Predicting Severity Level of Road Traffic Accidents in Oromiya East Shewa Zone using Iterative Dichotomiser3

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Abstract: - Abstract: - Highway traffic accidents are a main community health problem unease ensuing millions fatalities and million serious injuries in the world each year. In the developing country like Ethiopia, is also the victim of road traffic accident or crush causing deaths, property damage and serious injuries. In order to analyses severity level of road traffic accidents, data is important to find out factors that are related to fatal, grievous, minor and non- injuries to gauge a fixed variables that contributes towards forecast the severity level of road traffic crashes. A lane traffic stream pound or impact happens when a vehicle slams into another vehicle, passerby, creature, or geological or building obstruction and result in injury, property harm, and lethal/demise. Path traffic control framework is, where basic information about the squash is recorded and saved for looming use. Expending that information the proposed examination have been extricated the contributing elements of street auto collision and create prescient model to foresee seriousness level for street car crash, wounds and fatalities utilizing information mining methods.. The main task of research is to make known the applicability of data mining techniques in emerging a model to support road traffic accident brutality analysis in preventing and extracting patterns that are corresponding with road accident in different ways of presentation methods. The road traffic accident historical data ,obtained from traffic Oromia police commission of East Shewa Zone, Oromia and police commission of Federal government of Ethiopia.
Keywords: Association Rule Mining, Classification, Data mining, ID3, Prediction, Random Forest, Random tree and Naïve Bayes, Road Traffic Accident

I. INTRODUCTION

The issue of passings and wounds in light of street car crash is perceived to be an overall virtuoso and traffic prosperity has been a real concern since the start of the vehicle age, directly around one hundred years back. It has been assessed that

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in excess of 300,000 individuals bite the dust and 10 to 15 million individuals are hurt every year in road mishaps all through the world[1].Road car crashes or wounds in the 52 nations of the WHO European Region speak to a Main general medical issue.

Every year an expected 127 thousand individuals are assassinated (about 10% of worldwide street traffic passings) and about 2.4 million are hurt on lanes in a difficult situation adds to other horrible vehicle related prosperity impacts, for instance, those ensuing from air tainting a hazardous climatic deviation uproar continuously fixed lifestyles and unsettling influence of society. This heaviness is likewise unevenly dispersed over the Region, with low and medium-salary nations in the eastern and southern pieces of the Region being more seriously influenced than high-pay nations in the western piece of the Region [1]. Street traffic wounds are a central yet ignored general prosperity challenge that requires composed undertakings for reasonable and sensible expectation reliably road traffic systems are the most confusing and the most unsafe worldwide a normal 1.2 million individuals are murdered in street crashes every year and upwards of 50 million are harmed.

Projections demonstrate that these figures will increment by about 65% throughout the following 20 years except if there is new pledge to avoidance. Everybody executed, harmed or handicapped by a street car accident has a system of others, including loved ones, who are profoundly influenced. Universally, a great many individuals are adapting until the very end or inability of relatives from street traffic injury. It is difficult to join an incentive to each instance of human penance and enduring, include the qualities and produce a figure that catches the worldwide social expense of street accidents and injuries [2]. As per the World Health Organization's (WHO) report, distributed in April 2014, lane collisions in Ethiopia represent the passing's of 37.28 people per 100,000. This is 2.77% of the complete passing's in the nation, setting Ethiopia twelfth on the planet. Kenya's passing rate from traffic crashes as per a similar report remains at 19 people for each 100,000, while it is just two people for each beyond words street mishaps in England. Therefore, one of the objectives of Ethiopia's five-year Growth and Transformation Plan (GTP), which finishes in 2015, was to lessen the quantity of fatalities. From vehicle crashes by 80%. Developing worry about vehicle collisions is constraining some in the transportation division to concentrate on mishap maintaining a strategic distance from procedures of driving, called protective driving, and post-mishap protection systems.

One such institutional system is done by the Ethiopian Heavy Truck Drivers Association (EHTDA) that prepares its individuals and persuades them to have disaster protection inclusion. [3]

A highway vehicle crash alludes to any mishap required in any event one street vehicle, happening on a street open to open flow and in which at any rate one individual is harmed or slaughtered. Purposeful act (murder, self-destruction) and cataclysmic events are barred. "Killed people" are setback heartbreaking losses who pass on rapidly or inside thirty days following the disaster. "Harmed people" are mishap unfortunate casualties having endured injury requiring clinical treatment (with or without hospitalization)

