e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:01/January-2023 Impact Factor- 6.752 www.irjmets.com

MACHINE LEARNING TECHNIQUES ON ROAD ACCIDENT DETECTION AND CLASSIFICATION

Subhash KA[*1], Samhitha KS[*2], Reeshu Ranjan[*3], Rajat Koorse[*4], Dr. Chandrika J[*5]

[*1,2,3,4]Students, Information Science & Engineering, Malnad College Of Engineering, Hassan, Karnataka, India.

[*5]Professor And Head, Information Science & Engineering, Malnad College Of Engineering, Hassan, Karnataka, India.

ABSTRACT

There are more occurrences of death and disability annually due to daily traffic accidents. The majority of fatalities happen as a result of the slow response to these emergency situations. The period immediately following a catastrophic injury is referred to as the "golden hour," during which rendering immediate, life-saving medical and surgical care raises the likelihood of human survival. Accidents still happen despite all the contemporary advancements. Human safety and efficient traffic management depend on the rapid reporting of accidents to emergency facilities like hospitals or police stations in order to provide victims with emergency medical care. Different domains can be used for accident detection. Most of the publications examined use sensor technology, besides attempting to use computer vision and machine learning from surveillance cameras to automatically detect accidents. Any type of mishap is automatically reported as an alert to the necessary location. This review article explores methods for detecting traffic accidents on a road monitored by security cameras using machine learning and neural networks.

Keywords: Machine Learning. Road Accidents, Medical, Cameras.

I. INTRODUCTION

According to the National Highway Traffic Safety Administration, automobile accidents are the second largest cause of mortality. The average death rate across 28 nations, or every 25 seconds, is 449 million people (seven percent of the population of the world). India is the country where accidents and unintentional deaths happen the most frequently.

According to the “WHO Report 2015: Data Tables”[2], The transport industry both road and rail reports the highest number of accidents. and some estimates state that 105,000 accidental deaths occurred on Indian roadways alone in 2010. Even though India only accounts for 1% of the world's automobiles, this represents about 15% of all traffic fatalities. Between the years 2000 and 2015, there were more accidental deaths than ever before, including a 50% increase in 2010 over the preceding year, The Planning Commission of India estimates that the rising number of traffic deaths results in a total yearly economic loss to India of 2.5% of GDP, The Ministry of Road Transport & Highway Safety, the National Crime Records Bureau, and the Indian Law Commission all reported one severe traffic collision. One of the key factors contributing to the increase in this number is the delay in reporting collisions to emergency facilities.

According to the World Health Organization in 2016, the 2030 Agenda for Sustainable Development was established in 2015 with the intention of halving the number of fatalities and injuries brought on by traffic accidents by the year 2020[1]. In this regard, authors provide a summary of the most recent technological advancements intended to automatically detect accidents and promptly inform emergency departments. According to Mohammed Balfaqih et.al [3], The majority of fatalities happen as a result of the slow response to these emergencies. The chance of saving a person's life increases, on average, by one-third in the "golden hour," which is the time immediately following a traumatic injury.

According to Sharmila Gaikwad [4], The number of automobiles is rising quickly. This is leading to a significant rise in the number of traffic accidents that result in fatalities.1.2 million people pass away annually. India is the source of 1 percent of the world's road vehicles but 16 percent of all fatalities result from traffic accidents. According to a study in a reputable publication, over 1.51 lakh fatalities in road accidents in India occurred in 2018, an all-time high and an increase of around 3,500 over 2017. The majority of traffic fatalities occurred in Uttar Pradesh, followed by Maharashtra and Tamil Nadu. Many people pass away on the roads today as a result

of invisible traffic accidents. Due to an increase in the number of vehicles on the road, accidents are increasing. without comparable growth in the supporting road infrastructure. We may not be able to prevent injuries, but we may still save those who have been hurt. Several academics have proposed several systems for accident detection, including mobile apps, GSM and GPS software, vehicular ad hoc networks, and cell phones.

As per Raj Shah et.al [5] According to all accounts, car accidents are horrifying and terrifying occurrences that result in several fatalities. The number of lives lost in accidents is rising dramatically along with the number of incidents per year. There are conventional ways to aid those in need or victims who are reporting their crimes to the appropriate authorities but require support or help from others, however, these methods frequently take a long time and may even result in fatalities. Therefore, it is necessary to create an accident detection system that would identify the accident and notify the relevant authorities. The quick response to the alert would ultimately result in the greatest number of lives being saved. Several scholars have used convolutional neural networks, HDNN, RCNN, etc. to study this method.

