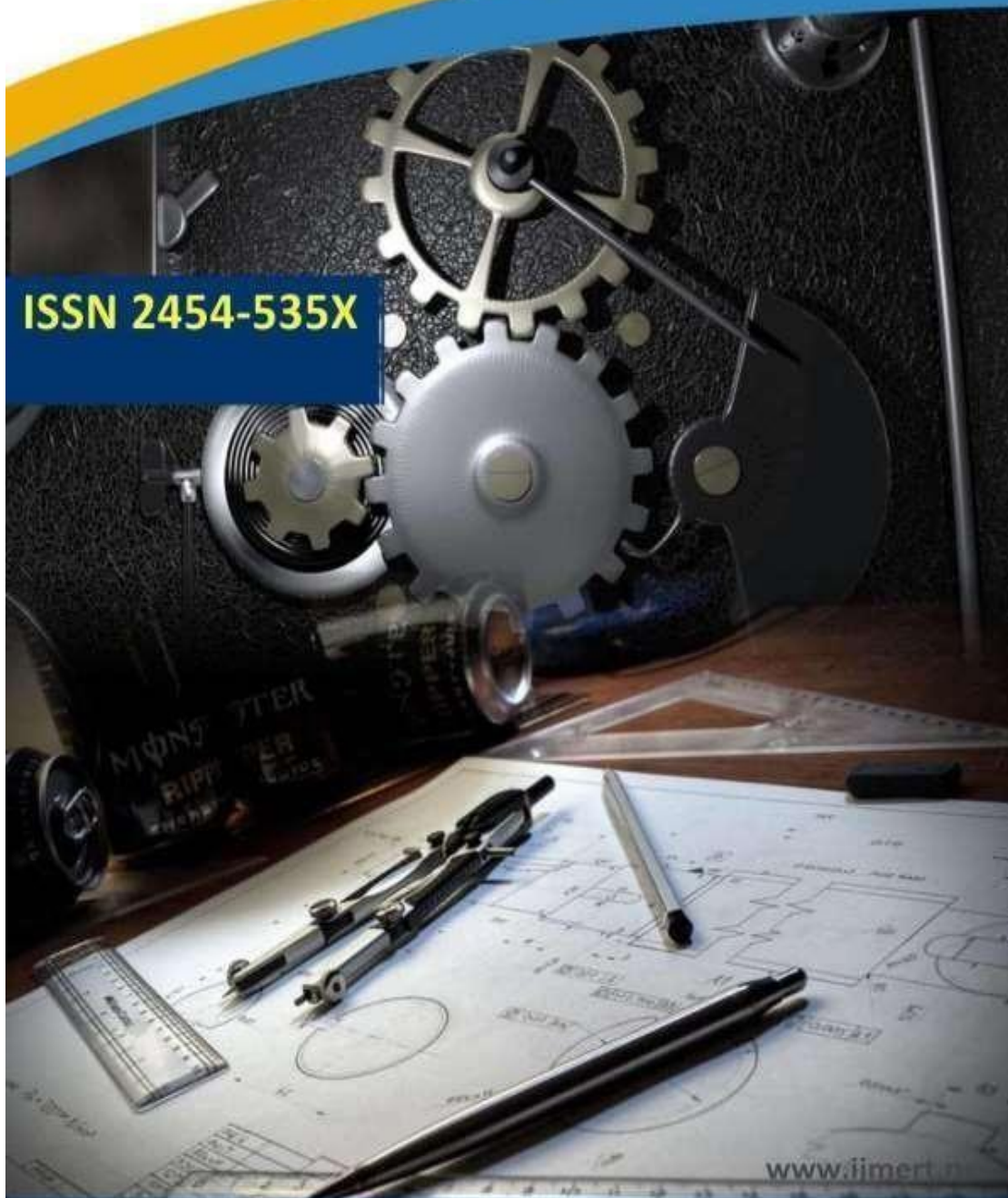




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ROADSAFE PREDICTOR: ML-DRIVEN ACCIDENT SPOT FORECASTING

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ABSTRACT

Due to the exponentially increasing number of vehicles on the road, the number of accidents occurring on a daily basis is also increasing at an alarming rate. With the high number of traffic incidents and deaths these days, the ability to forecast the number of traffic accidents over a given time is important for the transportation department to make scientific decisions. In this scenario, it will be good to analyze the occurrence of accidents so that this can be further used to help us in coming up with techniques to reduce them. Even though uncertainty is a characteristic trait of majority of the accidents, over a period of time, there is a level of regularity that is perceived on observing the accidents occurring in a particular area. This regularity can be made use of in making well informed predictions on accident occurrences in an area and developing accident prediction models. In this paper, we have studied the inter relationships between road accidents, condition of a road and the role of environmental factors in the occurrence of an accident. We have made use of ML techniques in developing an accident prediction model using Support Vector Machines and some other ML algorithms road accident datasets for the years few years available in the internet have been made use for this study.

