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Road Accident Analysis and Prediction using Machine Learning

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Abstract: Engineers and researchers in the automobile industry have tried to design and build safer automobiles, but traffic accidents are unavoidable. Patterns involved in dangerous crashes could be detected by developing a prediction model that automatically classifies the type of injury severity of various traffic accidents. These behavioral and roadway patterns are useful in the development of traffic safety control policy. It is important that measures be based on scientific and objective surveys of the causes of accidents and severity of injuries. The system presents some models to predict the severity of injury that occurred during traffic accidents using machine-learning approaches. We considered networks trained using learning approaches. Experiment results reveal that among the machine learning paradigms considered various paradigms approaches.
Keywords: Machine Learning, Analysis, Prediction, KNN algorithm, Naïve Bayes algorithm, Decision Tree algorithm;

I. INTRODUCTION

The problem of deaths and injuries as a result of accidents is to be a global phenomenon. [1] Traffic safety has been a serious concern since the start of the automobile age, almost one hundred years ago. [2] It has been estimated that over 300,000 persons die and 10 to 15 million persons are injured every year in road accidents throughout the world. [3] Statistics have also shown that mortality in road accidents is very high among young adults that constitute the major part of the work force. [4] In order to overcome this problem there is need of various road safety strategies, methods and counter measures. The survey was conducted on different causes of death due to injury.

World Health Organization (WHO) report tells a horrible story that, most of the deaths between the ages 15 to 29 years are occur due to road traffic accidents and per year, more than 1.25 million people lost their lives due to road crashes. A survey from WHO reported some common reasons like shortage of training institutes, poor condition of roads as well as poor traffic management are the root causes. So to overcome this issue a systematic approach and firmly based solution is required with efficient and effective measures. So our system encounters such parameters and gives a systematic and visualizes view to overcome and interpret the respective problem.

Engineers and researchers in the automobile industry have tried to design and build safer automobiles, but traffic accidents are unavoidable. [5] Patterns involved in dangerous crashes could be detected by developing a prediction model that automatically classifies the type of injury severity of various traffic accidents. These behavioural and roadway patterns are useful in the development of traffic safety control policy.

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II. PURPOSE

This document details the software requirements specification for the Road Accident Analysis And Prediction Using Machine Learning. When explaining the details, the IEEE standards for software requirement specification documents are mentioned below:-

Evaluation of road safety measures appears to be the weakest component of road safety management systems in entire world. To improve Road Infrastructure Safety Management, road authorities, road designers and road safety practitioners need prediction-tools, allowing them to analyse the potential safety issues, to identify safety improvements and to estimate the potential effect of these improvements in terms of crash reduction. In order to present a complete overview of currently used Accident Prediction Models (APMs) by different National Road Administrations (NRAs) worldwide, as well as the currently used data sources for the development and application of APMs a relevant survey was completed. To get appropriate result based on suitable parameters.

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III.PROPOSED SYSTEM

Requirements Analysis or requirement engineering is a process of determining user expectations for new software or providing update for previous product. This core points must be measurable, relevant and detailed. The software engineering term is also called as functional specifications. Requirements analysis mainly deals with communication with users or customer. A Software Requirement Specification (SRS) is a comprehensive description of the intended purpose and environment for software under development. SRS minimizes the time and effort required by developers to achieve desired goals and also minimizes the development cost.

A. Interface Requirements

The At the beginning of the application, the system authorization is required for the users. This login process is same for all users. They will submit valid authorized username and pass- word. In the below sections, user interface overview is described in a general manner.

1) *Sign In:* When the Accident Analysis and Prediction System web page is opened, the user will face with login screen. If user previously registered in system then he/she can make login into System using their login and password, if not register then user has to register into the system.
2) *Upload Data Set:* User has to upload the dataset into the system database for analysis and prediction of accidents based on parameters.
3) *Data Visualization:* The system visualize suggestion on the basis of uploaded data set system process data and predict the results. The user interface will show the suggestion and also shows in the form of graphical visualization.
4) *Sign Out:* Whenever the user click on sign out button then all process of the system will be closed and the user will be redirected to login page.