II. PROBLEM STATEMENT

In Ethiopia, Highway traffic collision has been one among the most noteworthy ten reasons for death. for example , in 2013 announced that the measure of people executed by highway car crash resembled those that passed on gratitude to malarial (which is ninth clarification for death) [2] all through the nation. Highway traffic fatalities and wounds has accordingly been the key general wellbeing and improvement difficulties of the nation can in any case antagonistically influence the job of network and in this way the economy of the nation except if viable measures are taken to direct the issue . Lane mishaps are negatively impact the matter of people likewise as their family members, since it can lead families into destitution by methods for the enduring effects of the scenes: the costs of clinical thought, treatment and loss of family's money and salary generators.[2], [3].Road car crashes have additionally a major effect on economy by devouring the effectively deficient assets, harming important property, and executing and debilitating the beneficial age section of the network. by and large , the seriousness of the issue is turning out to be awful incredibly and arriving at a cataclysmic level indicating that adequate work has not been done to manage and additionally lessen disturbing pace of the mishap. This likewise suggests opportune, precise, and pertinent information got the opportunity to be gathered and broke down intermittently so on look at the patterns, extension, and seriousness of the issue and are accessible up with sensible solution(s) utilizing information preparing procedures. The point of this proposed inquire about investigation is in this way to examine the patterns, causes, and financial ramifications of street car crashes seriousness levels in Ethiopian setting.
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III. RELATED WORKS

A. Researches on Data mining prediction in Ethiopia

R.Anusuya and Ms.Tsege, was built time series prediction model using nonlinear autoregressive with external inputs. 95% of all the correlation plots are indicates that the model is performing correctly in predicting. The training data R= 0.98938 and testing data R=0.99792 this indicates the testing data fit is as good as the training data done in Arbaminch University.[19]. Gebreegziabher Tsegay and R. Anusuya, This research have developed two modeled systems based on

ANN and Fuzzy logic approaches in order to develop a decision support diagnosis system. Output performs the ANN system using the training, validation and testing data set cross entropy accuracy result were 83.1%.[23]. R.Anusuya proposed that Detecting cancer is one of the challenging method, it is necessary to cure in earlier stage. In this work, a system called detection unit made by using K-SVD method. The algorithms k-Means and proposed K-SVD were implemented based on the requirements. [20]. DMS-PSO based framework has been proposed to choose the basic qualities and help the analysis of heart infections. Here, DMS-PSO has been utilized for creating MFs parameters while advancing the FDSSs. This examination demonstrates that a blend of the fuzzy rationale and DMS – PSO can offer progressively successful frameworks of therapeutic analysis with improved framework precision.[22].

B. Researches on road accident prediction

A number of previously proposed related literatures, books, reports, journal articles and sites of dependable writers and associations are surveyed in the request to have point of interest and understanding the domain in detail and to have detail understanding on this research works. Different techniques and tools which are relevant for the current research are analyzed, modified and used from previous works

Results from the examination concentrate on applying Extracting Hidden Patterns inside Road Accident Data Using Machine Learning Techniques strategies into investigation of auto collisions on the Finish streets are introduced by S.Vasavi. The expert researched the components causing deadly in street vehicle crash to deliver safe transportation frameworks, for example, ongoing modification of traffic stream, Model Prescient Control (MPC) procedure in rush hour gridlock light control, tolling system, and so on., can be utilized in plan and support of streets, and furthermore for creating more secure vehicles. Transport Quick travel (TQT) arrangement of Ahmadabad city has accomplished its target of furnishing a protected method of transport with over half abatement in street traffic.This research have used to analyse the cluster based only on limited data mining techniques (K-Medoid and Expectation Maximization) and association rule mining using priory algorithm[7].K.Jayasudha(2009), Portrayed the Road wellbeing specialists manage enormous volumes of quantitative data and gathered insights, to appreciate and assess the social and money related cost of the incidents and to have the alternative to familiarize security plans all along with hinder or diminish occasions of mishaps. The road street mishaps estimations must be acquainted in such a way with make it easier to be both seen and deciphered by a human manager. Past chips away at mishap examination included measurable strategies and formal procedures [12]. S. Ramya and R.S Kumar (2014), the car accident estimation is done dependent on verifiable information from past mishaps and furthermore sort of crash, for example, front accident, back accident and side accident utilizing information mining.