In the paper Accident Detection System Using Intelligent Algorithm [6] author Saad Mason Frequent traffic accidents have resulted in significant losses of life and property for the nation and its citizens.

In the interest of the country, traffic has become a significant event. If people are unable to call for assistance from the outside when traffic jams arise, terrible consequences will follow. A significant factor contributing to the high number of road deaths and the mortality rate in our nation.

Several technological and sociological advancements have contributed to the decline in traffic fatalities over the past ten years, for example, it is estimated that each 1% increase in seatbelt use will save 136 lives [2]. Additionally, each minute that an injured crash victim is left without emergency medical care can significantly affect their chance of survival, i.e. According to analysis, cutting the time it takes to respond to an accident by one-minute results in a six percent increase in the number of lives saved.

II. LITREATURE SURVEY

Vehicle accident automated detection and the remote alert device is the foundation of V. Goud's paper [7]. This system's focus is on a vehicle-based automatic accident detection system that alerts a rescue team, like a first aid centre and the police station, about the impact and its location, time, and angle. This data is included in an alert message that is distributed. However, in circumstances where there are no casualties, a switch is provided that the driver can flip to turn off the alarm message. GSM and GPS modules are used to send the alarm message and find the accident's location, respectively. Through a serial connection, the control unit is linked to the GPS and GSM modules. Two sensors a Micro Electro Mechanical System (MEMS) sensor and a vibration sensor are used to identify the accident itself. The MEMS sensor also aids in measuring the car's rollover angle. The primary high-speed data processing unit is a 32-bit ARM controller. An amplifying circuit is used to increase the vibrations before they are transmitted from the vibrating sensor to the controller. The MEMS sensor transmits the rollover angle to the controller in a similar manner.

In G. Liang's [8], It has proven effective to identify traffic accidents utilizing a cloud computing and Internet of Things (IoT) infrastructure. Support Vector Machine (SVM), which has been enhanced with the Ant Colony Algorithm, has been used to detect traffic accidents (ACA). SVM's parameter selection process, which is crucial to the precision that may be achieved, uses ACA. To be attained using SVM. Here, incredibly sensitive magneto resistive Internet of Things (IoT) sensors are being utilised to track the movement of the autos. Sensors that monitor changes in the magnetic field of the road, brake and impact sounds, and two different sensors that help identify the direction of the vehicles are among the sensor modules used to detect the presence of cars. SVM is trained using data from previous traffic and evaluated using data from future traffic. The algorithm looks for a decision plane that distinguishes between the classes of "traffic accident" and "no traffic accident." An ACA-based optimization strategy improves this. The improved SVM model with ACA outperforms the traditional SVM model, performs better than the traditional SVM model, and has a smaller Mean Square Error (MSE) than the traditional SVM, according to the results. The IoT-based strategy performs better than the conventional sensor-based method.

The Android application developed by K. Patel et al. [9] is the proposed solution, and it uses the smartphone's accelerometer to detect accidents. The phone cannot be in anyone's hands and must be docked inside the vehicle. The operation of this application is as follows:

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:01/January-2023 Impact Factor- 6.752 www.irjmets.com

When the accelerometer notices a tilt of the device above a set threshold, the application waits 15 seconds. Three different types of input are possible here. (1) If the user is present and the device was accidentally tilted, he can press "cancel." (2) If a mishap has occurred, the user can press "send" if he is active. (3) An accident is presumed to have occurred if the user is passive and no button is hit after 15 seconds. In cases (2) and (3), a pre-recorded voice message is delivered to the 108 ambulance emergency response service along with the location after the current location is determined using GPS. The GPS services offered by Android have undergone a thorough analysis, Xinhua Shu, at. al [16] J. Whipple at. Al [17]. Therefore, effective accident detection and notification have been accomplished using only a smartphone and no other hardware.

The proposed system by B. Fernandes [10] uses an Android app as well, but the smartphone needs to be in a holder that is fastened to the car.