I. INTRODUCTION

The alarming rate of increase of accidents in India is now a cause for serious concern. According to some recent statistics [1], India accounts for roughly six percent of global road accidents while owning only one percent of the global vehicle population. There are a lot of accident cases reported due to the negligence of two-wheelers, whereas over-speeding is also another contributing factor. Accidents caused while under the influence of alcohol or during general traffic violations are also common. In spite of having set regulations and the highway codes, the negligence of people towards the speed of the vehicle, the vehicle condition and their own negligence of not wearing helmets has caused a lot of accidents. While the major cause of road accidents is attributed to the increasing number of vehicles, the role played by the condition of the roads and other environmental factors cannot be overlooked. The number of deaths due to road accidents in India is indeed a cause for worry. The scenario is very dismal with more than 137,000 people succumbing to injuries from road

accidents. This figure is more than four times the annual death toll from terrorism. Accidents involving heavy goods vehicles like trucks and even those involving commercial vehicles used for public transportation like buses are some of the most fatal kind of accidents that occur, claiming the lives of innocent people. Weather conditions like rain, fog, etc., also play a role in catalysing the risk of accidents. Thus, having a proper estimation of accidents and knowledge of accident hotspots and causing factors will help in taking steps to reduce them. This requires a keen study on accidents and development of accident prediction models. To implement a well-designed road framework management system for looking into road security aspects, it is often desired to have an optimized accident prediction model which can analyze potential issues arising due to infrastructure fallbacks and to estimate the effect of existing models in reducing the occurrence of accidents. The main challenges involved in the creation of such a model include the evaluation of the weight that can be attributed to the impact of each variable in contributing

to the accident and assessing how the model can be best designed to incorporate the effects of all such variables. Data mining techniques and models have in the past been found useful for the purpose of data interpretation in a variety of domains including but not limited to credit risk management, fraud detection, healthcare informatics, recommendation systems and so on. Approaches involving artificial intelligence and machine learning have further helped to augment these studies. For this paper, we have investigated the inter-relationship between the occurrences of road accidents and the roles played by the underlying road conditions and environmental factors in contributing to the same. Since such a study requires us to cover several aspects affecting accidents, we can make use of data mining techniques to analyze this data to extract relevant details from them, as these huge volumes of data would otherwise be meaningless without the right interpretation applied to them. In this paper, we are discussing the effects of such an accident prediction model in identifying the risks involved in road accident scenarios. The next

section discusses the prior works done with respect to analyzing the different accidents that have taken place over the years. This is followed by a summarized description of the methodology used in this work. Further, the different components of implementation including the system architecture, software and languages used, simulation, user interface and screenshots of the developed application are discussed. Finally, the discussion and conclusions derived from the present study and the future scopes are outlined in the last two sections. The results from this study have been used to propose a model that can be used as a tool to estimate the possibility of road accidents in a particular area chosen by the user.

III. LITERATURE SURVEY

The steady increase in the rate of accidents in India have prompted many researchers to look into the factors affecting road accidents and study about it. Since data mining techniques do not require certain assumptions between dependent and independent variables which are required in traditional statistical techniques, various categories of data mining techniques have been

made use of in creating prediction models for road accidents in the past. Researchers have focussed on different sets of attributes in developing such models. Srivastava et al. [2] and Ghazizadeh et al. [3] have mainly concentrated on studying the accidents occurring at intersection points. While the former has looked into categorizing the accidents based on their levels of seriousness using a Multi-layered perceptron (MLP) technique that was found to be more effective, the latter has made use of a feed forward MLP that utilizes back propagation learning to analyse the effect of several factors such as day or night, traffic conditions etc. on accidents. Chen et al. [4] in their studies have found highways to be the common area where a majority of accidents had been reported to occur.

Williams et al. [5] have found through their studies that the age and experience of a driver also play a major role in the occurrence of accidents. Suganya, E. and S. Vijayarani [6] in their paper have analysed the road accidents in India and compared the performance of different classification algorithms such as linear regression, logistic regression, decision

tree, SVM, Naïve Bayes, KNN, Random Forest and gradient boosting algorithm using accuracy, error rate and execution time as a measure of performance. They have found the performance of KNN to be better than that of the others.

Sarkar et al. [7] have done a comparative study on the type of roads that are prominent in accidents. While exploring the other components associated with accidents, they have found that the occurrence of accidents in highways is more common than in a normal road similar to [4]. Stewart et al. [8] have utilized original data in building a neural network model to predict accidents. They found that this model was able to give quicker results than those being used in the models built on Indian roads.

