ROAD ACCIDENT DETECTION SYSTEM USING DEEP LEARNING

A Project Work Synopsis

Submitted in the partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

IN

ARTIFICIAL INTELLIGENCE

& MACHINE LEARNING

Submitted by:

AYUSH MUDGAL
18BCS6124

HRITHIK JOHRI
18BCS6145

HIMANSHU KUNCHAL
18BCS6131

SHIVAM
18BCS6138

SHUBHAM KARNWAL
18BCS6129

Under the Supervision of:

PROF. GURPREET SINGH PANESAR

CHANDIGARH UNIVERSITY, GHARUAN, MOHALI - 140413,

PUNJAB

SEPTEMBER 2020

Table of Contents

Abstract

Car accidents, a certain proportion of which cause a significant number of deaths and injuries happen every day. These are caused by untimely care and secondary injuries. Automatic car accident detection will to some degree shorten the response time of rescue services and accident vehicles to enhance rescue efficiency and the level of traffic safety. We proposed a method focused on Computer Vision for automatic car accident detection. First of all, the latest DETRAC image dataset is set up for performing vehicle detection so as to boost the accuracy of accident detection as it based on intelligent roadside devices. In particular, DETRAC consists of various types of vehicles in environmental conditions and location of incidents, which can enhance the self-adaptability of accident detection methods between different traffic situations. Secondly, we are using a deep neural network model based on CADP dataset and deep learning algorithms for accident detection. Finally, our experimental research assesses efficiency for the detection of car accidents, and as a result remove the human error and time required in calling for help for the injured.

1. INTRODUCTION

1.1 Problem Definition

Accident Detection System

Accident Detection System is an intelligent system that is able to detect car crashes in real-time by taking in CCTV camera footage as input and will inform medical and police authorities about the accident and the place where it took place. This will allow them to know the exact location of the accident and will be able to arrive at the scene at the earliest. Having the paramedic force arrive at the scene quickly, will act as a huge factor for determining whether the injured will survive as they will be able to provide immediate first aid and carry out all the required medical procedures. Having the police authorities get there will allow the coordinated flow of traffic, so that there are no unnecessary traffic jams and hence it would be easier for the paramedics to take the victims to the hospital swiftly, while also not stopping the regular lives of other people.

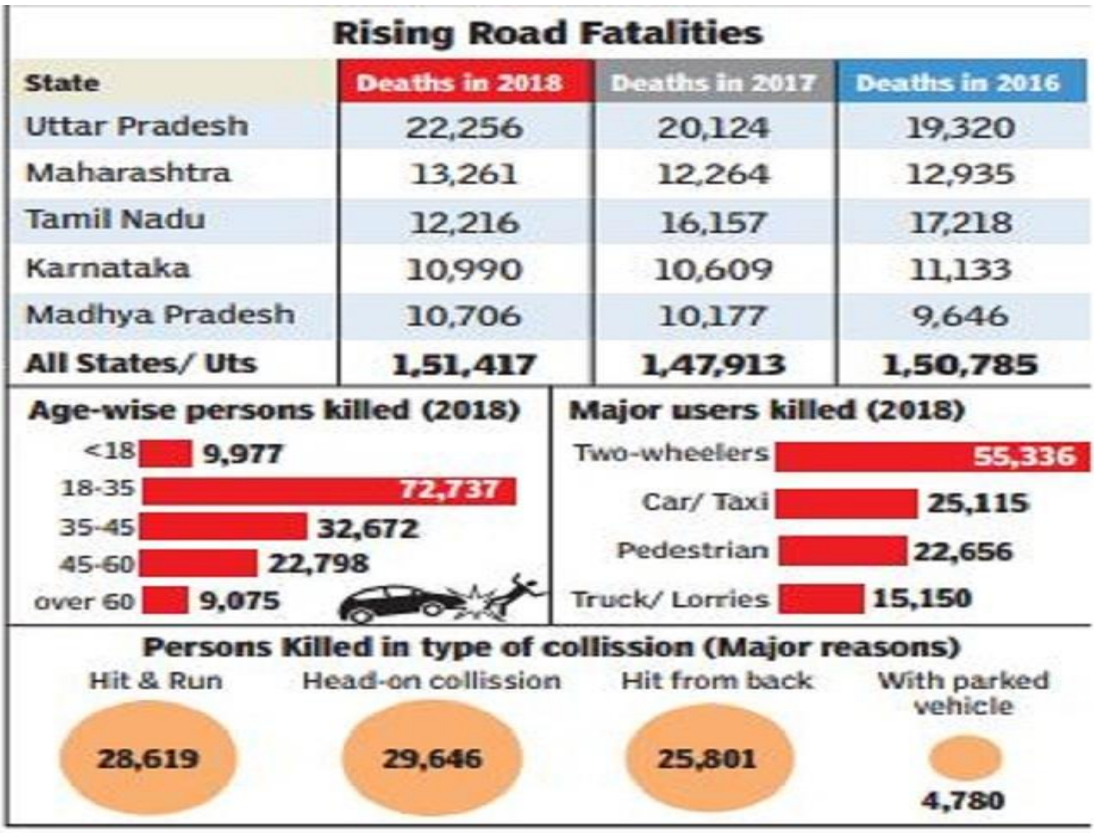
Approximately 1.35 million people die each year as a result of road traffic crashes. This means that approximately 3700 people die every day because of car accidents. Moreover 20 to 50 million more people suffer non-fatal injuries, with many incurring a disability as a result of their injury. Road traffic injuries are the leading cause of death for children and young adults aged 5-29 years. A noticeable percentage of these deaths is because of the injured not receiving healthcare at the proper time. If medical help would be able to arrive sooner, it would be possible to save the lives of a lot more people.

