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Survey of accident detection systems

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Abstract: *Vehicle accidents are by all accounts appalling and frightening occasions occurring which cause various deaths. As the number of accidents per year is increasing tremendously and so the lives affected by accidents. There are traditional ways to help the needy or the victim that is informing the right authority but needs assistance or help from others, but this tends to take ample of time and due to it could cost lives. So there is a need to develop an accident detection system that would detect and alert the proper authorities about the accident. The sudden assistance to the alert would in return lead to saving as many lives as possible. Many researchers have analyzed this technique using Convolutional neural network, HDNN, RCNN, etc. This paper will give us an overview of various techniques or methods that are used to detect accidents.*

Keywords- *Accident detection system, Convolutional neural network, HDNN, RCNN.*

I. INTRODUCTION

In the report of NCBI [1], it is clearly stated that there have been 464,910 accidents claimed and also it had been stated that there are daily 405 deaths and 1290 injuries thanks to road accidents. Also quite 30% of those deaths are thanks to late medication or late awareness of the accident. The worldwide economic loss caused by road traffic accidents annually is estimated at 518 billion US dollars [2]. With the increase in the vehicles, the accidents due to vehicles have also been increased. As since the accident is detected through traditional information and communication technologies, Ad hoc Networks and random forest Classifier [11]. But now with the help of machine learning and deep learning-based techniques, various models are being implemented for the detection of vehicle accidents and their severity with the help of a considerable amount of footage and images. Since accident rates are increasing rapidly, there is an urgent need for researchers to develop a system that would detect such accidents through videos. This paper focuses on various techniques like the deep learning-based RCNN model [6][7][8][12], CNN model [9][13]. Also, many different approaches such as considering the manipulation in the edge detection [5], GPS module [14].

II. LITERATURE SURVEY

Md. Farhan Labib, et.al. [3], Analysis has been done, by using Decision Tree, K-Nearest Neighbors (KNN), Naïve Bayes, and AdaBoost these four supervised learning techniques, the severity of accidents into Fatal, Grievous, easy Injury and Motor Collision these four classes. Eventually, the least complex execution is accomplished by AdaBoost. In this paper, the author characterized the force of accidents into four categories Fatal, Grievous, Simple Injury, and Motor Collision. To sort

the seriousness of accidents in these four classes, eleven primary factors that influence the most extreme number of accidents in Bangladesh are chosen as the features. Previously occurred, virtually forty-three thousand traffic accidents knowledge in People's Republic of Bangladesh from 2001 to 2015 area unit used as our learning materials. Among these four techniques best performance is achieved by AdaBoost and its accuracy was 80 percent. The machine learning concept remains within the formative stage here. In the paper, the authors proposed a way to detect the likelihood of accidents on the road by using vision-based techniques.

Nikhil Sharma, Rajat Rathi, et.al.[4], Loop detectors and automatic Vehicle Location sensors are tools that may sensor real-life traffic but the installation of those tools on urban roads may be a myth. As large-scale expertise in traffic, modelling isn't required therefore data driven techniques are approximately faster to create. With a really large dataset of images, at some point it's difficult to realize high accuracy and hence Researchers proposed to make some new layers of net then integrate them with the old layer's architecture net. this HDNN hybrid model of CNN and SVM model. HDNN was applied on two datasets one among images of traffic conditions and second of road accidents in India from different areas. The information set of traffic pictures consists of categorical data, distributed in four categories: Dense Traffic, distributed Traffic, Accidents and fireplace. On the dataset of traffic images, they applied convolutional layers with activation function, the main purpose of convolution layers is to seek out features in images using feature detectors. After every convolutional layer applied a pooling layer to preserve features from any quiet distortions and Flatten layer which reduces all dimensions of input to at least one dimension. Then the flattened matrix goes through a totally connected layer for classification of traffic flow.

