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Convolution Neural Network Framework for Accident Detection for Traffic Monitoring Applications

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ABSTRACT

In this fast-paced world, the number of deaths due to accident is growing at an expeditious rate. Major reasons for these accidents are rash driving, drowsiness, drunken driving, care less ness, etc. An indicator of survival rates after detecting accidents is the time between the occurance of accidents and the advent of medical care to the victim. Due to this delayed medical attention, the accident victims might die as well. As a solution to these problems, we introduce a system that detects road accident and will provide an alert message to the most proximate control room immediately.

Key Words

Cable News Network(CNN), Accident Detection, drowsiness, drunken driving, Delayed medical attention.

1. INTRODUCTION

Road accidents in India are a major cause of decreasing life expectancy with road accidents contributing to over 148,000 deaths out of 467,000 deaths in 2016. Indian Economy has a hit of 3 percent of GDP growth due to road accidents as per the United Nations with an estimated loss of $58,000 in terms of value every year. The metropolitan cities such as Chennai, Mumbai and New Delhi have been increasingly highlighted for lack of road safety and rash driving cases. The recent trends show that there has been an increase in the global number of road accidents even in developed countries. However, under-developed and developing countries suffer a more significant impact due to life and economic losses. These accidents occur due to violation of traffic safety rules, careless rash driving, driver drowsiness and lack of good quality roads. The problem becomes more adverse for highways and hilly areas where accidents are unavoidable. Road accidents are characterized by high death rates due to delay in arrival of help and inefficient systems of mitigation to alert the concerned authorities. Road accidents on the highways are typically caused by natural reasons such as extreme weather conditions such as fog and consecutive collision of vehicles are common on Indian highways due to lack of visibility. The states of Maharashtra, Tamil Nadu and Uttar Pradesh account for the highest number of road accidents in India. The problem can be handled by making use of computer vision and low-cost sensor networks. The current solutions involved heavy dependency on sensor networks and area coverage. This can be substantially replaced by making use of object detection and image segmentation for accident classification. The system identifies the accident-prone areas which are the target stakeholders for the deployment and sets it apart from other implementations since it provides a feasibility factor associated with it. Furthermore, the system provides enhanced mitigation alert to the concerned authorities which helps in preventing any consecutive collisions that could possibly lead to greater loss of lives.

2. LITERATURE SURVEY

Various literature papers were studied and analyzed to understand their work and techniques. Thus, we studied the demerits and merits of various ideas related to accident detection. In one paper, two

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phases are used, an accident detection phase and an accident prevention phase. The authors have mentioned that they used IR sensors and Arduino Uno technology. But in they do not provide an accurate result and also the sensors are costly. In another paper, an accident detection system using Inertial Measurement Unit (IMU) and 3G cellular module using an accident detection method, but the IMU suffer accumulated error and it is complex. Another technology discussed in the paper was a vision-based accident detection system for detecting, recording, and reporting accidents at intersections. They extract features of moving vehicles using cameras in order to detect accidents. In, the results may be wrong when vehicles move fast. There is a method in which accidents are detected using a set of speed sensors spatially located in a street that can communicate using a particular network. Also, there is a smart phone-based accident detection system, in which data is continuously collected from smartphone's accelerometer and analyzed using Dynamic Time Warping (DTW). In another paper, Accident Detection and Reporting System (ADRS) is placed inside the vehicle that uses a sensor to detect accidents. The sensor output is monitored using a microcontroller. In a paper, two methods for detecting and reducing accidents were discussed, one was to use a Smart Helmet in which the mechanism automatically checks whether the rider is wearing a helmet, and another system is used to detect accidents and report it using GSM module. But this system mainly focuses on two-wheeler accidents.

Machine Learning Classifiers: These are used to predict the class/target/labels/categories of a given data points. Classification belongs to the category of supervised learning in which the targets are provided with input data. They are used in many applications like medical diagnosis, spam detection, target marketing etc. They use a mapping function (f) from input variables (X) to discrete output variables(Y).

