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Accident Data Analysis Using Machine Learning

Dr. Venkata. Koti Reddy. G[1], Bandaru Venkataramana[2], P. Bhasakarareddy[3], P. Ram Nivesh Reddy[4]
[1]*Ph.D Dept of CSE, Holy Mary Institute of Engineering and Technology, Keesara, TS, India*
[2] *PhD Scholar, Dept of CSE, Holy Mary Institute of Engineering and Technology, Keesara, TS, India*
[3]*Professor, Dept of ECE, Holy Mary Institute of Engineering and Technology, Keesara, TS, India*
[4]*Student, Dept of CSE, Holy Mary Institute of Technology and Science,Keesara, TS, India*

Abstract: ***The main objective of this project is toanalyze the road side accidents by scrutinizing accident-prone or hotspot areas and their root causes. Accidents through roadways have been a greatthreat to developed as well asunderdeveloped countries. Roadaccidents and its safety have been a major concern for the world, and everyone is trying to handle this since years. Road traffic and reckless drivingoccur in every part of the world. Because of this, many pedestrians are affected too. With no fault, they become victims. Many road accidents occur because of numerous factors likeatmospheric changes, sharp curves, andhuman faults. Injuries caused by road accidents are major but sometimes imperceptible, which later on affect health too. This study aims to analyze road accidents in one of the popular metropolitan cities, i.e., Bengaluru,through Linear Regression, Polynomial Regression, Decision Tree Regressor, Support Vector Regressor, Random Forest Regressor algorithms and machine learning by scrutinizing accident-prone or hotspot areas and their root causes.***

Keywords: Machine Learning Algorithms such as Random Forest, Super vector Machine, Linear Regression, Polynomial Regression, Decision Tree.

I. INTRODUCTION

The main objective of this project is to analyze the road side accidents byscrutinizing accident-prone or hotspot areas and their root causes. Accidents through roadways have been a great threat to developed as well as underdeveloped countries. Road accidents and its safety have been a major concern for the world, and everyone is trying to handle this since years. Road traffic and recklessdriving occur in every part of theworld. Because of this, manypedestrians are affected too. With nofault, they become victims. Many road accidents occur because ofnumerous factors like atmospheric changes, sharp curves, and humanfaults. Injuries caused by road accidents are major but sometimesimperceptible, which later on affect health too[1]. This study aims to analyze road accidents in one of the popular metropolitan cities, i.e., Bengaluru, through Linear Regression, Polynomial Regression, Decision Tree Regressor, Support Vector Regressor, Random Forest Regressor algorithms and machine learning by scrutinizing accident- prone or hotspot areas and their root causes[2].

II. SYSTEM STUDY

A. Related Work

In the area of road safety traditional statisticalmodel-based techniques were used to predictaccident fatal and severity. Mixed logit modeling approach, ordered Probit model, logit model are few of adopted conventional statistical-based studies. some studies believed the conventional statistical model better identify dependent and independentaccident factors. But conventional statistical-based approach lacks the capability to deal with multidimensional datasets. In order to combat traditional statistical models limitations; Nowadays many studies used ML approach due to its predictive supremacy, time consuming and informative dimension.In these decade ML approach employed occupational educational classification insurance[4].construction industry, accident,argiculutre , classification ,sentiment and banking and Neural Network (ANN), Convolution Neural Network (CNN) and Logistic Regression (LR) are in front to build accident severity model. Kwon et al. Adopted Nave Bayes (NB) and Decision Tree (DT) on California dataset collected from 2004 to 2010[4]. Authors used binary regression to compare the performance of the developed model but Nave Bayes were more sensitive to risk factors than the Decision Tree model[3].

B. Proposed System

The K-means clustering model produced a low accuracy. Using K-means there werequite a few wrong predictions which wrongly got detected as accident spots. Therefore, K-means would not be the preferred model as itdoesn't correctly analyze accidents and it also produced a lot of false positives.

C. Existing System

Data Analysization will be done by DataAnalyst or Data Scientist. Most of the data Scientists are using K-Means clutering model algorithm. For predicting the major occuring accident hotspot area's. And mostlyit is preferred by data scientist too.

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III. METHODOLOGY

A. Linear Regression

Linear regression analysis is used to predict the value of a variable based on the value of another variable[3]. The variableyou want to predict is called the dependent variable. The variable you are using to predictthe other variable's value is called theindependent variable[3].

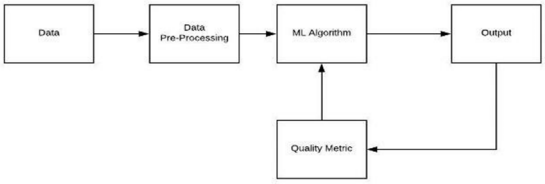

Fig 3.1 Linear Regression use-case diagram

B. Polynomial Regression

Polynomial Regression is a form of Linear regression known as a special case of Multiple linear regression which estimates the relationship as an nth degreepolynomial [3]. Polynomial Regression issensitive to outliers so the presence of one ortwo outliers can also badly affect the performance [3].

