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HIGHWAY ACCIDENT DETECTION AND NOTIFICATION USING MACHINE LEARNING

Nancy.P[*1]; Dilli Rao.D[*2]; Babuaravind.G[*3]; Bhanushree.S[*4]
[1]Assistant Professor, Rajalakshmi Engineering College, Computer Science and Engineering, Chennai, India
[2]Student, Rajalakshmi Engineering College, Computer Science and Engineering, Chennai, India
[3]Student, Rajalakshmi Engineering College, Computer Science and Engineering, Chennai, India
[4]Student, Rajalakshmi Engineering College, Computer Science and Engineering, Chennai, India
Email: nancy.p@rajalakshmi.edu.in, dilli218rao@gmail.com, gababu7@gmail.com, bhanushreeshivakumar@gmail.com

Abstract— Study shows that accidents in India are one of the major causes of deaths and accounts for about 64.4% of the total deaths in India, according to road transport and highways ministry report on 'Road Accidents in India,2018' and this number is ever increasing. One of the main reasons for this number is no timely availability of help. There are many proposed systems to detect these accidents and notify hospitals. Most of them include sensing objects which might cause accident or uses G-force to detect them. This project is about a system that can be used to detect accidents using Image Processing. The system will collect necessary information from CCTV cameras and process that information using Machine learning tools to detect possible accidents. Machine learning algorithms have shown success on distinguishing abnormal behaviors from normal ones. This project aims to analyze vehicles and their state to conclude a scenario as a potential accident. The dataset consists of 800 images, in that 400 for mild crash and 400 for severe crash out of which 200 images for training, and 200 for testing and validating purpose. .The algorithm showed with the performance of 93% accuracy. Results show that clustering algorithms can successfully detect accidents.
Keywords— Accident, Machine Learning, Image, Processing

1. Introduction

Road accidents are one of the major public issue around the world. The humongous amount of injuries and deaths from road accident brings to light the immediate need for global road safety. Road accidents are the major causes of death especially in India which ranks first among 199 countries and has claimed the lives of about 1,51,417 people according to The Ministry of Road Transport and Highways in their report for the year 2018. Our project focuses on collecting images and comparing them with the training dataset and classifying them into mild or severe accidents and then a mail is sent to the nearby hospital along with the co-ordinates of the location of accidents.

The proposed implementation increases the survival rate by meagre percentage. Efficient computation occurs when the algorithm utilizes the maximum GPU and the right functions.This is an example of supervised learning

where the machine is labeled with features and also for the input and output layers. The implementation works by manual collection of datasets, training, validating and testing the dataset for proper categorical results.

2. Literature Review

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. [1]. In highways where the traffic is really light and fast-paced an accident victim could be left unattended for a long time. To solve this issue a system was created which would detect an accident based on the live feed of video from a CCTV camera installed on a highway. This system will to take each frame of a video and run it through a deep learning convolution neural network model which has been trained to classify frames of a video into accident or non-accident [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 later which was able to only detect and classify whether accident has occurred [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]. 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 to send help as soon as possible to the contacts[5]. The existing system uses recurrent convolutional neural network that is present to capture images. These image capturing devices has a web application built inside which captures only few objects at a time. Though it is a fairly good idea, it does not work well when it comes to real time application**.** The next section describes the framework of the proposed implementation.

3. Proposed Framework

Cameras with transceivers relays (CCTV Mechanism) image captured at a certain rate(i.e.60/hour) to the server running the Web Application. Initial Implementation involves manual upload of the images. Web Application is integrated with Convolutional Neural Network and a Mailing System. Then images are received, only the collision images are categorized and an alert is sent to the hospitals to provide the necessary. CNN has hidden few layers that works upon an activation layer (ReLU, Sigmoid) and a loss function to eliminate the loss/noise in the image. The ideal activation function is always done by experimenting with the ML model and the accuracy of the model largely depends upon how vast the dataset is .The system categorizes as Mild/Severe that is sent or uploaded (prototype). Hundreds of images from the internet have been used to categorize and train the machine in order to identify the severity of the accident. The server then processes the image and then will categorize it. Once the image is categorized into Mild and Severe a Mail is sent to the Hospital. Further, the Mailbox works in a way such that it sends out the co-ordinates of the accident zone and thus trying to decrease the fatality rate of the accident. This way we can easily detect and classify accidents in order to send help quickly and save the affected. Constant feedback is send to improve the whole system at every iteration.