Elijah Blessing Rajsingh, Salaja Silas, et.al.[5] ,Accident images are the significant data for analysing the severity of collision in road accidents.Edge detection algorithms locate the significant change of pixel intensity so as to spot the objects in a picture. the sides are typically the border line among different regions in a picture. The challenge of an edge detection algorithm is to stipulate the important edges appropriately and have less possibility of erroneously considering the non- edges as a foothold. Filtering eliminates the unwanted noise from a picture and scale image coordinates. Image enhancement provides better contrast and more detailed information about the image than the original image.Image enhancement is performed by computing gradient magnitude. The desirable edge detection algorithms satisfy the subsequent criteria Good detection: the probability of neglecting real edges must be minimal. Good localization: the sting detected by the sting detection algorithm must be on the brink of the important edges. Minimal response: it must return just one response for every true edge. Therefore the performance of those algorithms were evaluated in terms of PSNR (Peak signal to noise ratio) and MSE(Mean square error). Higher the PSNR value and lower the MSE value indicate the specified edge detection algorithm. The experimental results show that the Sobel edge detection algorithm is acceptable for edge detection in the accident images.

Kyu Beom Lee, Hyu Soung Shin [6] Object Detection and Tracking System (ODTS) along with a notable deep learning organization, Faster Regional Convolution Neural Organization (Faster R-CNN), for detection and chase algorithmic rule square measure attending to be introduced and applied for automatic detection and watching of sudden events on CCTVs in tunnels, that square measure possible to (1) Wrong-Way Driving (WWD), (2) Stop, (3) Person out of an automotive vehicle in tunnel (4) hearth. ODTS accepts a video frame time as associate degree input to urge Bounding Box (BBox) results by Object Detection and compares the BBoxs of this and former video frames to assign a unique identification number to every moving and object to be detected. This framework makes it conceivable to follow a moving object in time, which isn't normal to be accomplished in conventional object detection frameworks. Deep learning model in ODTS was prepared with a dataset of event images in tunnels to Average Precision (AP) estimations of 0.8479, 0.7161, and 0.9085 for target objects: Car, Person, and Fire, etc At that point, supported trained deep learning model, the ODTS based tunnels surveillance accidents Identification framework was tried

utilizing four accident recordings which including every accident. This object following technology has been with success utilized for the tracing of targeted pedestrian and also the moving vehicle, accident observation in traffic camera, criminal and security observation within the sure native space of concern

Murugan. V, Vijaykumar V.R, and Nidhila. A. [7] , The object detection technique is Gaussian Mixture Model (GMM) The outcome of the detection is the intended region of interest, i.e. moving vehicles are the proposed region of interest, which were identified using background subtraction framework. Identification of these regions of interest from the input frames defines the region proposals in the region based CNN(Convolutional neural network). and the detected vehicles are recognized as variant classes using an SVM classifier. The efficiency of this algorithm is evaluated by determining the deviation in pixel values concerning ground truth pixels. Background subtraction is one of the most promising algorithms, which is then followed by kalman tracking and recognition by using the ANFIS classifier. Deep learning framework RCNN is used for the recognition of various classes of vehicles. RCNN architecture includes three major phases i. Capturing the region proposal. ii. CNN layers for feature extraction iii. Classifying the regions to recognize the variant classes. Performance metric values acquired show the proficiency of the RCNN with the state of art techniques.

Vipul Gaurav, Sanyam Kumar Singh, et.al.[8],the system provides a whole resolution to a distinctive, police investigation and mitigating concerning accidents and additionally provides the feasibility study to spot accident-prone areas across the Republic of India. The regression model outperformed its counterparts to predict the number of potential accidents that will occur in ANy given state across the Republic of India with an accuracy of 80- ninetieth. The image segmentation of the accidents is handled by the cloaked R-CNN model that gives correct instance segmentation higher than the quick R-CNN model which will provide solely linguistic segmentation and can't differentiate between the categories.The author experimented with numerous image augmentation techniques and located watershed segmentation and smart edge detection to be appropriate for distinctive the region of interest of any automotive accident pictures or footage. They additionally created the use of electric shock sensors in extremely prone areas wherever the frequency of accidents is extraordinarily high like Mumbai-Pune main road to observe the shock generated throughout a collision and this acts as an additional validation step in predicting the prevalence of road accidents with high severity.The alert system is predicated on the outputs of the image segmentation, electricity sensors, and also the accident severity classification model that is integrable with any monitor. This method offers America an inspiration that whereas detection of car Rcnn incorporates a higher edge over quick Rcnn the accuracy or rcnn detects well as compared to quick Rcnn.