Opencv: OpenCV is an open-source library which is primarily used for Computer Vision Applications. This contains many functions and algorithms for Motion tracking, Facial recognition, Object Detection, Segmentation and recognition and many other applications. Images and real time video streams can be manipulated to suit different needs using this library.

Tensorflow: It is an open-source machine learning framework to build and train neural networks. It has a collection of tools, libraries and community resources which helps in easy building of deployment of ML powered applications. This is developed and maintained by Google and was released in 2015.

3. PROBLEM ANALYSIS

3.1 EXISTING SYSTEM

Two phases are used, an accident detection phase and an accident prevention phase. The authors have mentioned that they used IR sensors and Arduino Uno technology. But in they do not provide an accurate result and also the sensors are costly. In another paper an accident detection system using Inertial Measurement Unit (IMU) and 3G cellular module using an accident detection method, but the IMU suffer accumulated error and it is complex.

3.1.1 Disadvantages

The rapid growth of technology has made everything more facile and this advancement in technology additionally increased accidents. Due to this delayed medical attention, the accident victims might die as well.

3.2 PROPOSED SYSTEM

Since there was no dataset available, a dataset was created that includes accident and non- accident

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images. If an accident occurs, an alert message will be sent to the nearby control unit. We trained the system with the created dataset. The trained system is then incorporated with the cameras so as to capture the video of the vehicles on the road. By calculating the probability, the system predicts whether an accident happened or not. In case of an accident, an alert is sent to the control rooms using the GSM module. Fig. 1 is the flowchart depicting working of the system. The camera module records the video of vehicles in the road. The camera is placed at fixed locations, mostly in accident-prone areas. Whenever an accident occurs, it is predicted using our deep learning model and followed by sending alert message to the nearby control rooms.

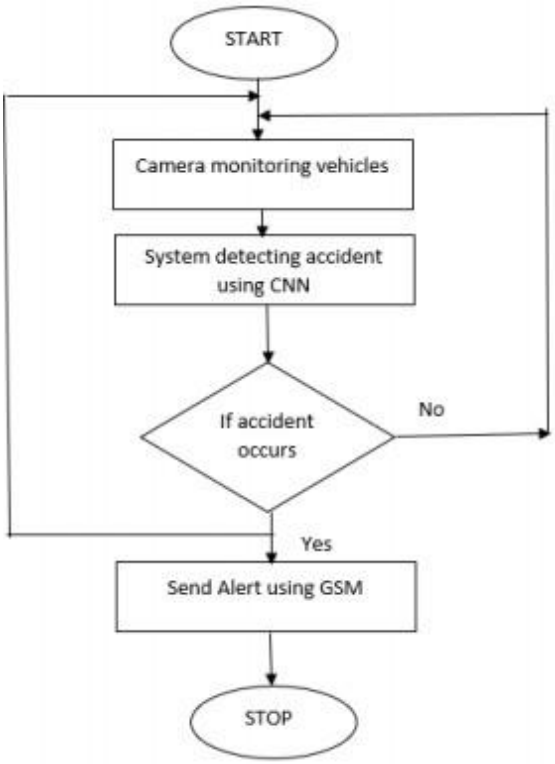

Fig. 1: Structure of the proposed system.

3.2.1 Advantages

The working of the system is based on deep learning techniques that use convolutional neural networks. By utilizing this system, many people can be saved from death.

4. ALGORITHM

Algorithm Used: Convolutional nueral network. There are two main parts to a CNN architecture. A convolution tool that separates and identifies the various features of the image for analysis in a process called as Feature Extraction. A fully connected layer that utilizes the output from the convolution process and predicts the class of the image based on the features extracted in previous stages.

4.1 Convolution Layers

There are three types of layers that make up the CNN which are the convolutional layers, pooling layers, and fully connected (FC) layers. When these layers are stacked, a CNN architecture will be formed. In addition to these three layers, there are two more important parameters which are the dropout layer and the activation function which are defined below.