This is where the Accident Detection System comes into play. It will completely remove the delay it takes for the medical authorities to know about the car crash. Therefore, the paramedics will be able to arrive at the scene sooner and provide first aid to the injured and also move them to a nearby hospital for much needed treatment.

1.2 PURPOSE:

The main purpose of Accident Detection System based on a grid infrastructure is to save the lives of the people who are met with a road accident. It will do so by performing real-time detection of whether an accident has occurred or not and to immediately alert the concerned authorities like the police and the paramedics, so that they are able to provide immediate healthcare to the people caught up in the accident.

This will greatly improve the survival rate of people affected by the accident.
Since our character recognition is based on a grid infrastructure, it aims to recognize multiple heterogeneous characters that belong to different universal languages with 3 different font properties and alignments.



Deaths due to road accidents in various states (2016 – 2018)

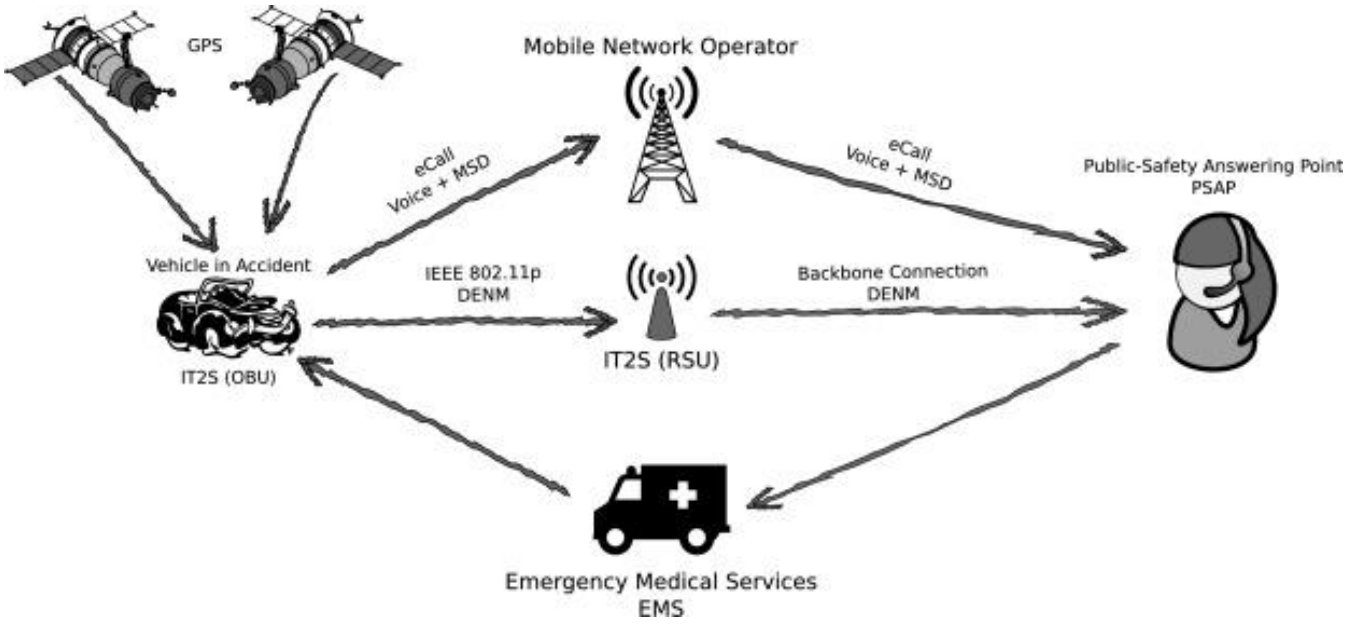
1.3 PROJECT SCOPE:

The scope of our Accident Detection System is working on a grid infrastructure is to provide an efficient way to provide timely healthcare to the injured people in road accidents and an enhanced machine learning model for not only detection of road accidents. This system can be linked with CCTV cameras all over the world. This system is generalized and it will work for any type of footage, no matter which vehicles are met with the accident or the location where the accident happens, if it happens at all.

This system will remove the need of human interreference in the currently existing procedure to call the medical authorities. It will be faster than the current system and will be more accurate in conveying the exact location of the accident. The authorities on the other end, will receive an alert specifying the place of the accident and will be able to leave for the location lightning fast.

1.4 OVERALL DESCRIPTION:

Accident Detection System is a technological advanced deep learning model that will enable us to save more lives by detecting accidents through a live stream of real-time CCTV footage and then immediately alerting the police and the medical authorities about the accident and the place where it took place. This has the potential to save lakhs of lives by removing the delay in time it takes for the paramedics to know about the accident. By the time that they are able to reach the scene of an accident it is often too late to save the lives of the people who got caught up in the tragedy. It will also be able to reduce the severity of the after effects the accident might have on the wounded people.



1.5 Software Specification

Software Components and Technology used:

The software components and technology used in this project are:

Technology enablers:

1. Python Framework
2. Python libraries enabling Machine Learning like
    a. numpy
    b. pandas
    c. opencv
    d. keras
    e. sklearn
    f. skimage, etc.
3. Operating Systems: Windows, MAC OS
4. RAM: 4GB recommended

1.6 Hardware Specification

Hardware Components:

Bluetooth 4.1
Camera
Network: 10/100 Mbps
GPU: 400MHz VideoCore IV multimedia
CPU: Quad-core 64-bit ARM Cortex A53 clocked at 1.2 GHz.

2. LITERATURE REVIEW

2.1 EXISTING SYSTEM:

There is no proper existing system being used for detecting accidents. The only way paramedics are able to know about an accident is through the witnesses calling the police and the police/people calling the medical helpline. This creates a delay in reporting the incidents to local emergency health centers and a delay in reaching the accident site in an ambulance which is one of the key reasons for these accident deaths. Such a pause can be minimized if injuries are immediately identified and reported to emergency assistance centers. Most state-of-the-art methods are used to identify road accidents using sensor technology.

Most existing Accident Detection Systems are only able to perform the detection of accidents using pre recorded videos and not in real time. Since these are not ready to be deployed for use, they are not of much significance. Also, many of the remaining real time Accident Detection Systems only focus on the accident detection part and not on alerting the concerned authorities of the same. These systems have completed the first part of the problem, but are still lacking the most important part that is necessary to save lives.

2.2 PROPOSED SYSTEM:

We present the outline of our architecture in this section to explain its meaning and then demonstrate how this structure is realized in order to be able to identify traffic accidents automatically. Our primary objective is to create an easy, quick technique to solve the issue of automatic recognition of traffic accidents that can work effectively under real-time constraints.

Various steps are taken to achieve real-time speed. Real 24-bit color video images are transformed to video images that are monochromatic. Averaged and sub-sampled to a resolution of 320 x 240, the 640 x480 digitized image is Using a simple 8-bin histogram, flow gradient directions are calculated. With these steps, 45 ms per frame is the total processing time.

Our secondary objective is to make a real–time notification/alert system that alerts the Police and nearby hospital about the accident. This alert will also send the GPS location of the camera which recorded the accident. This will allow the authorities and medical help to reach the exact location of the accident and not leave any room for mistakes that might've arisen from people describing the location in an ambiguous manner.

We are planning to implement this using GSM technology to send alerts directly to the already existing helpline numbers available for the general public. Working on an existing infrastructure will make it easier for us to develop our project while also making it easier for the existing staff members and operatives to understand the alerts and not be confused using a new technology which they might not be aware about.

3. PROBLEM FORMULATION

We are provided a number of videos containing cases of car accidents and also images of various vehicles. The first problem is to be able to detect a vehicle correctly, only then can the model work on the video dataset.