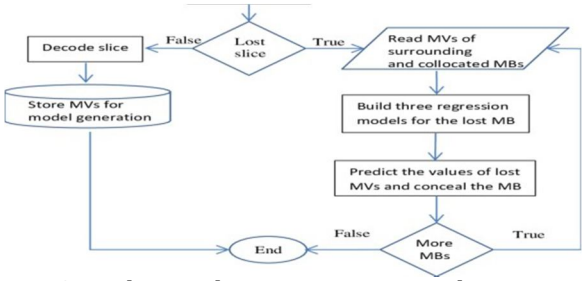

Fig 3.2 Polynomial Regression use-case diagram

C. Decision Tree

Decision tree builds regression orclassification models in the form of a tree structure[4]. It breaks down a dataset into smaller and smaller subsets while at the sametime an associated decision tree is incrementally developed. The final result is atree with decision nodes and leaf nodes[4].

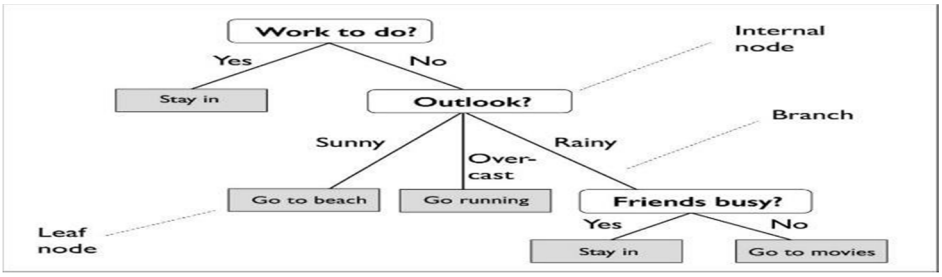

Fig 3.3 Decision Tree use-case diagram

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D. Support Vector Machine

Supervised Machine Learning Models with associated learning algorithms that analyze data for classification and regression analysisare known as Support Vector Regression. SVR is built based on the concept of Support Vector Machine or SVM. It is one among the popular Machine Learning models that can be used in classification problems or assigning classes when the data is not linearlyseparable.

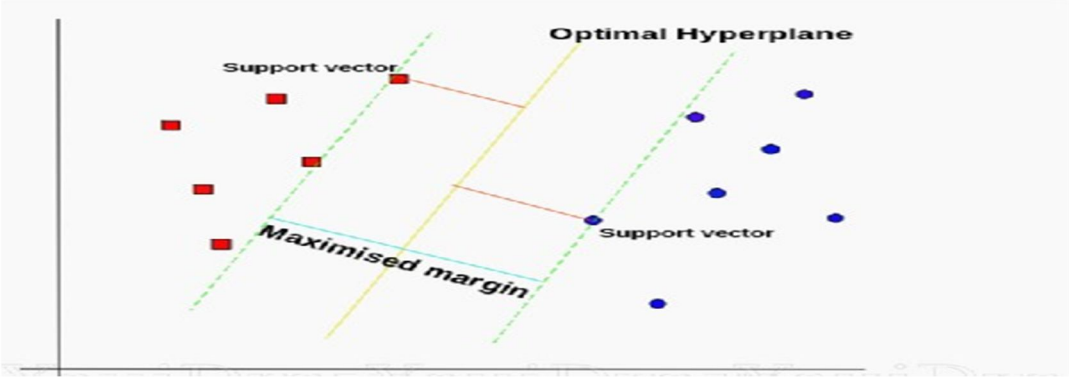

Fig 3.4 Support Vector Machine

E. Random Forest

Random Forest Regression is a supervisedlearning algorithm that uses ensemble learning method for regression. Ensemble learning method is a technique that combinespredictions from multiple machine learning algorithms to make a more accurate prediction than a single model[4].

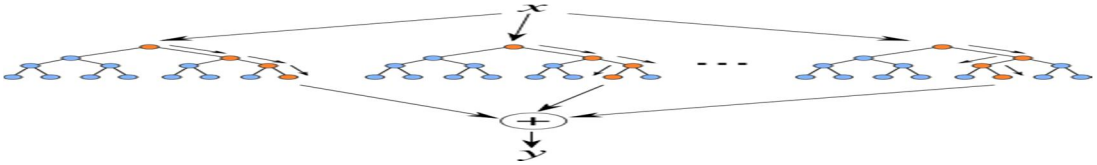

Fig 3.5 Random Forest Classification

IV. IMPLEMENTATION

A. Data Collection and Analysis

The data was collected from external websites like kaggale.com for this project. And during the project data analysis we have installed some python modules that are required they are

1) *PANDAS* - Pandas is a Python library for data analysis and it is most widely used in machine learning tasks.
2) *NUMPY* – It stands for 'Numerical Python' module, it can be utilised to perform numberof mathematical operations on arrays such astrigonometric, statistical and algebraic routines.
3) *MATPLOTLIB[6]* – It is a python library which is used for data visualization[6].
4) *SEABORN[6]* - It is a python library which is used for making statistical graphs[6].