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4.2 Convolutional Layer

This layer is the first layer that is used to extract the various features from the input images. In this layer, the mathematical operation of convolution is performed between the input image and a filter of a particular size MxM. By sliding the filter over the input image, the dot product is taken between the filter and the parts of the input image with respect to the size of the filter (MxM). The output is termed as the Feature map which gives us information about the image such as the corners and edges. Later, this feature map is fed to other layers to learn several other features of the input image.

4.3 Pooling Layer

In most cases, a Convolutional Layer is followed by a Pooling Layer. The primary aim of this layer is to decrease the size of the convolved feature map to reduce the computational costs. This is performed by decreasing the connections between layers and independently operates on each feature map. Depending upon method used, there are several types of Pooling operations. In Max Pooling, the largest element is taken from feature map. Average Pooling calculates the average of the elements in a predefined sized Image section. The total sum of the elements in the predefined section is computed in Sum Pooling. The Pooling Layer usually serves as a bridge between the Convolutional Layer and the FC Layer

4.4 Fully Connected Layer

The Fully Connected (FC) layer consists of the weights and biases along with the neurons and is used to connect the neurons between two different layers. These layers are usually placed before the output layer and form the last few layers of a CNN Architecture. In this, the input image from the previous layers are flattened and fed to the FC layer. The flattened vector then undergoes few more FC layers where the mathematical functions operations usually take place. In this stage, the classification process begins to take place.

4.5 Dropout

Usually, when all the features are connected to the FC layer, it can cause overfitting in the training dataset. Overfitting occurs when a particular model works so well on the training data causing a negative impact in the model's performance when used on a new data. To overcome this problem, a dropout layer is utilized wherein a few neurons are dropped from the neural network during training process resulting in reduced size of the model. On passing a dropout of 0.3, 30% of the nodes are dropped out randomly from the neural network.

4.6 Activation Functions

Finally, one of the most important parameters of the CNN model is the activation function. They are used to learn and approximate any kind of continuous and complex relationship between variables of the network. In simple words, it decides which information of the model should fire in the forward direction and which ones should not at the end of the network. It adds non-linearity to the network. There are several commonly used activation functions such as the ReLU, Softmax, tanH and the Sigmoid functions. Each of these functions have a specific usage. For a binary classification CNN model, sigmoid and softmax functions are preferred an for a multi-class classification, generally softmax us used.

5. PROBLEM STATEMENT

Traditional traffic monitoring system in designed only to monitor traffic or to control the traffic, but it does not provide any solution to decrease the fatal accidental human damages rate which occur due to lack of medical aid in real time. Consider a scenario where an accident occurred but no one was there

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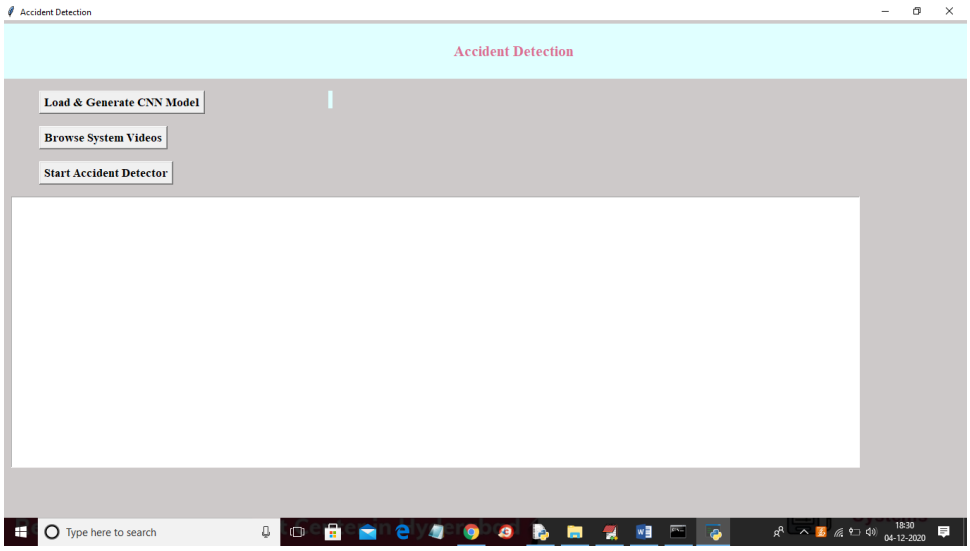
to report this accident, the victim is critical and every second counts, any delay can result in disability or death. We cannot root out accidents totally, but we can improve in providing post accidental care just-in-time. There are lots of sensor-based systems available in the market as well but that require vehicle owners to install those sensors in their vehicles. The working of these systems is based on any damage being sensed by the sensors installed; these signals from the sensors will trigger a system that will alert nearby medical assistance or an emergency contact number. But what if the accident happened of a vehicle which is not equipped with such sensor-based system. We need an advance Artificial intelligence-based surveillance system which not only can detect occurrence of accident but also can alert to nearby hospitals/ambulance or Traffic policemen in real-time. Our system is based on Neural Network and Deep Learning of object detection along computer vision technology and several methods and algorithms. Our approach will work on still images, recorded-videos, real-time live videos and will detect, classify, track and compute moving object velocity and direction using convolution neural network.

