Pune Institute of Computer Technology
Dhankawadi, Pune

A SEMINAR REPORT
ON

ACCIDENT DETECTION USING CONVOLUTIONAL NEURAL NETWORK

SUBMITTED BY

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DEPARTMENT OF COMPUTER ENGINEERING
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CERTIFICATE

This is to certify that the Seminar report entitled

" ACCIDENT DETECTION USING CONVOLUTIONAL NEURAL NETWORK "

Submitted by

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has satisfactorily completed a seminar report under the guidance of Prof.S.S Shendge towards the partial fulfillment of BE Honors Seminar under Artificial intelligence and big data analytics Semester II, Academic Year 2021-22 of Savitribai Phule Pune University.

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Abstract

Accidents have been a major cause of deaths in India. In India, two-thirds of road traffic injury (RTI) deaths are reported, that is more than 70 percent of deaths occur not due to the accident itself but the lack of timely help reaching the accident victims.These injures could have been cured with the timely help and at least 50 percent of deaths would have been avert. To help attend the accident victims on proper time, a system is created which would detect an accident based on the live feed of video from a CCTV camera installed on a highway. The point is to take each frame of a video and run it through a deep learning convolution neural network model. It has been trained to classify frames of a video into accident or non-accident. Convolutional Neural Networks have proved to be an accurate approach to classify images. CNN based image classifiers give more than 95 percent of accuracy and require less preprocessing as compared to other image classifying algorithms.

Keywords

Convolutional Neural Network; Accident Detection; Deep Learning; Video Classification; Recurrent Neural Network

1 INTRODUCTION

Road accidents are one of the major public issues around the world over 1.3 millions of deaths happen across the world. According to the World Health Organization (WHO), a survey was conducted on road accidents based on income status, it is seen that developing countries have the highest number of road accident related deaths.The death rate is about 23.5 per 10,000 population, which is much more when compared to 11.3 per 10,000 population for high income. India accounts for almost 11percent accident related deaths, as per WHO Global Report on Road Safety 2018.

In India, a total of 5 lakhs accidents happen each year and 1.5 lakhs of people lose their lives in these accidents. Despite the new 'Motor Vehicle's Act' by Parliament, only a 10 percent reduction was seen which involved various other factors. However, the real scenario is much worse when the accident injuries remain unattended for a long time.This can be avoided by timely reaching the victims at this critical hour.

The main intent is to design a system which helps out the accident victims in need, by timely detecting an accident and henceforth informing the authorities of the same.The focus is to detect an accident within seconds of it happening using advanced Deep Learning Algorithms which use Convolutional Neural Networks (CNN's or ConvNet) to analyze frames taken from the video generated by the camera.

We have trained an Inception v3 model to detect accidents by training it on two different sets of images and sequence of video frames. The images and video frames are 10,000 severe accident frames and 10,000 non-accident frames. The Inception v3 algorithm can now detect an image or frames of a video to be an accident frame by up to 98.5

When a video is shown to the Raspberry Pi through the Pi camera, it runs each frame of the video through the model we created and then predicts whether this given frame is an accident frame or non accident frame. If the prediction exceeds a threshold of 60 percent the Raspberry Pi then initiates the GSM module setup with it to send a message to the nearest hospital and police station, informing them about the accident by sending a picture with the timestamp of when it occurred and the location of where it occurred. The system we made can detect accidents to an accuracy of about 95.0

The system developed can act as a reliable source of information in detecting accidents which can be done automatically. This project would help us reduce the considerable amount of road accident related deaths that occur in our country.

2 MOTIVATION

According to the World Health Organization, road traffic accidents caused an estimated 1.35 million deaths worldwide in 2016.That is, one person is killed every 25 seconds.India has reported that every hour 13 people are killed over the country. With the present data, India is on the way to be the number one country in deaths from road accidents.

A recent study commissioned by the Ministry of Road Transport and Highways (MoRTH) estimated that the socio-economic costs of road crashes is Rs 1,47,114 crore in India, which is equivalent to 0.77 per cent of the country's GDP.The minister had stressed that the accident cost is a tremendous burden to society and the nation, and the estimated cost of a death in a road accident is around Rs 91.16 lakh.There is a high need to look over this situation.