The investigation incorporates that grouping calculations orders the seriousness of mishap dependent on the got information from sensors can perceptibly expand exactness of the framework. The data mining tools WEKA and Rapid Miner were used to implement data mining task. The algorithms J48 were used by the researchers to predict the final result, Supervised Vector Machine is used for classification and regression and Bayesian network is a probabilistic graphical model that represents a set of random variables and their conditional dependencies through directed acyclic graph [13]. M. Chong, A. Abraham, and M. Paprzycki (2005), studied the general estimate system (GES) automobile accident data from 1995 to 2000 and investigated the performance of neural network, decision tree, support vector machines and a hybrid decision tree – neural network for predicting drivers' physical issue seriousness in head on front effect point impacts [14]. The paper "Road Crash Proneness Prediction using Data Mining", presents the methodology to application of data mining for data analyzing and using probabilistic modeling to road crash prediction. [15]

C. Facts Regarding RTA in Ethiopia

Each year an estimated that about 1.2 million people are killed in road accident and up to 50milions injured in the world. The developing creating nations endure the worst part of the fatalities and incapacities from street car accidents representing over 85% of the world's street fatalities and about 90% of the aggregate Disability-Adjusted Life Years (DALYs) lost due to road traffic injuries. The problem is more sever when it comes to African continent, particularly sub-Saharan Africa. [2], [16].The seriousness of street car crash is probably going to be a lot more noteworthy in Africa than anyplace else, in light of the fact that numerous powerless street clients are included, poor vehicle conditions, for example, absence of safety belts, crowd zone, and unsafe vehicle situations. The poor reporting system has also masked the magnitude of the problem in Africa. The poor revealing system has furthermore greatness and degree of the issue in Africa the nonattendance of pre center and clinical facility emergency care after incidents makes the consequence of car crashs in Africa the most recognizably awful [13].Ethiopia as of now loses around 1,700 lives every year in street mishap with another 7,000 announced wounds. As these numbers are just those that are accounted for to the Police and the genuine setback number can be relied upon to be at any rate twice as huge. That is, under revealing is one of the issues for information validness. The reasons for street crashes in Ethiopia show that issues identified with street is in the request for 1% to 3% everything being equal (the biggest being drivers' mistake representing 81%). In spite of the fact that the street factor appears to be generally low, it is accepted that improvement in the street framework may decidedly impact different elements towards the upgrade of street security [12].

The demise rate because of fender bender is essentially expanding among walkers and travelers every now and then in Ethiopia. An aggregate of 2141 mishaps and 139 fatalities were recorded in the zone during 2010-2018. The for the most part part of fatalities were walker, 69(49.64%) trailed by travelers 62(44.60%) and drivers 85(5.76%).A statement from traffic Police station of East Shewa zone, Oromia point out in 2010, there were a complete 401 RTAs and in 2018 the all-out number RTAs expanded to 648. On the other hand, the report demonstrated that 96% of the causes were related to human hazard direct while 4% was a result of vehicle issue. Confirmations noticed that human conduct is the most widely recognized factor representing over 85% of all auto collisions. In some low-pay and center salary nations, orderly endeavors to gather street traffic information are not all around created and detailing passings and genuine wounds are basic [14]. The wellbeing area has a significant duty to guarantee that the fundamental information frameworks are set up and that information on the primary injury issues and on the viability of mediations are imparted to a more extensive crowd. The report also recommends only by systematic and data-led management of the leading road injury problems will significant reductions in exposure to crash risk and in the severity of crashes be achieved. As understood from the above paragraph, it is clearly indicated that one of the predicting the severity level of traffic accident problem is researching, and data mining technique is one research tool in predicting severity level of traffic accidents. Quarterly reports were collected from cities in the zone to Zone Traffic Offices, and then submitted to the regional Police Commission Traffic Office. A quarterly and yearly reports from the Regional police Commission Traffic office then submitted to the Federal Police Commission to generate national accident statistics and analysis. The following chart depicts the number of accidents recorded with their corresponding severity levels in the east Shewa zone Traffic Police Office from 2010. To 2018.
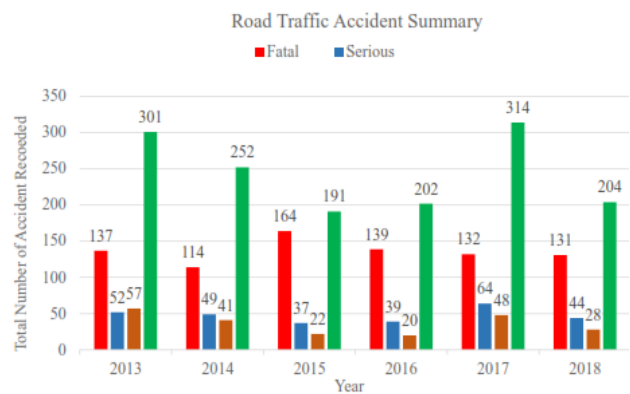

Figure 1 Data of traffic accident in case of East Shewa Zone

IV. RESEARCH METHODOLOGY

This part of the record examines about the proposed structure that this examination utilizes. To foresee the seriousness level of street car crash information with high precision and effectiveness, managed learning calculation ID3, Naïve Bayes, Random Forest, Random Tree, Decision Tree and regular example development are utilized.