Bulbula Kumeda, Zhang Fengli, et.al.[9] , the detection of accidents and potential algorithms for self acting image processing CNN is used. Tasks like determining the objects in an image, image localization, and other pattern acknowledging tasks.Grouping of images using CNN techniques and categorize images into classes that are Accident, Traffic, Flame, and low traffic. To identify the incidence of the accident, various classes like drunk and drive, month, and weather during the accident, human factors, and light conditions, etc are considered. Task perform,i.e used a traffic accident image dataset called Traffic-Net. The CNN layer is the main block of CNN. The layer consists of neurons that appear for particular features which will later make the neurons more active.

These determine the characteristics of the given image parameters like filters and kernel are associated.Relu layer is known as the rectified linear unit which is the next step to the convolution layer. The fully connected layer which connects the entire series of all layers. In this way, CNN works for the detection of accidents through a dataset. From the images, the training loss could be seen depicting the converges of the cost function. Miao Chong, Ajith Abraham et.al.[10] , the purpose that industry has tried to set up and build safer cars, however traffic accidents are inevitable. Thus for these issues several approaches like a neural network, nesting logic formulation, log-linear model, fuzzy ART maps. Neural networks trained by mistreatment the hybrid learning approaches, support vector machines, call trees, and a synchronic hybrid model involving call trees and neural networks. In a hybrid learning approach, a

Multilayer Perceptron (MLP) may be a feed forward neural network with one or additional hidden layers. The network consists of an associate degree input layer of supply neurons, a minimum of one or additional hidden layer of machine neurons, associate degree an output layer of machine neurons.The input layer accepts input signals and redistributes these signals to all neurons in the hidden layer. The output layer accepts a stimulus pattern from the hidden layer and generates the output pattern of the entire network. Decision tree algorithm used a Classification and Regression Trees (CART) model which consists of a hierarchy of univariate binary decisions. Hybrid decision trees integrate different learning models and give efficient performance than the individual learning or decision-making models by decreasing their individual limitations and exploiting their different mechanisms.

Nejdet Dogru, Abdulhamit Subasi [11],Real-time traffic management system which employs IoT devices and sensors to collect real-time traffic information. The collected traffic data are then used to analyze traffic density .ANNs motive to duplicate the behavior of a real neural network which consists of large number of interconnected neurons.Support vector machines (SVMs) are recently developed and attracting attention from researchers because of their notable accuracy and ability to manage with large and high dimensional data sets. Random forest (RF) is a data mining tool to solve classification and regression related mathematical problems.The performance of RF algorithm, in terms of its accuracy, was found superior to ANN and SVM algorithms.

Helen Rose Mampilayil, Rahamathullah K.[12] ,The paper proposes a system which automatically detects the one-way traffic rule violation without the assistance of human beings. The proposed system can detect the 3 wheeler automobiles which violates the one-way traffic rule. Modules of the proposed system are capturing the input stream, pre-processing the video, 3 wheeler vehicle detection and tracking and finally the direction calculation. The input video stream from the digital camera that's constant on the roadside. It is needed to initialize the route of the traffic so one can detect the incorrect route of vehicles. In the pre-processing step the input video is transformed into frames for video processing. Deep learning approach can be used to detect 3 wheeler vehicles and to identify the one-way traffic rule violation. The trajectory factors of the vehicle are used to decide the direction to which the vehicle is moving. If the route is opposite to the one-way traffic direction, then it may be taken into consideration as rule violation.

Monagi H. Alkinani, Wazir Zada Khan, et.al.[13] , This paper talks about the reasons and consequences of any other human volatile conduct known as Aggressive Driving behaviour (ADB). Aggressive driving Behaviour (ADB) is an extensive organization of risky and competitive using patterns that result in severe accidents. Human abnormal driving behaviours are affected by various factors including drivers experience/inexperience of driving, age, and gender or illness. The study of these elements which could result in deterioration in the driving skills and overall performance of a human driver is out of the scope of this paper. After describing the history of deep learning and its algorithms, it presents an in-depth research of latest deep learning-based systems, algorithms, and strategies for the detection of Distraction, Fatigue/Drowsiness,and Aggressiveness of a human driver, achieves a complete knowledge of HDIADB detection through offering an in depth comparative analysis of all the latest strategies. Moreover, it highlights the essential requirements.