3 LITERATURE SURVEY

The Following table shows the literature survey by comparing techniques propose in various references:

Table 1: Literature survey

No.	Contributions	Techniques	limitations
1	Tian, D., Zhang, C., Duan, X. and Wang, X. [2]	The detection method of car accidents is based on CVIS.	Real-time performance is low.
2	Yao, Y., Xu, M., Wang, Y., Crandall, D.J. and Atkins. [3]	Predicting trajectories of traffic participant in traffic as well as their future location. Use of a Convolutional LSTM Auto- Encoder.	This method is unable to detect an accident if participants getstotally occluded
3	Abadi, M., Agarwal, A., Barham, P., Brevdo, E., Chen, Z., Citro, C., Corrado, G.S., Davis, A., Dean, J., Devin, M. and Ghemawat, S.[13]	Use of open sourced a version of Tensor Flow, and wide range of Google products and services.	Node scheduling and placement algorithm were not sufficient enough to decide where to execute different node and when to execute.
4	Nitz, K.H., Boushek, G.L . and Klimek, K.J., Motorola Solutions Inc.[15]	Use of GSM module and GPS for location tracking.	Lack of communication mode with medication department to provide hospitality to victims at accidental spot

4 A SURVEY ON PAPERS

4.1 An automatic car accident detection method based on cooperative vehicle infrastructure systems.

1. An intelligent traffic accident detection system to find an effective way to reduce the frequency and severity of traffic accidents. The system uses simulated data that was collected from vehicular ad-hoc networks (VANETs) based on the speeds and coordinates of the vehicles and then, it sends traffic alerts to the drivers

4.2 Unsupervised traffic accident detection in first-person videos.

2..Detection of accident by using the video footage obtained from the camera attached to a car's Dashboard by using neural networks was proposed which was able to only detect and classify whether an accident has occurred.

4.3 Large- scale machine learning on heterogeneous distributed systems

3.Later new system was proposed to Classify the type of injury severity of various traffic accidents. These behavioral and roadway patterns are useful in the development of traffic safety control policy.

4.4 Localized accident notification

4.. In the automobile industry engineers have tried to design and build safer automobiles, but traffic accidents are unavoidable. The information obtained was not sent to nearby hospitals. SOSmart detects car accidents using the internal sensors(Accelerometer and GPS) of smartphone, and sends an emergency notification with the location to the pre selected emergency contacts. This allows us to send help as soon as possible to the contacts.

5 PROBLEM DEFINITION AND SCOPE

5.1 Problem Definition

To design a system which is able to detect an accident from the video footage provided to it using a camera and henceforth informing the authorities of the same.

5.2 Scope

The system developed can act as a reliable source of information in detecting accidents which can be done automatically. This project would help us in reducing the enormous number of road accident related deaths that occur in our country.

A timely help (providing medication) to the victims at the accident spot can save a precious life of an individual.It guarantees that no individual is left unattended or helpless in an unforeseen event of an accident, successively, securing and maintaining the quality of life to the highest standard.

6 DIFFERENT MACHINE LEARNING ALGORITHM

6.1 Long short-term memory (LSTM)

Long short-term memory (LSTM) is an artificial recurrent neural network (RNN) architecture employed in the field of deep learning. LSTM networks are suitable for processing, classifying and making predictions based on time series data.We have used LSTM in this module to model sequential data and make predictions based on them.

6.2 Convolutional Neural Network (CNN)

A Convolutional Neural Network (CNN) is a Deep Learning algorithm which takes an input image, assigns importance to various objects in the image and is able to differentiate one from the other. The preprocessing required in a CNN is much lower as compared to other classification algorithms.They have the ability to learn these filters/characteristics on their own.In this module we used CNN to extract useful information from the images and to preserve the relationship between the pixels.

