IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 9, Issue 7, July 2021

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.542

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.542

|| Volume 9, Issue 7, July 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0907108 |

A Review on Road Traffic Crashes using Machine Learning

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ABSTRACT: Road traffic accidents are regarded as the main health problem as many injuries & deaths are caused around the world. India is an emerging country with the highest accident rate. Traffic agencies &the public are thus focusing on methods to decrease the severity of such an accident to reduce the fatality rate. We think that it is necessary to base action on scientific and objective assessments of the causes of accidents and injury to achieve the highest potential impact in reducing the accident, with limited budgetary resources. This paper summarizes the road traffic crashes and their impacts on multiple areas applied to modeling injury severity that occurred during traffic accidents. This work reviews crash severity predictions and applications related to prediction models.In addition, it provides the introduction of machine learning and its techniques.Then we have described dimensionality reduction techniques in feature selection and ensemble method classification. Also, we provide some literature reviews about road traffic accidents and finally concludes this paper.

KEYWORDS: Road traffic Crashes,Crash Severity Prediction, Machine Learning.Dimensionality Reduction, Ensemble Method.

I. INTRODUCTION

The influence on the socio-economic development of a country from accidents and fatalities from road traffic accidents (RTAs). Approximately 1.2 million deaths & 50 million injuries each year (World Health Organization, 2004) in RTAs are some of the government's most dangerous problems. There is a severe danger to RTAs from the main states that contribute to the growth of the country in many ways [1]. A key objective of this work is to collect empirical data and different relevant statistics on the severity of road accidents and RTAs. Safety may be enhanced by linking accident frequency and the severity of causal variables successfully. RTAs can be decreased by properly educating and promoting the usage of safety equipment. The impacts of safety education programs and driver education programs are not widely recognized. This study provides a comprehensive examination of the causes and frequency of accidents in major cities throughout the world. A study was also carried out to avoid them to enhance a country's socio-economic characteristics. [2].

Some studies have shown that the efficiency of the transport process may be increased by 25 percent to 30 percentover 2-3 times, to reduceno. of road accidents. The development of systems design techniques of highways produced objective circumstances for the growth of novel concepts for road safetyevaluation in which driver's activities have a logical basis[3]. The analysis of interactions among driver-vehicle/road-traffic system components also examines their mutual effect, helps to create strategies for optimizing environmental and road variables, and develops solutions that fulfill the security and comfortable movement criteria.

The crash severity of vehicle crashes depends mostly on participants' kinetic energy. The aim of vehicle safety from its inception in the early 1950s was to minimize its accident severity by minimizing forces acting on occupants during a crash. Structural solutions, like a crumble zone, airbags, or seat belt, can achieve this aim by disseminating over a lengthy period the forces underwent by the occupants and therefore decreasing their maximum strength. These so-called Passive Safety procedures had an enormous influence on vehicles'safety, which led to an all-time high of 21.332 deaths on German roads in the year 1970.

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Notwithstandingthe effectiveness of Passive Safety, physical constraints, likea high-speed collision of a small car with a large truck, cannot be overcome by any structural measure only. Active Safety solutions are already cropping up to try to prevent a crash by assisting correct braking or steering. Modern vehicles detect their environment as other vehicles, pedestrians, or road infrastructure using exteroceptive sensors such as lidar, radar, or camera. Advanced perception techniques enable car security developers to identify, assess and respond to crucial circumstances as soon as the sensors see a threat [4].

Machine learning, a sub-branch for artificial intelligence, provides computer learning from data stores. In the event of machine learning, the assumptions of computer systems have improved. The use of machine learning is a widely used and functional way to make real choices utilizing experience. Machine learning cangather data & utilize statistical methods [5].

The remaining of the paper is systematized as follows: section IIelaborates analysis onroad traffic crashes with theircauses. Section III gives a brief introduction tocrash severity prediction and applications of statistical models for prediction. It talks about machine learning and its techniques in Section IV. Section Vdefines thedimensionality reduction techniques. And The classification of the ensemble method provides in section VI.Section VII presents a literature review in the area of road traffic accidents. At last, Section VIIIconcludes this work.