Siddharth Tripathi, Uthsav Shetty, et.al.[14] ,In this paper an intelligent device known as CBITS has been proposed. It is like a Holistic method as it's far properly ready with a network of sensors that offer real-time emission tiers as properly because it signals. .A Unique Vehicle Identification Number can be assigned to each automobile via which the motors are recognized through the tracking authorities. The collective statistics can be shared to the cloud the usage of the Wi-Fi port of Raspberry Pi. CBITS is a relatively powerful, real-time, mild weight, reliable, low-power consuming and a value effective device for the automobile-proprietors in addition to the tracking government. GSM and GPS modules are used for sharing the location to the cloud. Raspberry Pi (B Plus) is the motherboard used, which has 40 GPIO pins and four USB slots which makes the interfacing easy. CBITS combines the different processes into one single and holistic device in addition to its functionalities which show to be highly value-effective and fast responding. CBITS makes use of the cloud-computing platform known as Thingspeak, beneath the class of Software as a Service (SaaS).

III. ANALYSIS TABLE

Table 1 shows the analysis of survey of the existing system by stating the Title of Paper, Technology Used, Dataset used and Accuracy.

Table 1 analysis survey of the existing system

Sr. No.	Title of Paper	Technology Used	Datasets	Accuracy
1	Road Accident Analysis and Prediction of Accident Severity by Using Machine Learning in Bangladesh[3]	AdaBoost	ARI of BUET (Accident Research Institute of Bangladesh University of Engineering and Technology	80%
2	Traffic Density Investigation & Road Accident Analysis in India using Deep Learning.[4]	HDNN	Images of four different traffic scenarios	0.7429(epoch 1) 0.7830(epoch 5)
3	Performance Analysis of Edge Detection Algorithms for Object Detection in Accident Images.[5]	Sobel edge detection	Images of various accidents	MSE:- 197.77 PSNR:- 50.368
4	An application of a deep learning algorithm for automatic detection of unexpected accidents under bad CCTV monitoring conditions in tunnels.[6]	Faster R-CNN	This dataset is composed of 70,914 video images by dividing 45 videos into frames.	Ranging from 0.7 to 0.8
5	A Deep Learning R-CNN Approach for Vehicle Recognition in Traffic Surveillance System[7]	R-CNN	3 types of dataset with their frame counts	80%-90%

6	Accident Detection, Severity Prediction, Identification of Accident Prone Areas in India and Feasibility Study using Improved Image Segmentation, Machine Learning and Sensors[8]	Masked Rcnn	Provided by the Government of India	80%-90%
7	Vehicle accident and traffic classification usingDeep Convolutional Neural Network [9]	CNN	Traffic Net	Approx 80% 90%
8	Traffic Accident Analysis Using Machine Learning Paradigms[10]	ANN (Hybrid learning approaches , support vector machines, decision trees)	GES (General estimation system) automobile accident data.	85%-90%
9	Traffic Accident Detection Using Random Forest Classifier.[11]	Traditional information and communication technologies, Ad hoc Networks and random forest Classifier.	Bootstrap sample and Out of bag (OOB) dataset	88% to 89.91%
10	Deep learning based Detection of One Way Traffic Rule Violation of Three Wheeler Vehicles.[12]	Deep Learning	N.A	Upto 85%
11	Detecting Human Driver Inattentive and Aggressive Driving Behaviour using Deep Learning: Recent Advances, Requirements and Open Challenges. [13]	Deep Learning (CNN, DBN).	COCO datasets	92%

12	Cloud Based Intelligent Traffic System to Implement Traffic Rules Violation Detection and Accident Detection	Holistic method (Network of sensors). GPS and GSM module.	Accelerometer and Force-resistive sensors Value > 5.0	N. A
	Units. [14]			

The various algorithms and features used for accident detection are analyzed in the above table. It includes the Machine Learning and Deep Learning-based technique used for Real-time object detection. Even there is a various model which uses the IoT based technique which includes various hardware components and software connectivity, From the analysis table above and studying it can be seen that best algorithm object detection are CNN algorithm and RCNN gives better results and accuracy while performing and hence using an RCNN or CNN based model would provide a better performance as compared to other algorithms used for the same problem.

IV. CONCLUSION

Since there is a major growth in accidents of vehicles and deaths related to it, it is very vital to detect such incidents. From the literature survey, we came to know various models use various machine learning and deep learning-based techniques such as AdaBoost, HDNN, CNN, ANN with different features to detect the accident and locate the incident in the footage. But the above-mentioned papers do not have good accuracy and alerting systems to the nearby emergency unit. From different studies of paper, we came to know the Faster RCNN gives better results and accuracy.

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