The analyst have utilized Rapid Miner data mining tools for demonstrating the highway vehicle crash seriousness level expectation in the chose territory of the examination. The chose apparatus is open source information digging programming principally utilized for scholarly research reason. It has been proposed more data mining techniques from exploratory data examination, factual learning, AI and database. This dataset contains around 2141 examples and 14 chose highlights are discrete properties. Among these occasions or records thirteen characteristics (Driver Education, Driving Experience, License level, Service of vehicle in year, Driver Age, Driver Sex, Severity Level, mishap Area, Road Layout, Road surface condition, Road Flooring type, Light condition, Weather condition and Road appropriation) influence the mishaps. The total state of factors is appeared in the Coding timetable of traits on street condition above. Circumstance

A. Proposed RTA Severity prediction Model

Data mining is utilized in many order, information mining have been effectively applied in various fields including transportation building. Traffic estimating issues including complex interrelationships between factors of traffic framework, can be productively explained by utilizing information mining methods. They offer practical and rapid means for developing models provided sufficient data. Support vector Machine learning has the ability to solve problems that are too complex and can learn how to deal with new and unexpected situation by the help of past experience without having prior knowledge about the variables to be modeled. Attribute or variables determination includes looking through every possible combination of attributes in the dataset to discover which subset of attributes works best for severity level prediction. The most ideal approach to choose pertinent properties is manual dependent on the profound comprehension of the learning issue and what the characteristics really mean. A significant advance in creating information mining based prescient models is to choose model information factors that have the most noteworthy effect on model execution. A decent subset of information factors can generously improve model execution. Introducing as enormous various info factors as conceivable to prescient models generally builds execution arrange size, bringing about a decline in handling speed and a decrease in the proficiency of the system. Various methods have been recommended in the writing to help with the choice of info factors. One methodology is that suitable information factors can be chosen ahead of time dependent on from the earlier information [12]. The accompanying table shows the portrayal of the entire street mishap factors on account of Oromia local state.

S. No.	Variable Name	Description
1.	Accident-Time	Exact time on which accident has
2.	Accident-Hour	Exact hour at which accident has
3.	Driver-Age	Age of driver bring out accident
4.	Driver-Sex	Sex of the driver causing the
5.	Driver-Educational-	Driver Educational level causing
6.	Driver-Relation-Wi	Driver's relationship with the care
7.	Driver-Driving-Exp	Driving experience of the driver
8.	Driver-License-Lev	Driver's driving level causing the
9.	Vehicle-Year-Of-S	Total service of the vehicle in years
10.	Vehicle-Type	Type of vehicle in the accident
11.	Fault-Type	Category of vehicle fault in the
12.	Road-Type	Type of the road where an accident
13.	Accident-Area	Specific area name where an
14.	Road-Separation	How the road sections are separated
15.	Road-Orientation	How the road is directed.
16.	Road-Junction	Type of lane junction
17.	Road-Surface-Type	The type of road (asphalt, ground,
18.	Road-Surface-Cond	The state of the surface of the path
19.	Light-Condition	Light situation of the road
20.	Weather-	The weather circumstance of the
21.	Accident-Type	The type of accident
22.	Victim-Occupation	The occupation of the victim due to
23.	Victim-Health-Con	The health condition of the victim
24.	Pedestrian-Moveme	The pedestrian action during the
25.	Accident-Causes	the root causes of the accident the
26.	Accident-Severity(Target-Class)	The measure of the degree of the severity of the accident

Table 1 Description of the whole accident variables

Driver related factors (Age, License Level, Driving experience, Educational Background, Relation with vehicle), Road related factors (Road type, Road surface condition, Road layout, Road junction), environment related factors (weather condition, Light condition), vehicle related factors, pedestrian related factors and other factors. In most of all literatures that have been reviewed so far in the study, none researches has been done exploring the role of human, environmental, road, vehicle, weather and light condition related factors for RTA severity level prediction using data mining techniques, especially in Ethiopia. Due to this reason out of 26 variables (attributes) of the total RTA data sets, 14 variables have been selected purposefully together with the domain experts and through literature reviews which are believed to have significant contribution to road traffic accident severity level prediction and remain focus of the study.