Each video is a set of individual images that are time-dependent sequences. The algorithm - a hierarchical recurrent neural network - is able to treat each video as a time-dependent sequence, but still allow each video to be an independent data point.

The algorithm uses two layers of long short-term memory neural networks. The first neural network (NN) is a recurrent network that analyzes the time-dependent sequence of the images within each video. The second takes the encoding of the first NN and builds a second NN that reflects which videos contain accidents and which do not. The resulting model enables a prediction of whether new dashcam footage has an accident.

Through this method, the HRNN incorporates a time-dependent aspect of the frames within each video to predict how likely a new video contains a car accident.

4. RESEARCH OBJECTIVES

The proposed research is aimed to carry out work leading to the development of a machine learning model that is able to identify accidents correctly in real time and ultimately a software that also sends immediate alerts to the concerned authorities about the accident.

We also aim to research about Hierarchical Recurrent Neural Networks or HRNNs, in order to be able to develop a good model which is able to meet our expectations. A detailed research needs to be carried out on how to implement the Alert System which will follow after the model has detected that an accident took place.

The proposed aim will be achieved by dividing the work into following objectives:

1. One member will work on cleaning and extracting data from CCTV camera videos and converting it into a form that can be inputted directly to the model.

2. One member will be responsible for expanding the dataset by finding more positive and negative cases of cars crashing.

3. One member has to document all the available options for models and compare their performance to find the best match to be implemented in the Accident Detection system.

4. One member will be working on a way to send alerts to the police and nearby hospitals.

5. The last member has to maintain the development cycle and do the testing for each process of development and integration processes.

One of the most difficult tasks will be to find the required datasets and convert it to a form that can be used to train our model. Without this step, neither will we be able to identify whether an accident has happened, nor will we be able to send notifications about the accident.

5. METHODOLOGY:

- We will use the CADP dataset for videos containing accidents and the DETRAC dataset which was originally for object detection of vehicles, as the videos did not contain accidents. To expand our dataset, we will also search the internet for videos containing cases of accidents.

- For the final dataset, we plan to have 150-200 videos with car, bus, bike etc. accidents recorded in the CCTV camera at the corners of the street. We will take the same number of negative cases (without accident) to maintain balanced classes.

- Each video can be broken up into its individual frames to be analyzed separately. Each of these images is a two-dimensional array of pixels where each pixel has information about the red, green, and blue (RGB) color levels.

- To reduce the dimensionality at the individual image level, we will convert the 3-D RGB color arrays to grayscale. Additionally, to make the computations more tractable on a CPU, we will resize each image to (144, 256) - in effect reducing the size of each image to a 2-D array of 144x256.

- We are planning to use a hierarchical recurrent neural network algorithm to tackle the complex problem of classifying video footage. This is because a HRNN works better than a traditional RNN and are able to process the hierarchies in a system.

- Then we will run the model for multiple epochs and begin the work of improving the accuracy by tuning the hyperparameters of the neural Network. This will be an important step for improving the model and extracting the best out of it.

- We will make multiple models to see which one provides the best accuracy measure, and is able to detect the accidents accurately. This is a combination of the previous steps and will be done just in case we are able to find a better model that suits our data more.

- After that we will try to integrate our model with an alert system to provide the details of the accident to the concerned authorities. This will be the final stage of our project and will conclude our research