6. RESULTS

This work is trained with images where vehicles collided, and accident occurred and in test video if anything such collision happens between vehicles then application detect as accident. Training is done with tensor flow and CNN Algorithm.



In above screen click on ‘Load & Generate CNN Model’ button to trained CNN with dataset and to load CNN model using tensorflow.

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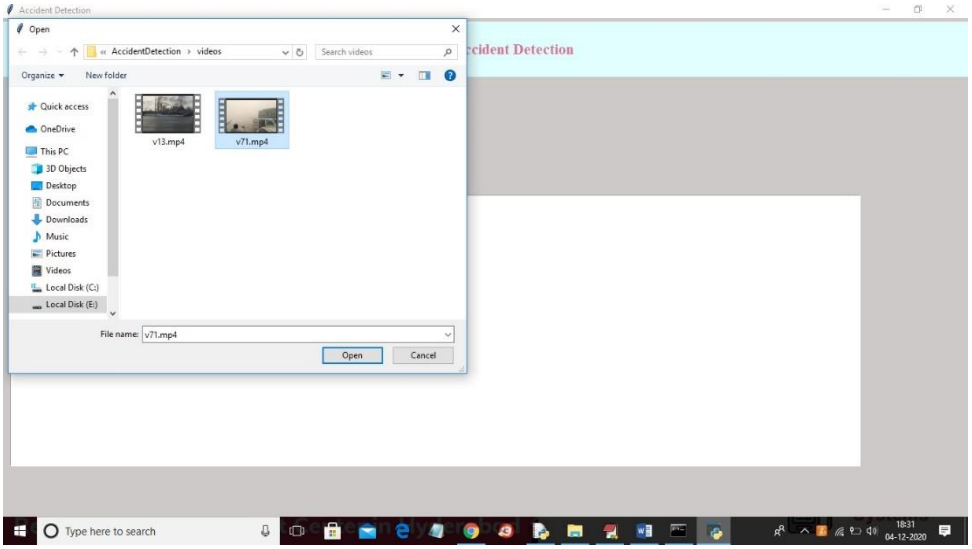
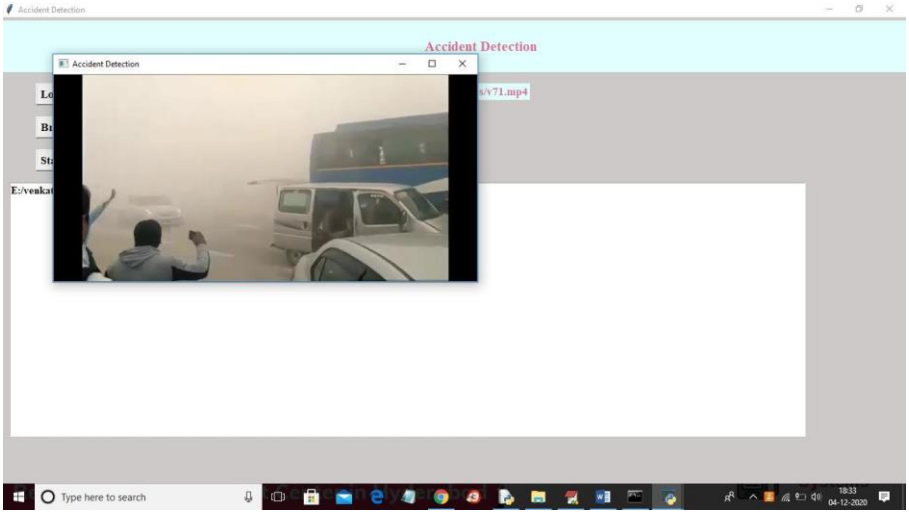
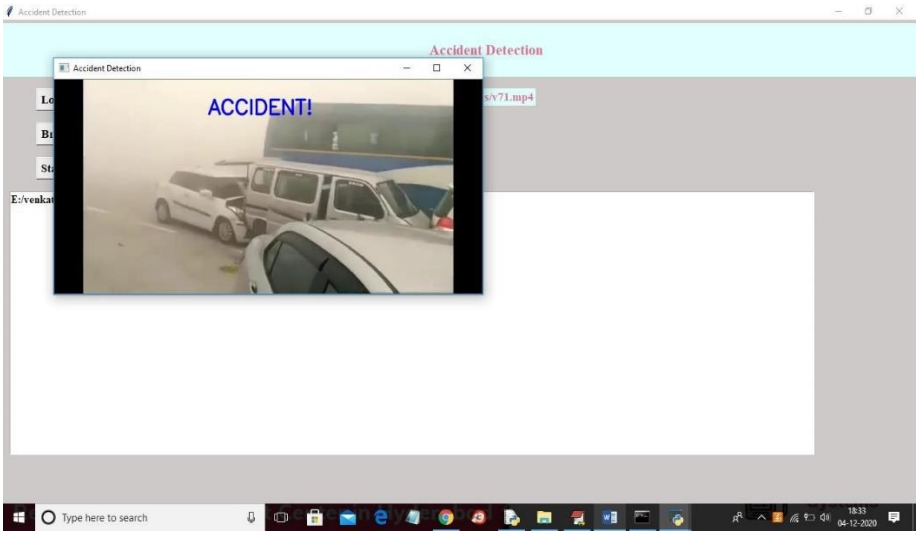