II. ROAD TRAFFIC CRASHES (RTCs)

RTCs area major global public health concern. In several nations, RTC was reported by Peden et al. [6] as a primary cause for severe injury and death. According to a WHO worldwide traffic safety status report, 1.35 million people die every year as a consequence of traffic collisions, & injuries caused by road crashes are a primary cause of young people's fatalities. In addition, vehicle collisions are considered to be the eighth biggest cause of mortality.

Injuries to road traffic are one of the world's leading fatality causes [7]. 1.24 million people die every year on world highways &among 20 million & 50 million, wounded and the eighth cause of mortality in road traffic accidents in the world [8]. Road injuries are predicted to rise to the third position among the main cause of the global burden of illness in 2020. by 2020. Victims, their families also their nations as a whole suffer enormous economic damage.

Studies suggest that about 10% of the road damage occurs while the driver travels during work, while an additional 18% of the injuries occur while the driver goes to or from work, that is, commuting [9]. An accident bus driver would be viewed as such while driving for business. Around Europe, 40% of road injuries are estimated during commuting or business journeys. In 2016, there were 566,235 traveling to and from work injuries in Spain, in which 64,737 RTAs occurred throughout business or work travel, representing over 11.4% of the total [10].

Fig. 1. Road Traffic Crashes

India is not an exception as records have shown that above 1.3 lakhs were died on Indian roads, giving India uncertain honour to lead the world's list of road accidents deaths. The problem has been aggravated by rapid urbanization, motorization, lack of suitable road-building, low levels of awareness, non-existent injury prevention, and the inadequate enforcement of traffic laws.

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A. Health Burden of Road Traffic Injuries

Every day, about 3,400 people (1.25 million people per year) die on the world roads, making RTIs the tenth biggest worldwide cause (WHO 2014). Since 1990, the global RTI mortality rate has grown by 46 percent (Lozano and others 2012). Recent Global Health Estimates (WHO 2014) have estimated that 24% of all injury-related fatalities globally (Figure 2) have been caused by vehicle accidents — and a total of DALY 78.7 million lost in 2012, up from DALY 69.1 million in 2000 (WHO 2014). Latest trends indicate that, unless action is done, the sixth leading cause of death is by 2030. (WHO 2015a).

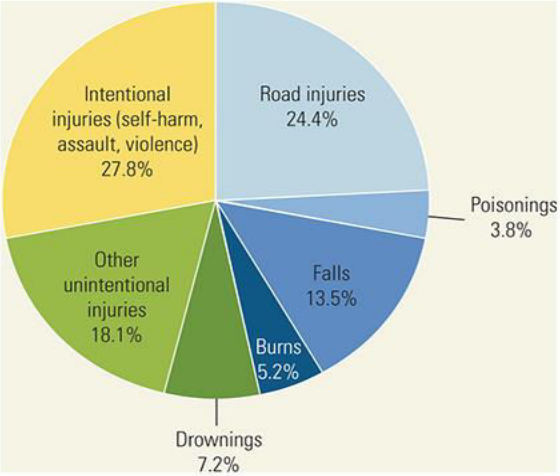

Fig.2. Global Mortality from All Injuries, 2012

B. Major Causes of RTAs

In the cause of significant Ras (Road Accidents), environmental variables and stress play a key role. The fatality and seriousness of the accident are decided by other significant elements such as vehicle age, safety actions, human error, and the time and location of the accident. In most vehicle accidents, human errors seem to be the biggest cause.

An operator or human causes examination will be important to the analysis of accidents. Research on the role of the human component of the transportation system in road safety issues is highly significant. Factors that are involved in accidents include operator skill and the traffic environment. Stress caused by economic or family issues is sometimes caused by human error. That kind of state of mind causes them accidents on the road. In our nation, caring is one of the reasons for traffic accidents.

C. Frequency of RTAs

Apredictable 1.2 million people die each year in RAs while about 50 million are wounded and about 85% in developing nations. In India, the world's the highest incidence of road accidents. More than 135,000 fatalities in India have been reported in the National Crime Records Bureau report.