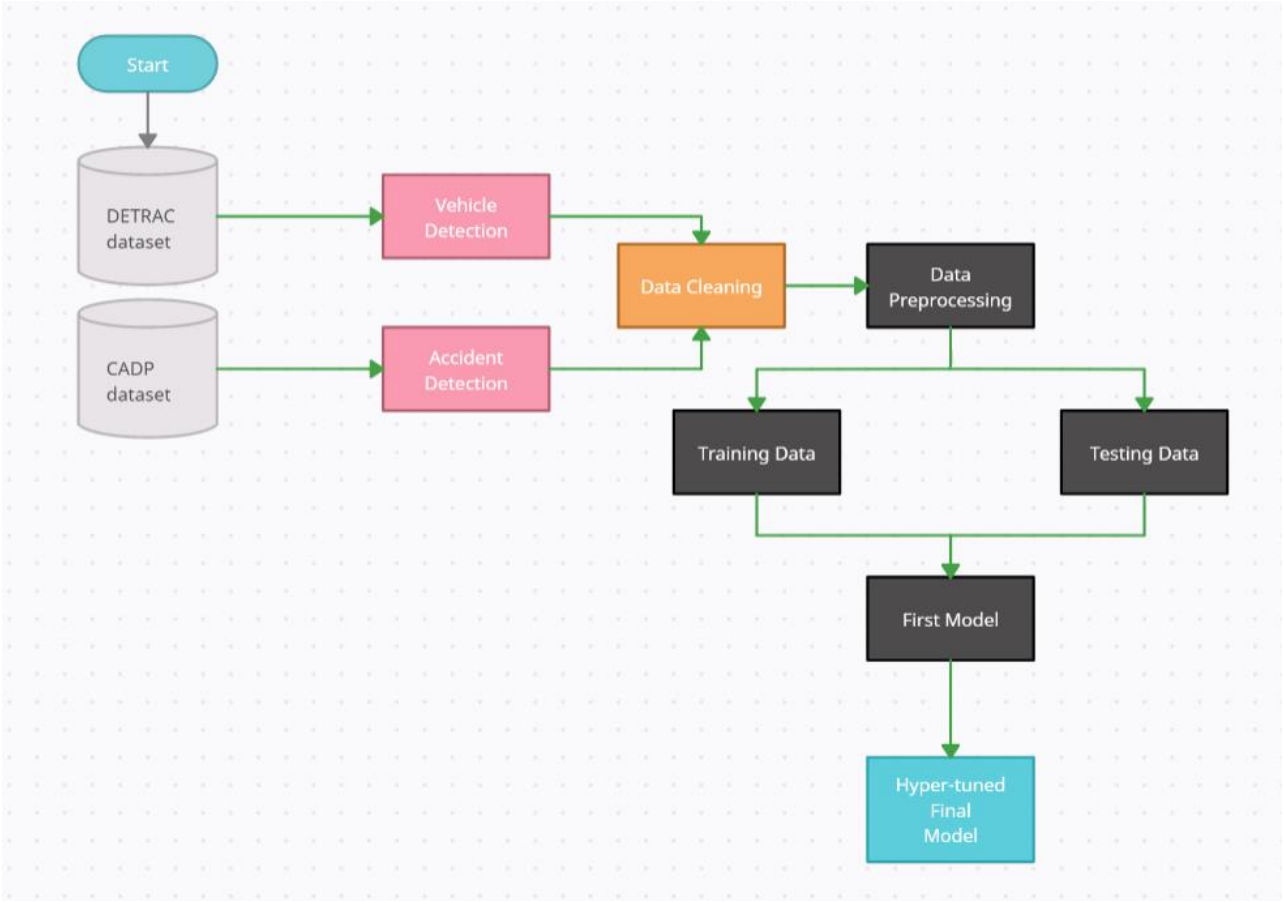


Fig: Flowchart showing Development Steps

6. TENTATIVE CHAPTER PLAN FOR THE PROPOSED WORK:

CHAPTER 1: INTRODUCTION
This chapter will cover the overview of the Accident Detection System using Deep Learning.

CHAPTER 2: LITERATURE REVIEW
This chapter includes the literature available for the Accident Detection System using Deep Learning The findings of the researchers will be highlighted which will become the basis of current implementation.

CHAPTER 3: BACKGROUND OF PROPOSED METHOD
This chapter will provide introduction to the concepts which are necessary to understand the proposed system.

CHAPTER 4: RESEARCH OBJECTIVES:
This chapter will cover the research work and the technical work that each member would have worked on for the proposed approach.

CHAPTER 5: METHODOLOGY
This chapter will cover the technical details of the proposed approach.

CHAPTER 6: RESULTS AND DISCUSSION

The result of the proposed technique will be discussed in this chapter.

CHAPTER 7: CONCLUSION AND FUTURE SCOPE

The major finding of the work will be presented in this chapter. Also directions for extending the current study will be discussed.

7. REFERENCES

[1] Nicky Kattukkaran, Arun George, Mithun Haridas, INDIA Intelligent Accident Detection and Alert System for Emergency Medical Assistance

[2] Zainab Salim Alwan, Hamid M. Ali Alshaibani, Car Accident Detection and Notification System Using Smartphone

[3] Vardhini Radhakrishnan, Smart Vehicle Accident Detection System

[4] Murat Ozbayoglu, Gokhan Kucukayan, Erdogan Dogdu A Real-Time Autonomous Highway Accident Detection Model Based on Big Data Processing and Computational Intelligence

[5] https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries

[6] https://medium.com/@rjm2017/vehicle-detection-options-and-recommendations-b447fddccc22

[7] https://medium.com/@iceberg12/vehicle-detection-and-tracking-f607bbf860dd