B. Data Cleaning

Datasets are collected from different manually recorded materials. Some of the data values are incomplete, noisy andinconsistent. Real world data set is not feasible for analysis or to make efficient decisions. Real world datasets are most of the time contains unintentionally 'dirty data.' In case of machine learning datasets shouldbe in a proper format to get a classification model. Further to get quality output from the classification model the input must be quality. Prior to analysis dataset should be preprocessed intensively to get valuable trends from the historical data.

V. CONCLUSION

The principal aim of our project is to choice the best machine learning regression algorithms out of 5 algorithms which helps the data scientist to analyze the the data efficiently and easily. By the end of the project we can conclude that we can use 1 out 5 of the best algorithm to analyze the data.

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VI.FUTURE SCOPE

The main goal of this project is to decrease the number of accidents rate.
For this goal it is necessary to analyse the accidents rate first.
This helps the data scientist to use their timeefficiently as data scientists invest most of their time in data analysing.

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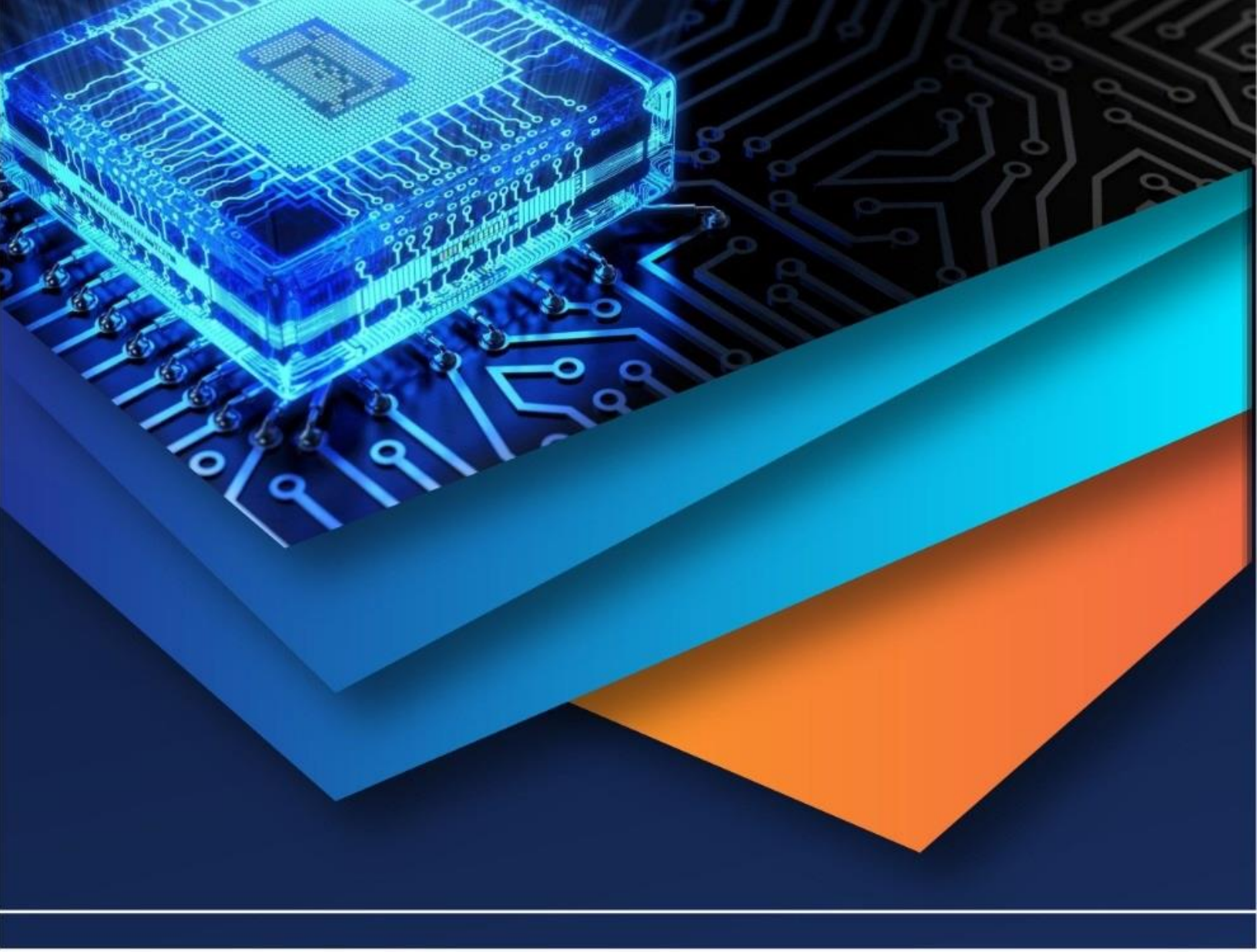

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