Zheng et al. [9] have studied the range of injuries that come forth in a motor vehicle accident and have also analyzed the emotions of the drivers involved in the accidents that could have been a causal factor. Arun Prasath N and Muthusamy Punithavalli [10] have conducted an extensive survey on the different techniques used in road accident detection over the years, the

approaches implemented in them and discusses their merits and de-merits.

George Yannis et al. [11], in their paper, have discussed about the current practices used in the development of accident prediction models on an international level. Detailed information on various models have been collected with the help of questionnaires and they have made use of this data to identify which could be the most useful model that can be applied for accident prediction.

Anand, J. V [12] has developed a method to determine the effect of different variables in the detection and prediction of atmospheric deterioration all over the world. Fuzzy C means clustering, R-studio, and the ARIMA frame work have been made use of in creating this method. A similar approach can also be tried in evaluating the impact of various factors on road accidents. Analyzing the original cause of accidents is important because this will tell us the impact factor and contribution of each attribute towards road accidents. Tiwari et al. [13] have made use of self-organizing maps, K-mode clustering techniques, Support

Vector Machines, Naïve Bayes and Decision tree to classify the data from road accidents based on the type of road users. An analysis of the historical data will be useful in identifying accident hotspots. This was done by N. Singh et al. [15] to create a conceptual framework for the development of a model to detect the accident prone areas. On another note, Kaur, G et al. [14] have utilized correlation analysis and other visualization techniques with the help of R tool to study road accidents and traffic collision data and created an accident prediction model, focusing on state highways and normal district roads. The key takeaway from all the previously mentioned researches done in the past is that if we are able to provide information to the people regarding the possibility of an accident, it will act as a guide to the inexperienced or new travelers in an area and make the people more cautious while driving. Government authorities will get to know the causes of accidents, the dominant factors such as weather conditions, transport infrastructure etc. that are inflicting upon the various accident prone regions and will help to provide assistance in sketching out the

association between the various factors that directly or indirectly have a part in causing the accident. Information can be provided to the Regional Transport Office regarding the accident prone regions where alcoholic intoxication, distracting circumstances like making a phone call while driving, aggressive and careless driving, and disregard towards safety rules, fatigue of driver are the main causes of accidents. This information will help the RTO to impose strict actions such as checking the license of the driver, conducting alcohol check or even placing of additional traffic policemen in such areas. Our aim is also to assist them in organizing the traffic.

IV. EXISTING SYSTEM:

An analysis of the historical data will be useful in identifying accident hotspots. This was done by N. Singh et al. [15] to create a conceptual framework for the development of a model to detect the accident prone areas. On another note, Kaur, G et al. [14] have utilized correlation analysis and other visualization techniques with the help of R tool to study road accidents and traffic collision data and created an accident

prediction model, focusing on state highways and normal district roads.

Anand, J. V [12] has developed a method to determine the effect of different variables in the detection and prediction of atmospheric deterioration all over the world. Fuzzy C means clustering.

Disadvantages:

- Accuracy is Low.
- Only using Machine Learning Data Mining algorithms.

V. PROPOSED WORK:

In this paper, we have built an application that is capable of predicting the possibility of occurrence of accidents based on available road accident data. Data pre-processing is done on this road accident data to obtain a dataset. The data preprocessing step includes cleaning to remove the null and garbage values, and normalization of the data, followed by feature selection, where only relevant features from the original dataset are selected to be included in the final dataset. The dataset is then subjected to different data mining techniques. Clustering is performed on

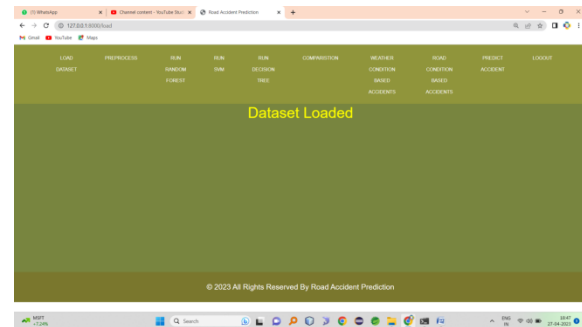
this dataset. The clusters are then subjected to other algorithms like Support Vector Machines (SVM), Decision tree and Random forest. Since the data being used for the study has an unknown distribution and we need to sort out the frequent and infrequent items in the dataset, the Support Vector Machines (SVM), Decision tree and Random forest, For the frequently occurring item sets, the chosen support and confidence values imply the higher probability of the particular combination of attributes in leading to an accident. By applying these three algorithms we got different accuracies. we predict output by using which gives better accuracy.

Advantages:

- Accuracy is Very high.
- Better Prediction.

