumar & Durga Toshniwal [1] has used some algorithm which is used to predict the accident prone zones and to identify the various factors that have a huge impact at those specific places. Using k-means clustering he divides the accident zones into k- multiple groups. Based on those factors which caused accidents we are clustering those zones into each k group and rule mining (association) is applied to identify relationship between unique attributes which are there in the dataset.

Tessa K. Anderson [2] proposed a approach of finding very high density accident spots, which describes a technique for clustering that shows the stochastic indices have the possibility to exist in some clusters, and can't be able to be compared in space and time. The kernel density evaluation tool allows the manipulation and visualization of high density based events, which in turn is also able to create the basic spatial unit of the clustering model of hotspot.

Kalyoncuoglu SF, Tigdemir M [3] conducted an experiment that shows the major criticality of damage that occurs at the

time of road accident is depicted using the performance of many machine learning paradigms, such as support vector machines, neural networks trained using hybrid learning methods, decision trees & concurrent mixed models involving decision trees and neural networks. The output of experiment shows that hybrid decision tree neural network method is much better than the single method in machine learning paradigms.

Andri Irfan, Ronal Al Rasyid and Susanty Handayani [4] conducted research which shows toll road accidents are conducted using convectional descriptive statistics. But they found out that this technique fails to identify the cause-effect relationships and are not capable of constructing the models to predict accidents. This paper presents the TRA prediction model for Jakarta Outer Ring Road Toll Road (JORR), in order to identify most important causes of accidents and to develop effective predictive models. Data mining (DM) techniques (artificial neural networks (ANNs) and support vector machines (SVM)) were used to model accident and incident data compiled from the historical data. Here R-Tools have been used to compare the results with those from some classical statistical techniques (logistic regression (LR)) which show the accuracy of SVM and ANNs in predicting and identifying the factors which led to the accidents in toll road.

P. Senk, J. Ambros, P. Pokorny, R. Striegler [5] presented a paper which introduces the possibility of using accident prediction models for the identification of hazardous road locations. They have applied this method as an example to the rural road in South Moravian which is classified in terms of road segments and traffic parameters. This prediction model uses the traditional linear model which on the basis of historical data predicts the probability of expected number of road accidents for each type of road segments. A critical road segment is a segment where reported number of road accidents exceeds the expected number road accidents on a normal road segment. This method is considered as effective method for road safety management.

Jabar H. Yousif, Mamoun Suleiman AlRababaa [6] published a paper that aims to design and implement a neural technique for predicting the behaviour of car accident in Jordan. MPL neural network is used to apply the predictor system to estimate the number of road accidents. They have analyzed the historical data about road accidents such as number of accidents, types and reasons. This experiment found out to be very accurate in classifying different accident types. The call precision and accuracy are 100 percent. This paper introduces analytical studies and develops an equation that helps to control the behaviour of increase in road accidents.

Jianhu Zheng, Xiongbin Wu [7] proposed a new combined prediction model based on induced ordered weighted geometric average (IOWGA) operator. This new model combines the GM(1,1) model and the Verhulst model with changeable weight coefficients of each single model. Here a combined model on the basis of the optimal weighted (OW) method is also presented for comparison. The results indicate that the proposed combined model is better than the other three models. Accordingly, the model is even consistent with real world accident tendencies.

Nejdet Dogru, Abdulhamit Subasi [8] conducted a research on a system which detects happening accidents. The system will gather the required information from its neighbouring vehicles and use that information to process using machine learning tools to identify the possible accidents. Machine learning algorithms have shown success on distinguishing abnormal behaviours than normal behaviours. This research aims at analyzing traffic behaviour and considers vehicles which move different than current traffic behaviour as a possible accident. The results prove that clustering algorithms can successfully detect accidents.

G. Mani Kandan, Sarilya Jaiswal, Rahul Mishra & Mrs. Steffina Muthukumar [9] published a paper which attempts to create a model to analyze the external factors such as weather conditions, poor road conditions, fog, rainfall, partial visibility etc which are the major reasons for accidents according to the statistics. The proposed system is a middleware which uses techniques that involves data slicing, data analysis and data pre- processing for secured and optimized results. The prediction model used here analyzes the important parameters. The model makes use of 3 main algorithms which are random forest, artificial neural networks, support vector machines. Results from this paper may help the civic authorities to take actions on crash prone weather and traffic conditions.

Fshatsyon Brhane Gebretensay, Jayesh Juremalani [10] conducted a detailed micro analysis of road accidents by taking into consideration each and every parameter related to the accidents to develop a prediction model. For this micro level analysis they have taken the data of 7 years from the police station and analysis is performed on basis like Hour, year, location, type of collision, type of road, physical feature of road, age group, sex, weather condition etc Linear regression model and multiple linear regression models are developed for the prediction of expected accidents.

3. CONCLUSION

We conclude by going through all the research papers the accident cases are caused by so many reasons like vehicle condition, age and also depends on the age of the driver. Thus we must build an efficient, real-time and dynamic application which predicts accidents and road safety features. The linear regression and multiple regressions are effective in predicting road accidents to some extent. A test

must be conducted by making use of support vector machines and decision tress for the above cases as they as effective in almost all cases.

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