In 2012, 195,723 vehicle accidents on Britain's highways, including 1754 deaths and 23,039 severe fatalities, were reported. There were 100 000 accidents between 2008 and 2012 in 33 thousand fatalities, wounded 150 thousand and destructing 125,000 cars, the Ministry's Home Office and the Ministry of Transportation released a joint report. The average likelihood of an accident occurring in Washington is a shocking 4.8 years more than twice the national 10-year average.

D. Road Traffic Accident Studies in Various Countries

ThusoMphela (2011) has gathered and drafted the influence of traffic legislation on road accident deaths in Botswana. This report examined the effects of traffic law enforcement on deaths by multiple regression analysis

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utilizing secondary data and interview data acquired from law enforcement agencies in Botswana. The study shows that licensed drivers between 30 and 45 years of age had the lowest death rate [11].

The situation in Bangladesh, Khulna City, Road Traffic Accident (RTA) has been documented by Banik et al (2005). Data from the many police stations in the city have been collected for two years on traffic accidents [12]. During the reporting time, there have been 157 traffic accidents and 25% of victims are 30 to 39 years old, 33% are fatalities and 34% are wounded. Omar and Ashawesh (2008) projected that the number of leading causes of mortality and disability will reach third by 2020 [13].

Atubi (2010) had done a monthly road accident study in chosen municipal authorities Grease in Laos State, Nigeria utilizing data from secondary sources. Preventive and corrective safety methods to reduce road accidents are proposed in this study. In Nigeria, disturbing road accidents have been seen during the last 30 years. Compared to Britain, a person is 47 times more likely to be killed in Nigeria [14].

III. CRASH SEVERITY PREDICTION (CSP)

Problems with crash prediction have been a prominent study subject across the world for a long time. Several studies have conducted a prediction analysis dependsupon classic statistical models, for examplenonlinear, linear,GEE (Generalized Estimating Equation), NB (Nominal Binary), GLM (Generalized Linear Model),and Poisson regression models that are considered to be useful attempts at carefully formulating tens or hundreds of explicatory variables. Though, it must be noted that traditional statistical technique has its limitation. The technology of AI(Artificial Intelligence), in a particular method of DL,[15] should be examined and explored as a new yet promising means to deal with the issues faced by the traditional statistical field.

SPFs (Safety Performance Functions) are often used to show relations amongvarious crashes & characteristics of crash influence. Usually, such functions are variable to target crash frequency. The Road Safety Manual contains numerous chapters which show that an overall network, facility, or location has an average collision frequency 6 equations are slightly revised to the following road characteristics: fatal and severe injuries, fatal injuries, all injuries, and fatal injuries, fatal accidents and all accidents, including the use of 6 power functions to showthe relationship among speed and road safety;Russo et al. [16] developed 4 sets of SPFs dependsupon crash frequency using the negative binomial regression model and ran a remaining analysis to show their accuracy. Several crash modification factors (CMFs), developed by Park and Abdel-Aty[17], were used as a cross-sectional method to combine the transverse traffic and road elements in noncurved and curved road sections and established a decrease in the CMFs for an increase in lane width and shoulder width, with an increasingly large annual average daily traffic (AADT) level.

A. Statistical Models Application in Crash Severity Prediction

Method to accident severity modeling comprises statistical modeling that takes seriousness into account as an adjunct to the driver, vehicle, road, and environmental factors. Traffic crash severity was modeled using regression methodssuch as logit &probit. [18,19].Various research utilized binary probit& logit models for modeling 2 crash severity levels while others utilized multinomial logit &probit to simulate several levels of crash severity. Various sophisticated models for normal heterogeneity and the correlation of traffic crash data factors have been created. These models comprise hierarchical Bayesian, ordered probitand logit models, imitated logit models also their combination models [20,21].