Three different types of events are used by the accident detection algorithm to identify accidents: (1) A collision is recognized when the accelerometer reads more than 4g (g=9.8m/s2), and the accident's estimated severity is calculated using a statistic called the Acceleration Severity Index (ASI). (2) A magnetometer and a gyroscope are used to detect rollovers. A rollover is deemed to have occurred if the rotation is greater than 45 degrees and the immediate speed is less than 5 km/h. (3) Airbag deployed indication also signals an accident.

If one of these three occurrences is discovered, an alarm is delivered via three separate channels:

an SMS, an e-Call to an EMS, and a Decentralized Environmental Notification Message (DENM) message with a Road Hazard Warning. By delivering accident notifications only if a countdown sequence is not interrupted by any of the passengers, this system manages false positives.

The framework put forward by Anik Vega Vitianingsih and others, [11] We evaluate the effectiveness of the proposed spatial analysis model for routes with a high risk of traffic accidents against that of the current framework using a review of the literature. The comparison framework includes the spatial analysis model, the primary study (PS) geographic analysis technique, the spatial datasets used to test the model through method selection, and the significance of the measurement results through assessment. In this section, the framework created by earlier scholars will be explained. the H. Pilko et al. framework model [12].

The W. Chen et al.,[13], M. Kabanov et.al.,[14], M.Schlogl et.al.,[15] PROMETREE-RS MCDM model produced a framework. Because MCDM allows for the use of several parameters, this model was created to assess the effectiveness of the DEA and TOPSIS strategies for improving road safety. The average cluster variation, rank, and correlation data will be entered into the MCDM PROMETHEE-RS to evaluate the generated model. This model took into account a number of different parameters, including Police Department statistics on fatalities, serious injuries, population, and the number of registered vehicles. In order to represent mathematical geographic data using DEA and TOPSIS, the value of this element will be used to build the optimum composite index.

The model framework was created using MCDM. The goal of this model is to use the FP-growth and Apache Spark framework to develop a knowledge data mining rule decision tree. a road accident analysis trial model whose findings are highly accurate and effective in enhancing traffic safety. The road accident data to the attribute of injuries and fatalities constitute the multi-parameter criteria. The appropriate association rule's testing model is tested and validated using quality measurement. With an accuracy value of 0.8830 for threshold value 1, the MCDM model effectively solves the issue of accident-prone road sections (APRS) on the kind of horizontal alignment, vertical alignment, intersections, key locations, and shoulder widths.

The review and the comparison between different frameworks are discussed in the following table.

Table 1: compares literature reviews according to a framework.

Framework	Model and method	Spatial datasets	Results
V. Goud et.al., [7]	Automatic Vehicle Accident Detection and Remote Alarm System with GSM Module.	The accidents, car rollover angles.	The MEMS sensor measure car's rollover angle and transmits the rollover angle to the controller in a similar manner and the alert

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:01/January-2023 Impact Factor- 6.752 www.irjmets.com

			message is sent.
G. Liang's et,al., [8]	Automatic Traffic Accident Detection, utilizes a cloud computing and Internet of Things (IoT) infrastructure	SVM is evaluated on data from future traffic and trained on data from past traffic.	The algorithm looks for a decision plane that distinguishes the classes of "traffic accident" and "no traffic accident."
K. Patel et.al., [9]	Utilizing the Emergence of Android Smartphones	that uses the smartphone's built-in accelerometer to identify accidents	A pre-recorded voice message is delivered to the 108 ambulance emergency response service along with the location determined by the GPS.
Anik Vega Vitianingsih, H. pilko et.al., [11,12]	deep-learning approach to traffic flow prediction	The Police Department data included information on fatalities, serious injuries, population, number of registered vehicles, traffic risk, and public risk.	The problem of accident-prone road sections on the type of horizontal alignment, vertical alignment, intersections, key locations, and shoulder widths can be efficiently addressed by the MCDM model.
W. Chen, M. Kabanov, M.Schlogl et.al., [[13,14,15]	Model of spatial analysis for the classification of routes with high accident rates	Road accidents involving all types of vehicles	Accordingly, the spatial analysis varies, with STAC having a greater Prediction Accuracy Index (PAI) than NNH.