B. System Design

1) *User Interface Layer:* It basically comprises of interaction of the external user with the system , here the basic manifesto is composed by highlighting the registration module and login module .The login module is used by specific entities those who already have a authenticate account and the registration module is for the new user who wants to sign up to a visualized view of the generated report and select the specific parameters to make future predictions that will lead to reduction in loss of life
2) *Database Layer:* At this layer data required to carry out analysis and to generate a visualized report is stored and retrieved. The data would be like csv file comprises of records of accidents and the causes and the main reason behind the causality or fatal death of the individual. The data would be uploaded at real time basis too by the user with the help of user interface by user side.
3) *Road Accident Analysis System:* At this layer the data manipulation is made. basically it comprises of classification and prediction modules.

C. Classification

Data classification is the process of sorting and categorizing data into various types, forms or any other distinct parameters. Data classification enables the separation and classification of data according to data set requirements for various objectives. It is mainly a data management process. Which has been used to classify respective data into a particular form so that data pre-processing is made easy and also helps to neglect the features which does not have as much effect or response.

D. Prediction

Prediction refers to the output of an algorithm after it has been trained on a historical dataset and applied to new data when forecasting the likelihood of a particular outcome. Prediction is been carried out using naïve bayes, Decision Tree, K-Nearest Neighbours (KNN) and AdaBoost.

E. Objectives

1) Analyze the previously occurred accidents in the locality which will help us to determine the most accident-prone area and help us to set up the immediate required help for them.
2) To make predictions based on constraints like weather, pollution, road structure, etc.
3) To determine the main factors associated with road accident data analysis.
4) Analyzing accident patterns of different types of accidents on roads.
5) To predict the root cause behind fatality.

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6) Factors that serve measure impact over causality.
7) Determine severity of accident.
8) Analyzing road, weather condition that affects the cause for accidents.Figures and Tables.

IV. SYSTEM ARCHITECTURE

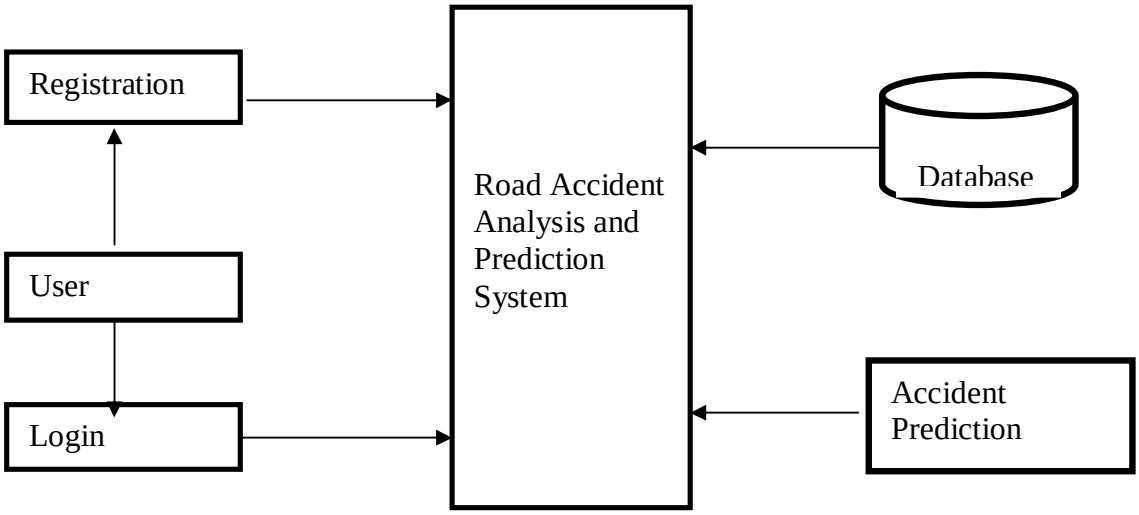

Fig. System Architecture

A. *Algorithms*

1) *KNN Algorithm*

a) Load the data
b) Initialize K to your chosen number of neighbors
c) For each example in the data
i) Calculate the distance between the query example and the current example from the data.
ii) Add the distance and the index of the example to an ordered collection
d) Sort the ordered collection of distances and indices from smallest to largest (in ascending order) by the distances
e) Pick the first K entries from the sorted collection
f) Get the labels of the selected K entries
g) If regression, return the mean of the K labels
h) If classification, return the mode of the K labels