6.3 Inception V3,

The inception v3, works on a heterogeneous set of convolutions. This image recognition model has shown to attain greater than 78.1 percent accuracy on the ImageNet dataset. It allows you to dive deeper into the image and extract more features. Thus, through the Inception architecture, we are aiming to put several convolution filters of different dimensions and also pooling layers, all into the same layer of the network and allow the model to choose the best.

7 METHODOLOGY

7.1 Workflow

First, we run every frame from our video through Inception v3 model

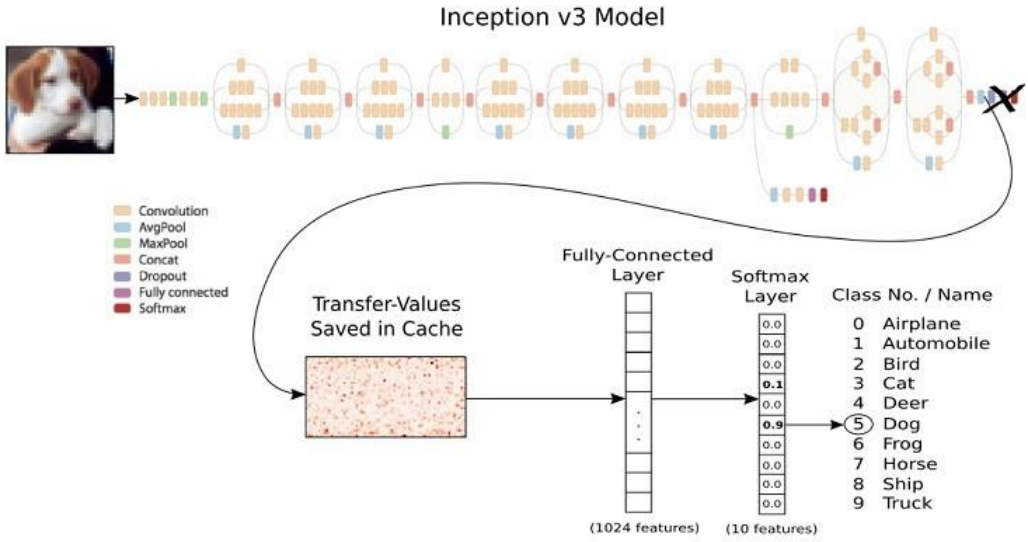

Figure 1: Inception model

from the final pool layer of the network we save the output. We convert these extracted features into sequences of extracted features. We join the sampled frames from our video together, save that to the disk, and now we train different RNN models without needing to continuously pass our images through the CNN every time we read the same sample or train a new network architecture

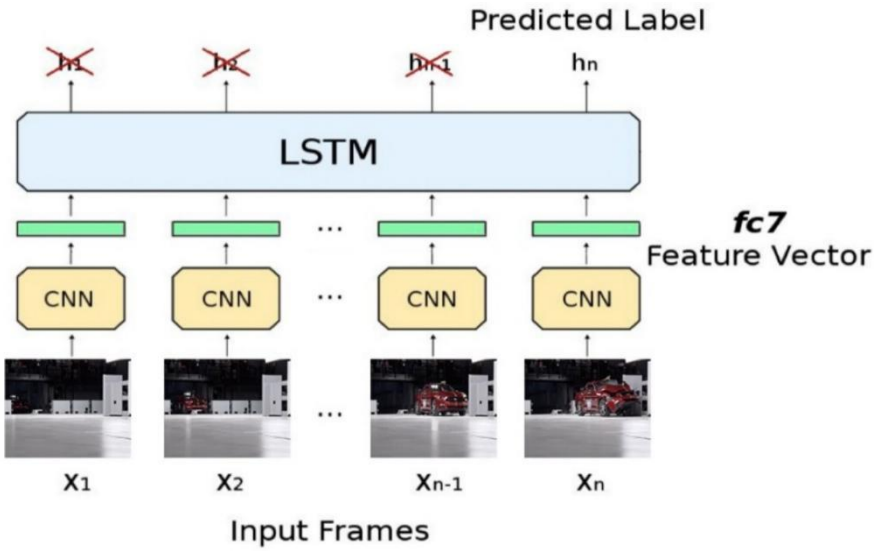

Figure 2: working

7.2 Mathematical model

A kernel (or filter), is passed over our image and Subsequent feature map values are calculated.