To forecast the severity of road collisions, an ordered probit model was created. Many contributing elements for humans, cars, and roads have been investigated to see their influence on the severity of crashes. In research, the severity of the collision was substantially impacted by the type of place (urban or rural) and by gender. For all forms of an accident involving single vehicles and two vehicles, Kockelman and Kweon[22] created probit models. In comparison to passenger automobiles, sports cars and trucks involved significant collisions while young men driving at moderate speeds were involved in less severe collisions in newer cars.Chen et al. [23] researched the severity of truck-involved collisions with probit models to find relevant components. Gender, age, daytime, weather, and many other factors have been proven to substantially impact collapse. Hu et al. [24] constructed a logit model to explore major crash severity variables in the junction of railways. It was observed that a substantial impact on crash severity was achieved by theno. of daily trucks, no. of daily trains, obstacle detection & approximate crossing points.Comparative research was carried

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out amongthe Bayesian network for CSP and regression modeling in China country, in which the Bayesian network outperforms crash severity prediction regression modeling.

Al-Ghamdi [25] has utilized logistic regression in Riyadh, Saudi Arabia to discover factors that contribute to crash severity. The accident cause & location of the crash were the most important variables determining crash severity. Multiple MLPs predict collision severity on expressways in Thailand & concludes that traffic speed is the largest variable with an impact on the degree of severity. To examine and forecast road & environmental impacts on traffic collision severity in the US (United States), the logistic regression (LR) model has been developed[26]. Road alignment, speed limit, light condition, road class, position & quality of paving contribute substantially to the severity of the collision.

IV. MACHINE LEARNINGTYPES AND TECHNIQUES

Machine Learning (ML) is a major AI subfield,which allows machines to learn and perform specified tasks. Machine learning comprises a group of techniques and algorithms that may predict certain future occurrences or categorize certain information by learning the patterns in existing data. LR, SVM (Support Vector Machines), algorithm Naive Bayes [27], decision-making, gradient boosting, random forest & deep learning, are all of the most significant algorithms in this subject.

LR is a method of ML that seeks to discover a linear pattern of variables by placing one line on the data curve [28]. It can also be used for grading reasons.

SVM algorithm is one of the most used algorithms used in data classification [29]. Best data classification for provided data is found. SVM may deliver very excellent performance generalization.

A decision tree is another data modeling technique that employs tree-like structures to categorize decisions to output the given data class. A whole learning approach called random forest is developed when certain decision trees are used [30].

In some learning issues, a gradient boosting technique is commonly utilized. It creates an ensemble model by using certain weak models. The capacity to decrease bias and variation in the model is one of the benefits of this technique.

Deep Learning (DL) is another algorithm, which in some complicated machine learning tasks has become widely accepted as an effective technique. DL is one of another family of ways of ML called ANN (Artificial Neural Network). A network of cells is created in ANN algorithms and cell connections are modified so that the resultant network can learn how to organize the training data. No. of layers in-network is significantly greater than ordinary ANN in the field of deep learning. The method allows greater levels of the input data to be extracted [31].

V. DIMENSIONALITY REDUCTION TECHNIQUES

Dimensionality reduction is extremely helpful and crucial for the assessment of data of high dimensions, an important analytical aspect for the study of RNA-seq data. Suitable dimensional algorithms for reducing performance, likesensitivity, accuracy, specificity, robustness, recall, computational cost, andcomputational scalability, can facilitate efficient evaluation, classification, and classification performance for their ability to enhance innovative expressioncharacteristics [32].

Due to high processing costs and memory use, high-dimensional data are problematic. In data mining literature, there have been two types of approaches of dimensional reduction: 1) feature selection & 2) feature extraction and transformation.

1) Feature Selection

It [33], [34] chooses a subset of original characteristics without loss of relevant data. It is a heuristic search procedure for the selection of descriptors that characterize a given domain most effectively. It deals with the specific task of selecting a subset of features relevant for solving the problem of the domain. The objective of the selection of

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features is to pick the smallest possible subset of characteristics. These procedures must be implemented as pre-processing phase before implementing data mining tasks.