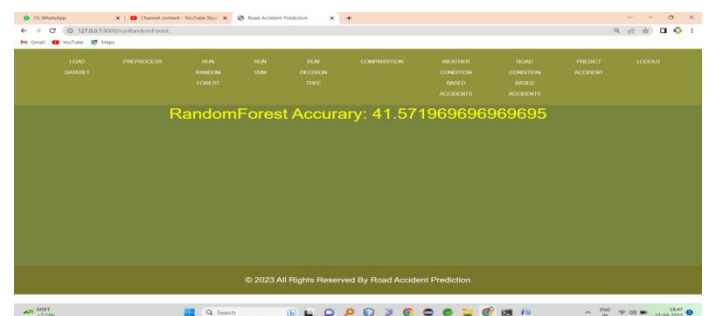
VI. Module description

1. Dataset Upload & Analysis: using this module we will upload dataset and then perform analysis methods such as finding various Road accidents and its count and then clean dataset by removing missing values



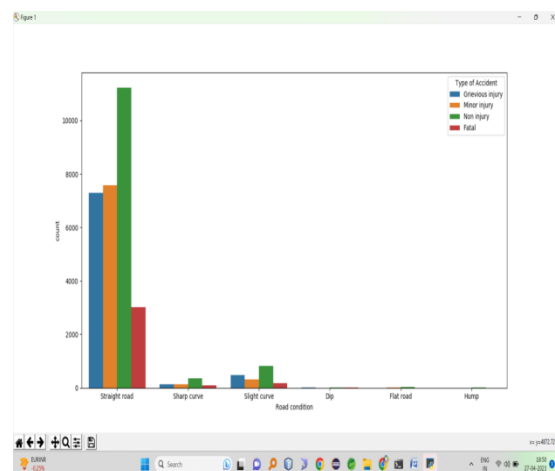
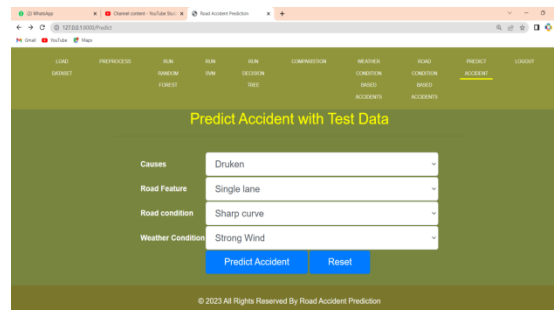
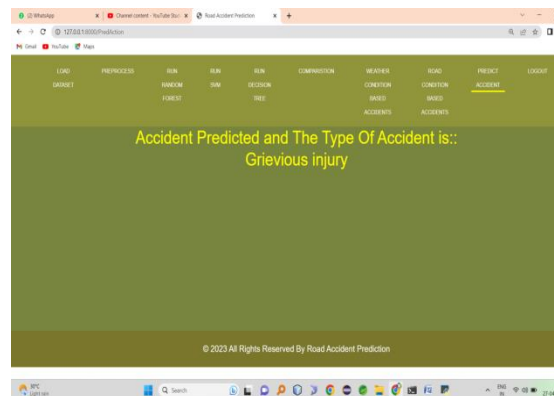
2. Dataset Processing & Analytical Methods: using this module we will encode attack labels with integer ID and then split dataset into train and test where application used 80% dataset to train classification algorithms and 20% to test its prediction performance

3. Run ML Model: using this module we will trained classification algorithm with above 80% dataset and then build a prediction model



4. Classification Performance Graph: using this module we will plot accuracy graph to know its performance accuracy

5. Predict Output: using this module we will upload test dataset and then classification model will predict output based on input data

V.CONCLUSION

An accident can change the lives of many people. It is up to each of us to bring down this increasing number. This can be made possible by adopting safe driving measures to an extent. Since all instances of accidents cannot be attributed to the same cause, proper precautionary measures will also need to be exercised by the road development authorities in designing the structure of roads as well as by the automobile industries in creating better fatality reducing vehicle models. One thing within our capability is to predict the possibility of an accident based on previous data and observations that can aid such authorities and industries. This project was successful in creating such an application that can help in efficient prediction of road accidents based on factors such as types of vehicles, age of the driver, age of the vehicle, weather condition and road structure, so on. This model was implemented by making use of several data mining and machine learning algorithms applied over a dataset for Bangalore and has been successfully used to predict the risk probability of accidents over different areas with high accuracy. The model can be further optimized in future to include several constraints that have been left out in the current study. These

optimized models can be efficiently utilized by the government to reduce road accidents and to implement policies for road safety. Another scope of this work would be to develop a mobile app that will help the drivers in choosing a route for a ride. A call out to the driver through the maps service can also be implemented that would also announce the risk probability in a chosen route along with the directions. This can then be implemented by service provider companies such as Uber, Ola and so on in future. This will also be useful in having a better surveillance of accident prone areas and providing emergency services in the event of an accident. Better road safety instructions can also be installed along the highways taking into account the risks obtained from this model.

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