In above screen selecting and uploading video and then click on 'Open' button to load video.



In above screen video start playing and upon accident detection will get below screen with beep sound



In below screen playing another video without message if normal driving appear.

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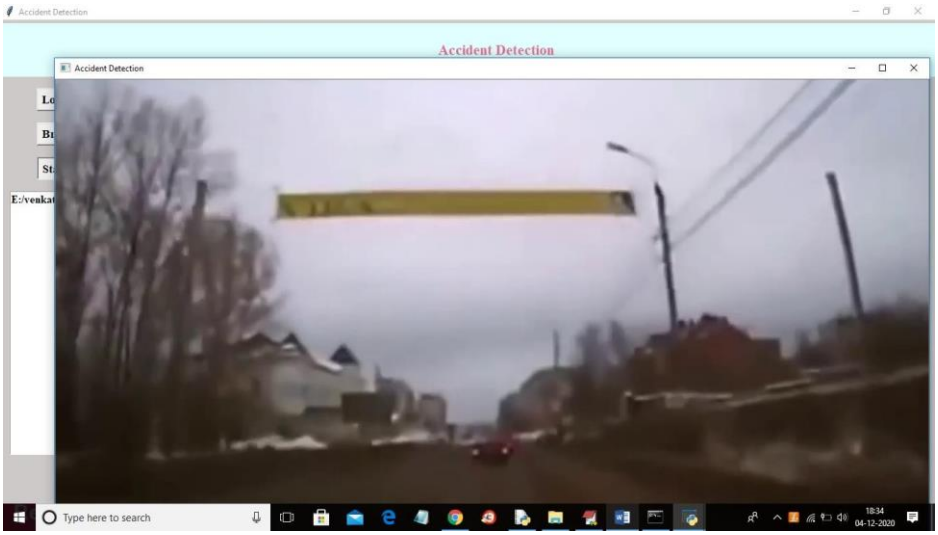