Feature selection gives different benefits [35], such as:

- Decreasing storage requirement
- Avoiding overfitting
- Decreasing training times
- Speeding up the execution of mining algorithms
- Facilitating data visualization

2) Feature Extraction/Transformation

Feature extraction [36] provides a way by using certain transformations to achieve new functions to decrease the complexity of each variable and offer a simple representation of data as a linear combination of input variables in the area of each variable. The extraction of features is more common than the selection of features. Main PCA(principal component analysis),independent component analysis, non-linear main component analysis,etc. are several extraction methods of the feature.

PCA [37] developed by Karl is the most popular and extensively used method for extracting features. PCA involves an orthogonal transformation in which samples from related variables are converted into samples of linearly uncorrelated variables. It may uncontrollably project data from original space into lower-dimensional space. The principal reason for using PCA is that PCA is a straightforward non-parametric approach for extracting the most pertinent info from series of redundant or noisy data.

VI. ENSEMBLE METHOD

In literature, there has been a wide range of combination schemes and ensemble approaches. Combination technologies, depending on the main classification criterion selected, can be categorized and studied indifferently. When you use the input pattern representation as to the key criterion, you may identify two separate big groups, one using the same one and the other using different input representations.

In this summary, we take a similar technique to that above to differentiate amonggenerative &non-generative ensemble approaches. Non-generational ensemble techniques are confined to combining some presumably well-designed foundation learners: they don't dynamically create new foundation learners howeverthey try to integrate a collection of current base classifiers appropriately. Generative ensemble techniques produce basic learners using the basic learning algorithm, or the dataset structure and seek to enhance the variety and precision of the base learners actively.

A. Non-Generative Ensembles

This broad collection of ensemble methods covers a wide range of approaches to combining machine learning. They share an extremely common feature of employing a preset set of previously trained learning machines using relevant algorithms. The basic students will be assembled by a combiner module, which can change based on the adaptability of the input models and the demands of individual learning machines for their output. The combination type might dependupon the output type. If labels are only provided, or if the continuous output is required, majority voting, the class of basic classifications most represented, will be utilized.

B. Generative Ensembles

Generative ensemble techniques aim, via the dimensions of accuracy and variety of the basic learner, to increase the overall accuracy of an ensemble. They mayadapt structure & characteristics of obtainable input data, as in resampling techniques or feature selection techniques, they mayoperate aggregation of classes (Output CodingMethods), maychoose base learners specialized for particular input region (experts techniquesmixture), maychoosean appropriate set of base learners assessing performance &features of component base learners (testandselect techniques) or may randomly adapt base learning algorithm (randomized techniques) [38].

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VII. LITERATURE REVIEW

S. Sonal and S. Suman (2018) The study of data from road accidents use data mining and machine learning approaches to detect characteristics that impact the severity of an accident. There are some reasons for accidents. Some are within the driver, but many of them are outside. Unfavorable weather such as fog, rain, and snowfall, for example, can create limited visibility and make driving on such roads both difficult and risky. The findings in this article are intended to assist civic authorities in proactively acting on weather and road conditions that might cause a crash [39].

K. Tsai et al. (2018) Play an overview of traffic accident severity variables and also examine methodologies often employed in prior research, including logistic regression, power model, and so on. In the examination of literature, the speed of vehicles driven followed by human characteristics is the main variable identified to be relevant for road accidents. Other important elements are vehicle kinds, weather, consumption of alcohol, fatigue of the driver, etc. [40].

W. Taiet al. (2019) Develop a road accident information system to handle the accident suitably and conveniently, draw out the diagram for the digital accident, collect evidence, improve the quality of government's service effectively and reduce social costs and possibly contribute to further accident analysis and applications. Their system at the Traffic Division of our city has shown service with the aim that the features for feasible applications will continue to improve [41].

Mamlook et al. (2019) The goal of this project is to assess and compare various techniques to crash severity modeling and to study the influence of risk variables on fatality outcomes of RAs via ML driving simulation. To decrease accidents, they have designed prediction algorithms for identifying risk variables for road crashes. The Random Forest model had the greatest performance with an accuracy of 82.6% of the six alternative methods [42].