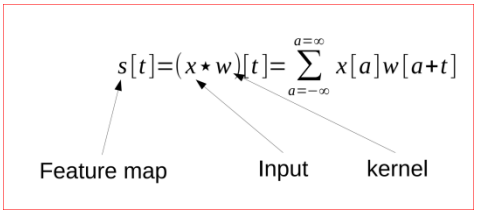

Figure 3: Formula

LSTM-Network :-

- **Input gate**: $i_t = \phi(W^{ic}c_t + W^{ih}h_{t-1})$
- **Forget gate**: $f_t = \phi(W^{fc}c_t + W^{fh}h_{t-1})$
- **Output gate**: $o_t = \phi(W^{oc}c_t + W^{oh}h_{t-1})$
- **Input node**: $g_t = tanh(W^{gc}c_t + W^{gh}h_{t-1})$
- **Hidden output**: $s_t = s_{t-1}.f_t + g_t.i_t$
- **Prediction output**: $h_t = tanh(s_t).o_t$

Accuracy=

Numberofcorrectpredictions/Totalnumberofallcasestobepredicted]

8 Results

8.1 Data

From the Pi-camera each frame of the video is captured and runned through our module. After it detects an accident the system immediately sends a message using the GSM module. It also sends the frame at which it detected an accident and what percentage of the accident it is. It also shows at what time the accident has occurred. The proposed model gave an accuracy ranging from 82 percent to 98.76 percent.

8.2 Implementation Results

The images and video frames of 10,000 severe accident frames and 10,000 non-accident frames were used and then passed over the model. The values used for the proposed model are as follows:

Table 2Values for proposed model

S.No	Name	value
1	Rescale	1/255
2	Shear range	0.2
3	zoom range	0.2
4	horizontalflip	True

All training images were trained for 500 epochs. The results obtained were as follows:

Table 3Values for proposed model

S.No		
1	Training accuracy	0.85
2	Validation accuracy	0.85
3	Training loss	0.2568
4	Validation loss	0.2894

Figure 4This is placeholder image: Result of KDD 1998 dataset

Figure 5This is placeholder image: Result of KDD 1999 dataset

9 CONCLUSION

Accidents are one of the most common problems that humanity faces on a daily basis, leading to loss of both life as well as property. The proposed system provides an effective and very viable solution to this problem.The proposed vehicle accident detection system can track an accident at its moment of occurrence and sends an instantaneous alert SMS regarding the accident to the nearby hospitals and police stations which includes details like timestamp, geographical location and severity. The proposed system is much more cost effective and foolproof unlike other systems in use, which consists of expensive sensors and unwanted hardware. The system gives a much-improved accuracy rate than its counterparts mainly due to a model-based approach. The experimentation, testing and validation has been carried out using images and the results are so viable and shows that higher sensitivity and accuracy is indeed achieved using this method, henceforth, making it a feasible option for implementing this system in most of the state and national highways of the country. Thus, the project works towards a social cause and helps create a system which guarantees that no individual is left unattended or helpless in an unforeseen event of an accident, successively , securing and maintaining the quality of life to the highest standards.

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Table 4Review log

No.	Date	Discussed points	Suggestions
1	28th Feb 2021	Informed guide about the selected domain and shortlisted research paper according to it.	Discussed the understanding of the paper to finalize the topic and base paper.
2	8th Mar 2021	Presented the shortlist paper and dicussed the understanding with guide	Seminar guide: V.S Gaikwad approved the selected topic and signed to proceed further.
3	13th Mar 2021	Presented my understanding and findings of the paper through presentation till Literature slide	Certain corrections in the introduction and scope. Guided further points of seminar review
4	11th April 2021	Submitted the abstract in the prescribed format for the guide's approval.	Guided me about the Phrases used in the report as in "you must write **your** own understanding"