V. EXPERIMENTAL RESULT

In this investigation, it has been inspected the presentation of the diverse characterization strategies that could produce exactness and some blunder to conclusion the informational index.

Table 2Accuracy of different classification comparing tools

The experim	Random Forest	Random Tree	Naïve Bayes	Decision Tree	J48/ID3
WEKA	92.24	90.33	80.33	90.56	90.56
Rapid Miner Studio	97.93	79.85	81.99	94.60	98.00

To foresee mishap seriousness level, different characterization models are manufactured utilizing Naïve Bayes, ID3, Random Forest, Random Tree and Decision Tree. Choice trees are anything but difficult to assemble and comprehend can oversee both persistent and clear cut factors and can play out the arrangement just as relapse in underneath figure 2.

Figure 2 Accuracy using ID3 classification algorithm

The underneath Figure 3, shows the examination of exactness among WEKA and Rapid Miner devices. The measurements shows that having a methods for foreseeing likely exactness of various strategies dependent on some information esteems. It is clear that the line diagrams that the estimation of innocent Bayes in WEKA instrument is not exactly the Rapid Miner apparatus. It is obviously observed that the most noteworthy exactness is 98% has a place with that of the ID3 and the least precision is 91%. The complete time required to assemble the model is likewise a basic parameter in contrasting the characterization calculation. Classification models are produced based on the preparation information whose autonomous factors and target factors are known to be applied for the new dataset whose goal is the expectation of the objective variable.
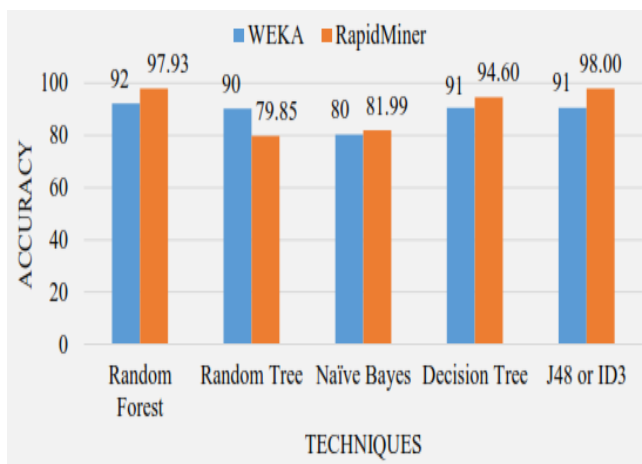

Figure 3 Accuracy among WEKA and Rapid Miner classification

VI CONCLUSION AND FUTURE WORK

A. Conclusion

The goal of this exploration is to construct information mining based car crash seriousness level forecast model by extricating the Main factors that impact mishap. The consequence of this examination is to detect the reasons for mishaps and seriousness level expectation model. There are various information mining order calculation that can be utilized for driver and street factors for vehicle mishaps and recognize covered examples in the mishap informational collection. To achieve these objectives; the WEKA and Rapid Miner information mining instruments have been utilized to utilize the Naïve Bayes , ID3, Random Forest, Random Tree and Decision Tree calculations. The information hotspot for this examination information is gathered from east Shewa zone of Oromia traffic police which stores the partial street mishap records of the years 2010-2018 that happened in the zone and city organizations. The complete street mishap dataset acquired from the investigation territory is 2141. Model likewise assessed utilizing exactness, accuracy and reviews. The evaluation of the model utilizing WEKA apparatus try indicated that Random Forest outflanks, ID3, Decision tree, Naïve Bayes and Random Tree calculations with a precision of 92.24%, 90.56%, 90.56%, 90.33% and 80.33% individually and examination of the model utilizing Rapid Miner explore demonstrated that the ID3, beats Random Forest, Decision tree, Naïve Bayes and irregular tree calculation with an exactness of 98%, 97.93%, 94.60%, 80.33% and 79.89% separately. At long last the exploration have presumed that the Rapid Miner device is the best information mining instrument in this examination when contrasted with WEKA. For additional, the examination need to broaden the exactness of street traffic seriousness level expectation, mishap type and information quality must be improved and another future exertion is to test the relevance of other information mining strategies. Information mining is the trying to remove the concealed information or examples from the enormous measure of informational collection. Information mining is the way toward extricating novel example from crude assortment of information and put away in the necessary organization of dataset. It very well may be utilized to reveal the examples in the information yet it is frequently completed just examples of information. At last, a procedure is related with a progression of information mining devices and methods. The elements that impacting the car crash seriousness level can be improved and progressively helpful examples can be distinguished and completely explored by some other intrigued analyst.

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