A. Ji and D. Levinson (2020) This work intends to use an ensemble machine learning model to definecrash prediction potential mechanism-related factors. Findings show selected models that mayforecast seriousness to the high level of efficiency. For the intended ensemble combination, a stacking model bythe linear blender is chosen. Most methods for boosting, bagging,and stacking perform well, showing that ensemble models can enhance individual models [43].

R. E. Al Mamlook et al. (2020) Purpose of this study is to study risk variables contributing to the severity of collision injury between elderly drivers. It is done by creating accurate prediction models that dependupon machine learning. The proposal is made for the Random Forest model &Naïve Bayesian (NB), Logistic Regression (LR), Decision Tree (DT), and Light-GBM. The results demonstrate that 87 percent of the five models evaluated attained the greatest level of accuracy. The Light-GBM model shows that driver's age, traffic volume, and car age are three major factors that affect injuriesseverity [44].

S. Elyassami et al. (2020) Used 3ML algorithms to the DT, RF, & Gradient Boosted Tree to Maryland State Police for State-Wide Vehicle crashes Dataset. The boost gradient model showed the best accuracy of the prediction and the predictive model had the most influential elements. The results have shown that the most critical variables in the prediction model for road collision are road signals & stop signs, road design issues, poor visibility,& bad weather. In the determination of measures to decrease the risk associated with such variables, the use of identified risk factors is important [45].

VIII. CONCLUSION

Due to the substantial economic and social consequences on society, traffic collision severity is of major concern to policy-makers and security specialists. The precise forecast of the severity of traffic collisions helps provide critical information that may be utilized to take adequate steps to reduce crash consequences. Different research examined factual data and different crucial facts relating to the severity of the road accident and the methods to decrease RTAs. It is not simply a human mistake or negligent drivers who cause road accidents. The issue of road traffic accidents must be considered as a matter of urgency to reduce the social, economic, and health consequences. This article offers a general review of road hazards and their effects in different areas. Thesefields include major causes of health, frequency, and various countries.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.542

|| Volume 9, Issue 7, July 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0907108 |