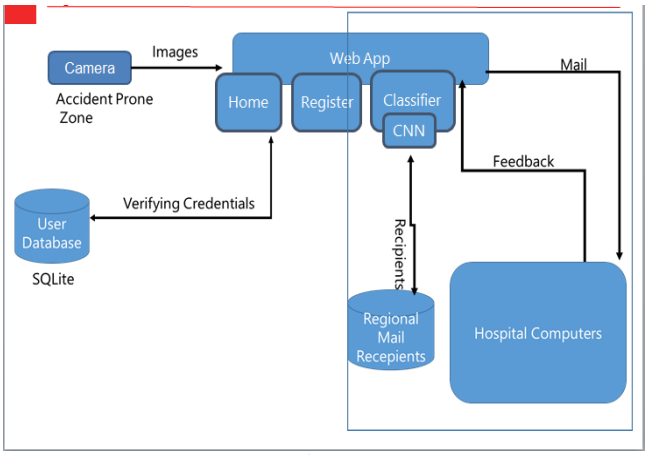


Fig.3.Working of the web application

3.1. Dataset Description

Data could be documented; it contains images of various types of car accidents. Our method uses only 800 images, however we can use Google Dataset Search to get how much ever data that is needed. The data is of two types, mild crash data which contains 400 images where the damage is less and severe crash data which contains 400 images where the damage is more severe and help has to be sent as soon as possible. These data help the system to train by undergoing supervised learning in order to understand between these two types of accidents.

In (Fig no.1) Camera with transceivers sends (CCTV Mechanism) image captured at a certain rate(i.e.60/hour) to the server running the Web Application. Initial Implementation involves manual upload of the images. Web Application is integrated with Convolutional Neural Network and a Mailing System. Then images are received, only the collision images are categorized and an alert is sent to the hospitals to provide the necessary. CNN has hidden few layers that works upon an activation layer(ReLU,Sigmoid) and a loss function to eliminate the loss/noise in the image. The ideal activation function is always done by experimenting with the ML model and the accuracy of the model largely depends upon how vast the dataset is.

3.2 List of Modules:

3.2.1 Loading Dataset:

Image Capturing/Upload: The image to be categorized as Mild/Severe is sent or uplorototype) from a live stream and if capturing is done it done at a

Object Detection: Using the features and labels from the dataset, the uploading image will be detected involving statistical relationship among the features.