2) *Naïve Bayes Algorithm:* Bayes' Theorem finds the probability of an event occurring given the probability of another event that has already occurred. Bayes' theorem is stated mathematically as the following equation:

$P(A|B) = (P(B|A) * P(A)) / P(B)$

Where A and B are events and P(B) not equal to 0.

a) Basically, we are trying to find probability of event A, given the event B is true. Event B is also termed as evidence.
b) P (A) is the priori of A (the prior probability, i.e. Probability of event before evidence is seen). The evidence is an attribute value of an unknown instance (here, it is event B).
c) P (A|B) is a posteriori probability of B, i.e. probability of event after evidence is seen.

Now, with regards to our dataset, we can apply Bayes' theorem in following way:

$P(y|B) = (P(B|y) * P(y)) / P(B)$

Where, y is class variable and X is a dependent feature vector (of size *n*) where:

$X = (x1, x2, x3,\ldots\ldots,xn)$

Now, it's time to put a naive assumption to the Bayes' theorem, which is, independence among the features. So now, we split evidence into the independent parts.

Now, if any two events A and B are independent, then,

Hence, we reach to the result:

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P(y|x1,x2,…,xn)=[P(x1|y)P(x1|y)….. P(xn|y)P(y)]/[P(x1) P(x2)…. P(xn)]

So, finally, we are left with the task of calculating P(y) and $P(x_i \mid y)$.

Please note that P(y) is also called class probability and $P(x_i \mid y)$ is called conditional probability.

The different naive Bayes classifiers differ mainly by the assumptions they make regarding the distribution of $P(x_i \mid y)$

3) Decision Tree Algorithm

a) Pick the best attribute/feature. The best attribute is one which best splits or separates the data.

b) Ask the relevant question.

c) Follow the answer path.

d) Go to step 1 until you arrive to the answer.

V. ACKNOWLEDGMENT

"Road Accident Analysis and prediction Using Machine Learning " has a system which analyses and simplifies the accidental data and gives a proper and effective visualize report which intern highlights the parameters based on which fatality took place after which the end user understand the basic parameters and tries to overcome them so that there would be reduction in casualty rate.

We dedicate all our project work to our esteemed guide Prof. R. N. KANKRALE whose interest and guidance helped us to complete the work successfully as well as he has provided facilities to explore the subject with more enthusiasm.

This experience will always encourage us to do our work perfectly and professionally. We also extend our gratitude to Dr. M. A. Jawale (H.O.D. IT Department). We express our immense pleasure and thankfulness to all the teachers and staff of the Department of In-formation Technology Engineering, Sanjivani College Of Engineering, Kopargaon for their co-operation and support.

Last but not the least, we thank all others, and especially our friends who in one way or another who helped us in the successful completion of this project.

VI. CONCLUSION

Losses in road accidents are unbearable, to the society as well as a developing country like us. So, it has become an essential requirement to control and arrange traffic with an advanced system to decrease the number of road accidents in our country. By taking simple precautions, based on prediction or warnings of a sophisticated system may prevent traffic accidents. Moreover, it's a primary need for our country now, to tackle this situation where every day so many people were killed in a traffic accident and day by day this rate is getting increased. The implementation of machine learning is a functional and a great approach to take an accurate decision with the experience to manage the current situation and the findings of the analysis part can be suggested to traffic authorities for reducing the number of accidents. We can use proposed approaches to implement machine learning here because of their proven and higher accuracy to predict traffic accident severity.

Moreover, to make it more feasible, we will try to make a recommender system by using these approaches that can give a prediction to the traffic accident and can warn the road user. In the future, it will be our try to create a mobile application by implementing this methodology to provide an accurate prediction to the user and make it very useful and beneficial also.