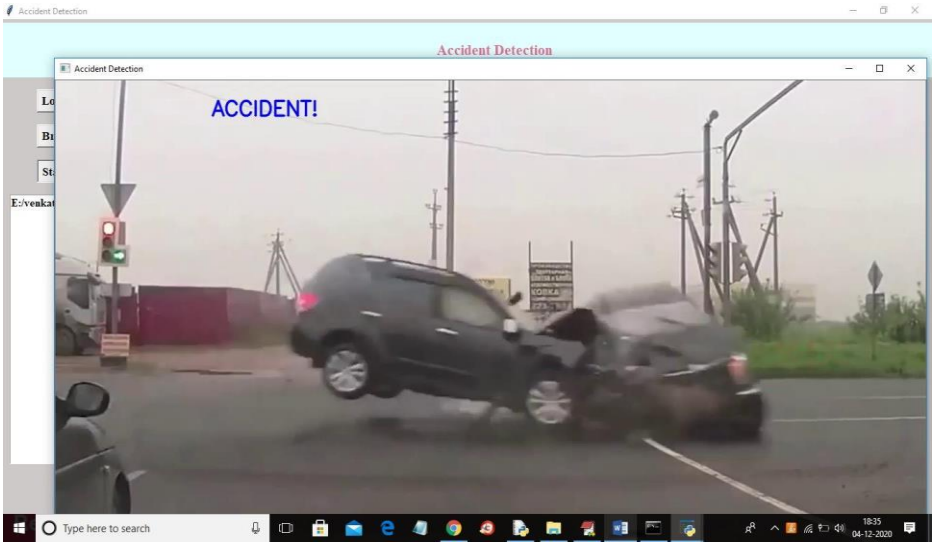

In above screen upon collision then accident display message will appear with beep sound.

8. CONCLUSION

The proposed system is used to detect road accidents. When an accident is detected, an alert message is sent to nearby control rooms using the GSM module. This system is more reliable and economical when compared to existing systems. It can detect accidents with high level of accuracy as the model architecture is trained using the created dataset. Our preliminary evaluation shows that the system works in a perfect manner and can be deployed over a large area. With the help of this system, immediate action can be taken by sending alert to the officials and will help the medical teams to reach the accident spot in time and save the valuable human lives. Thus, the proposed system will play an important role in the society where road accidents have nowadays become a major threat.

REFERENCES

[1] "Global status report on road safety 2015", World Health Organization, 2019. [Online]. Available: http://www.who.int/violence_injury_prevention/road_safety_status/20 15/en/. [Accessed: 07- Mar- 2019].

[2] Prabakar, S., et al. "An enhanced accident detection and victim status indicating system: Prototype." India Conference (INDICON), 2012 Annual IEEE. IEEE, 2012.

[3] "Lexus Enform", Lexus, 2019. [Online]. Available: https://www.lexus.com/enform. [Accessed:

ISSN- 2394-5125 VOL 9, ISSUE 05, 2022

07- Mar- 2019].

[4] "OnStar Safety and Security Services", Onstar.com, 2019. [Online]. Available: https://www.onstar.com/us/en/services/safety-security/. [Accessed: 07- Mar- 2019].

[5] "SOSmart automatic car crash detection and notification app", SOSmart automatic car crash detection app, 2019. [Online]. Available: http://www.sosmartapp.com. [Accessed: 07- Mar- 2019].

[6] C. Kockan, “Communication between vehicles” PhD thesis, Istanbul Technical University, 2008

[7] Zeng, Yuanyuan, Deshi Li, and Athanasios V. Vasilakos. "Opportunistic fleets for road event detection in vehicular sensor networks." Wireless Networks 22.2 (2016): 503-521.