REFERENCES

[1] Muthusamy A P et al., "A Review on Road Traffic Accident and Related Factors", International Journal of Applied Engineering Research, Volume 10, Number 11, (2015), pp. 28177-28183.
[2] Nasrin S. Saiyed et al., "Road Traffic Injuries and Related Safety Measures: A Multicentre Analysis at Military Hospitals in Tabuk, Saudi Arabia", Emergency Medicine International / 2021.
[3] Angelica Batrakova, and Olga Gredasova, "Influence of Road Conditions on Traffic Safety", 9th International Scientific Conference Transbaltica, Procedia Engineering, 134 (2016) 196 – 204.
[4] Marcus Müller and Michael Botsch ET AL., "Machine Learning Based Prediction of Crash Severity Distributions for Mitigation Strategies", Journal of Advances in Information Technology Vol. 9, No. 1, February 2018.
[5] S.Thirumurugan, "Application of Machine Learning In Road Transportation – A Literature Survey", IJCRT, Volume 8, Issue 12 December 2020
[6] Peden M., Scurfield R., Sleet D., Hyder A.A., Mathers C., Jarawan E., Hyder A.A., Mohan D., Jarawan E. *World Report on Road Traffic Injury Prevention.* World Health Organizatio; Geneva, Switzerland: 2004
[7] S. Yasmin, N. Eluru, A. R. Pinjari, and R. Tay, "Examining driver injury severity in two vehicle crashes–a copula based approach," *Accident Analysis & Prevention*, vol. 66, pp. 120–135, 2014.
[8] P. Hamalainen, "The effect of globalization on occupational accidents," *Safety Science*, vol. 47, no. 6, pp. 733–742, 2009.
[9] B. Charbotel, J. L. Martin, and M. Chiron, "Work-related versus non-work-related road accidents, developments in the last decade in France," *Accident Analysis & Prevention*, vol. 42, no. 2, pp. 604–611, 2010.
[10] Eurogip, "Understanding ocupational risks in Europe," Eurogip, 2013
[11] ThusoMphela,(2011). The Impact of Traffic Law Enforcement on Road Accident Fatalities in Botswana. J. of Transport and Supply Chain Mgt. 5(1): 264-277.
[12] Banik, B. K., Chowdhary, M. A. I., Hossain, E., and Moumdar, B. (2011).Road accident and safety study in Sylhet Region of Bangladesh. J. of Engg. Sci. and Tech. 6(4):493-505.
[13] Omar AH and AshaweshK,(2008). Road safety: A call for action, Libyan J Med, 3(3):126-127.
[14] Atubi Augustus O,(2010). Road Traffic Accident Variations in Lagos State, Nigeria: A Synopsis of Variance Spectra. Afr. Res. Rev. 4(2):197-218.
[15] Y. LeCun, Y. Bengio, and G. Hinton, "Deep learning," Nature, vol. 521, no. 7553, pp. 436–444, 2015.
[16] R. Elvik, P. Christensen, and A. Amundsen, "Speed and road accidents: an evaluation of the power model," TOI Report, vol. 740, 2004.
[17] F. Russo, M. Busiello, and G. Dell Acqua, "Safety performance functions for crash severity on undivided rural roads," Accident Analysis & Prevention, vol. 93, pp. 75–91, 2016.
[18] Kashani, A.T.; Shariat-Mohaymany, A. Analysis of the tra_c injury severity on two-lane, two-way rural roads based on classification tree models. Saf. Sci. 2011, 49, 1314–1320.
[19] Mujalli, R.O.; de Oña, J. Injury severitymodelsformotor vehicle accidents: A review. Proc. Inst. Civ. Eng. Transp. 2013, 166, 255–270.
[20] Christoforou, Z.; Cohen, S.; Karlaftis, M.G. Vehicle occupant injury severity on highways: An empirical investigation. Accid. Anal. Prev. 2010, 42, 1606–1620.
[21] Eluru, N.; Bhat, C.R. A joint econometric analysis of seat belt use and crash-related injury severity. Accid. Anal. Prev. 2007, 39, 1037–1049.
[22] Kockelman, K.; Kweon, Y.-J. Driver injury severity: An application of ordered probitmodels. Accid. Anal. Prev. 2002, 34, 313–321.
[23] Chen, S.; Zhang, S.; Xing, Y.; Lu, J. Identifying the factors contributing to the severity of truck-involved crashes in Shanghai river-crossing tunnel. Int. J. Environ. Res. Public Heal. 2020, 17, 3155.
[24] Hu, S.-R.; Li, C.-S.; Lee, C.-K. Investigation of key factors for accident severity at railroad grade crossings by using a logit model. Saf. Sci. 2010, 48, 186–194.
[25] Al-Ghamdi, A.S. Using logistic regression to estimate the influence of accident factors on accident severity. Accid. Anal. Prev. 2002, 34, 729–741.
[26] Wang, Y.; Zhang, W. Analysis of roadway and environmental factors affecting traffc crash severities. Transp. Res. Procedia 2017, 25, 2119–2125.
[27] Bonaccorso G. Machine learning algorithms. Packt Publishing Ltd; 2017.
[28] Kleinbaum DG, Dietz K, Gail M, Klein M, Klein M. Logistic regression. Springer; 2002.
[29] Cortes C, Vapnik V. Support-vector networks. Machine learning. 1995;20(3):273–97.
[30] Koning M, Smith C. Decision Trees and Random Forests: A Visual Introduction for Beginners. Amazon Digital Services LLC - Kdp Print Us; 2017.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.542

|| Volume 9, Issue 7, July 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0907108 |