The framework being examined consists of the major research geographic analysis method, the model employed, and the spatial datasets used to assess the model through method selection. The framework developed by prior scholars Anik Vega Vitianigsih et al [11] determines the effectiveness of the spatial analysis model presented for traffic accident-prone roads. In comparison to other frameworks, MCDM provides the best ranking results because it may use several parameters to maximise the effectiveness of the created options.

III. CONCLUSION

This research paper involves a comparison between various work studies conducted on accident detection and classification using several tools and technologies. . The framework that Anik Vega Vitianigsih et. al. found appealing in their study will be used as a model-based hybrid estimation methodology on a combination of MCDM-ANNs classification, strengthening data mining techniques in spatial multi-criteria analysis in multi-class classification decision-making. Road management choices will be based on the outcomes of the best methods for analysing APR.

IV. REFERENCES

[1] "Global status report on road safety 2015", World Health Organization, 2016. Available: http://www.who.int/violence_injury_prevention/road_safety_status/2015/en/.

[2] "Global status report on road safety 2015", World Health Organization, 2016. Available: http://www.who.int/violence_injury_prevention/road_safety_status/2015/en/

[3] Mohammed Balfaqih, Soltan Abed Alharbi, Moutaz Alzain, Faisal Alqurashi and Saif Almilad, "An Accident Detection and Classification System Using Internet of Things and Machine Learning towards Smart City" 2021.

[4] Sharmila Gaikwada, Mahek Khannaa, Shreyans Kothari, Ashutosh Kudalea, "Systematic Literature Survey on Accident Alert & Detection System" 2021

[5] Raj Shah, Heena Shaikh, Devashish Shetty, Dr. Tatwadarshi Nagarhalli "Survey of accident detection systems" 2021.

[6] Saad Masood Butt, "A Review Paper on Accident Detection System Using Intelligent Algorithm for VANET" 2016.

[7] Varsha Goud*, V.Padmaja, "Vehicle Accident Automatic Detection and Remote Alarm Device" 2012.

[8] G. Liang, "Automatic Traffic Accident Detection Based on the Internet of Things and Support Vector Machine", IJSH, Vol. 9, no. 4, pp. 97-106, 2015.

[9] K. Patel, "Utilizing the Emergence of Android Smartphones for Public Welfare by Providing Advance Accident Detection and Remedy by 108 Ambulances", International Journal of Engineering Research & Technology (IJERT), Vol. 2, No. 9, 2013.

[10] B. Fernandes, M. Alam, V. Gomes, J. Ferreira, and A. Oliveira, "Automatic accident detection with multi-modal alert system implementation for ITS", Vehicular Communications, Vol. 3, pp. 1-11, 2016.

[11] Anik Vega Vitianingsih1, Nanna Suryana2, Zahriah Othman3, "Spatial analysis model for traffic accident-prone roads classification: a proposed framework" 2021.

[12] H. Pilko, S. Mandžuka, and D. Barić, "Urban single-lane roundabouts: A new analytical approach using multi-criteria and simultaneous multi-objective optimization of geometry design, efficiency, and safety," Transp. Res. Part C Emerg. Technol., vol. 80, no. July, pp. 257–271, 2017.

[13] W. Chen et al., "A novel fuzzy deep-learning approach to traffic flow prediction with uncertain spatial–temporal data features," Futur. Gener. Comput. Syst., vol. 89, no. June, pp. 78–88, 2018.

[14] M. Kabanov, M. Becker, M. Atzmueller, and A. Hotho, "Adaptive kNN Using Expected Accuracy for Classification of Geo-Spatial Data," in Proceedings of the 33rd Annual ACM Symposium on Applied Computing Pages 857-865, 2018, pp. 857–865.

[15] M. Schlögl, "A multivariate analysis of environmental effects on road accident occurrence using a balanced bagging approach," Accid. Anal. Prev., vol. 136, no. March, pp. 1–12, 2020.

[16] Xinhua Shu, Zhenjun Du and Rong Chen, "Research on Mobile Location Service Design Based on Android", 5th International Conference On Wireless Communication Networking and Mobile Computing, Beijing, pp. 1-4, 2009.

[17] J. Whipple, W. Arensman and M.S Boler, "A Public Safety Application of GPS-Enabled Smart Phones And The Android Operating System", IEEE International Conference on System, Man and Cybernetics, San Antonio, pp. 2059-2061, 2009.