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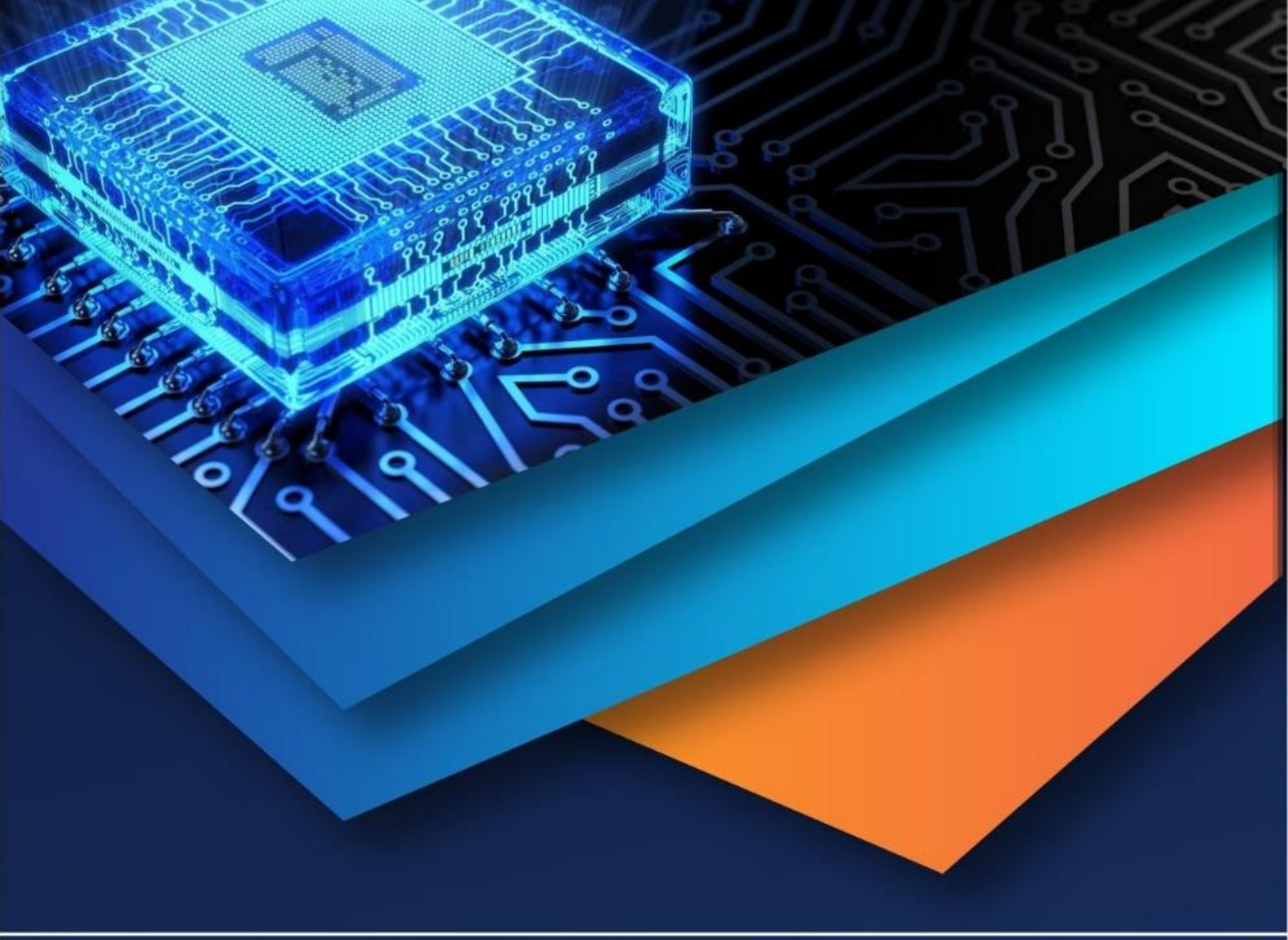

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