[31] NeginShafaf and Hamed Malek, "Applications of Machine Learning Approaches in Emergency Medicine; a Review Article", Arch AcadEmerg Med. 2019; 7(1): 34.
[32] Arowolo, M.O., Adebiyi, M.O., Aremu, C. et al. A survey of dimension reduction and classification methods for RNA-Seq data on malaria vector. J Big Data 8, 50 (2021).
[33] Kajal Naidu, Aparna Dhemge and Kapil Wankhade, "Feature Selection Algorithm for Improving the Performace of Classification: A Survey", In proceedings of fourth international conference on Communication Systems and Network Technology, pp. 468-471, 2014.
[34] Monica Rogati, Yiming Yang, "High-performing Feature Selection for Text Classification," In proceedings of 11th International Conference on Information and Knowledge Management, McLean, Virginia, USA, pp.659 – 661, 2002.
[35] Zilin Zeng, Hongjun Zhang, Rui Zhang, and Youliang Zhang, "Hybrid Feature Selection Method based on Rough Conditional Mutual Information and Naïve Bayesian Classifier", ISRN Applied Mathematics, Vol. 2014, Article Id 382738, pp. 1-11, 2014.
[36] Prashant K. Aher, Swapnil D. Daphal and Alice N. Cheeran, "Analysis of Feature Extraction Techniques for Improved Emotion Recognition in Presence of Additive Noise", In proceedings of International Conference on Computation System and Information Technology for Sustainable Solutions, pp. 350-354, 2016.
[37] Ali Sophian, Gui Yun Tian, David Taylor and John Rudlin, "A feature Extraction Technique Based on Principal Component Analysis for Pulsed Eddy Current NDT", NDT & E International, Vol.36, No. 1, pp. 37- 41, 2003.
[38] Giorgio Valentini, "Ensembles of Learning Machines", Lecture Notes in Computer Science 2486:3-22, 2002.
[39] S. Sonal and S. Suman, "A Framework for Analysis of Road Accidents," 2018 International Conference on Emerging Trends and Innovations in Engineering And Technological Research (ICETIETR), 2018, pp. 1-5, doi: 10.1109/ICETIETR.2018.8529088.
[40] A. Ditcharoen, B. Chhour, T. Traikunwaranon, N. Aphivongpanya, K. Maneerat and V. Ammarapala, "Road traffic accidents severity factors: A review paper," 2018 5th International Conference on Business and Industrial Research (ICBIR), 2018, pp. 339-343, doi: 10.1109/ICBIR.2018.8391218.
[41] W. Tai, H. Wang, C. Chiang, C. Chien, K. Lai and T. Huang, "RTAIS: Road Traffic Accident Information System," 2018 IEEE 20th International Conference on High Performance Computing and Communications; IEEE 16th International Conference on Smart City; IEEE 4th International Conference on Data Science and Systems (HPCC/SmartCity/DSS), 2018, pp. 1393-1397, doi: 10.1109/HPCC/SmartCity/DSS.2018.00230.
[42] R. E. Al Mamlook, A. Ali, R. A. Hasan and H. A. Mohamed Kazim, "Machine Learning to Predict the Freeway Traffic Accidents-Based Driving Simulation," 2019 IEEE National Aerospace and Electronics Conference (NAECON), 2019, pp. 630-634, doi: 10.1109/NAECON46414.2019.9058268.
[43] A. Ji and D. Levinson, "Injury Severity Prediction from Two-Vehicle Crash Mechanisms With Machine Learning and Ensemble Models," in IEEE Open Journal of Intelligent Transportation Systems, vol. 1, pp. 217-226, 2020, doi: 10.1109/OJITS.2020.3033523.
[44] R. E. Al Mamlook, T. Z. Abdulhameed, R. Hasan, H. I. Al-Shaikhli, I. Mohammed and S. Tabatabai, "Utilizing Machine Learning Models to Predict the Car Crash Injury Severity among Elderly Drivers," 2020 IEEE International Conference on Electro Information Technology (EIT), 2020, pp. 105-111, doi: 10.1109/EIT48999.2020.9208259.
[45] S. Elyassami, Y. Hamid and T. Habuza, "Road Crashes Analysis and Prediction using Gradient Boosted and Random Forest Trees," 2020 6th IEEE Congress on Information Science and Technology (CiSt), 2020, pp. 520-525, doi: 10.1109/CiSt49399.2021.9357298.

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