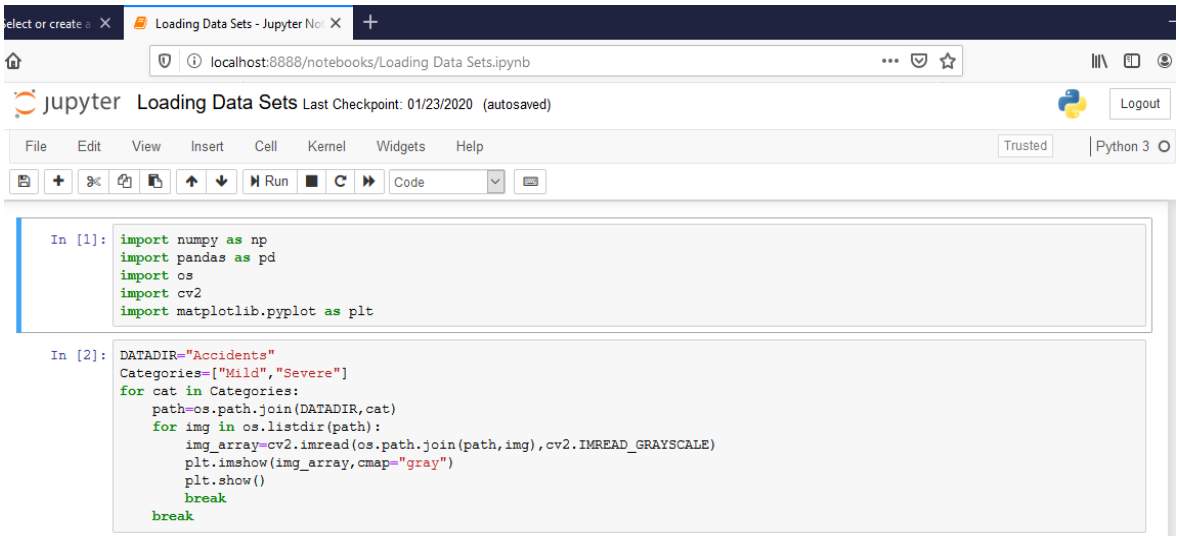


Fig 3.2.1 Loading dataset

The images show the type of accident as (a)Mild or (b)Severe

Fig 3.2.1.(a) Images of mild accident

Fig3.2.1.(b) Images of severe accident

3.2.2 Training Dataset: Load the directory which holds images of the accident.Reshape it to a particular size and make it gray scale. Serialise into a format for validation and testing

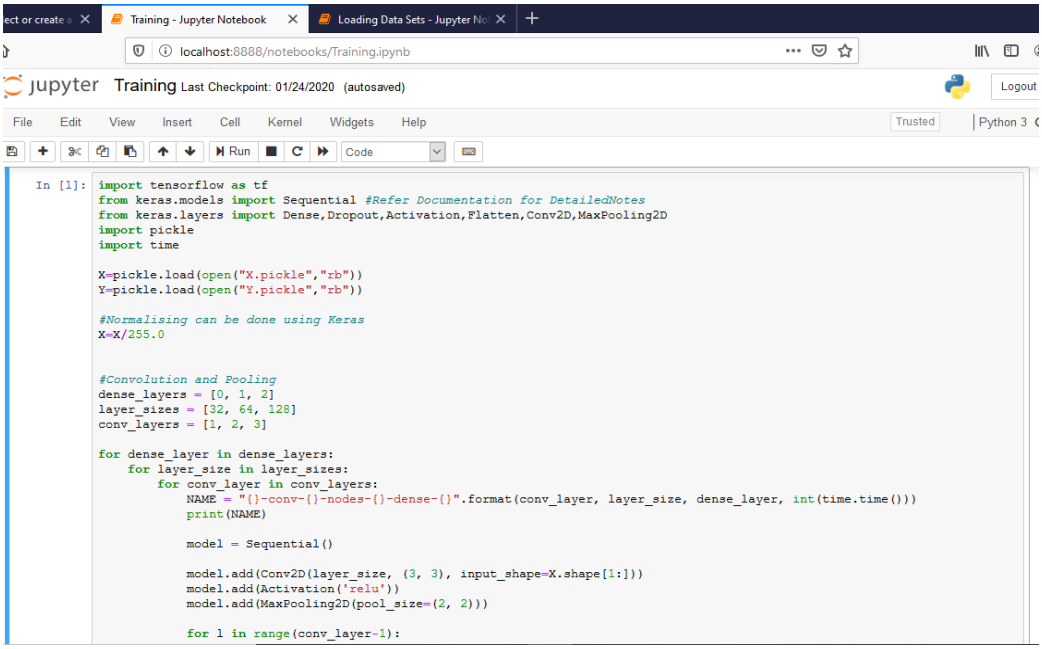


Fig.3.2.2 Training the data set

3.2.3 Testing and Validation:

- Categorize
- Resize again
- Predict

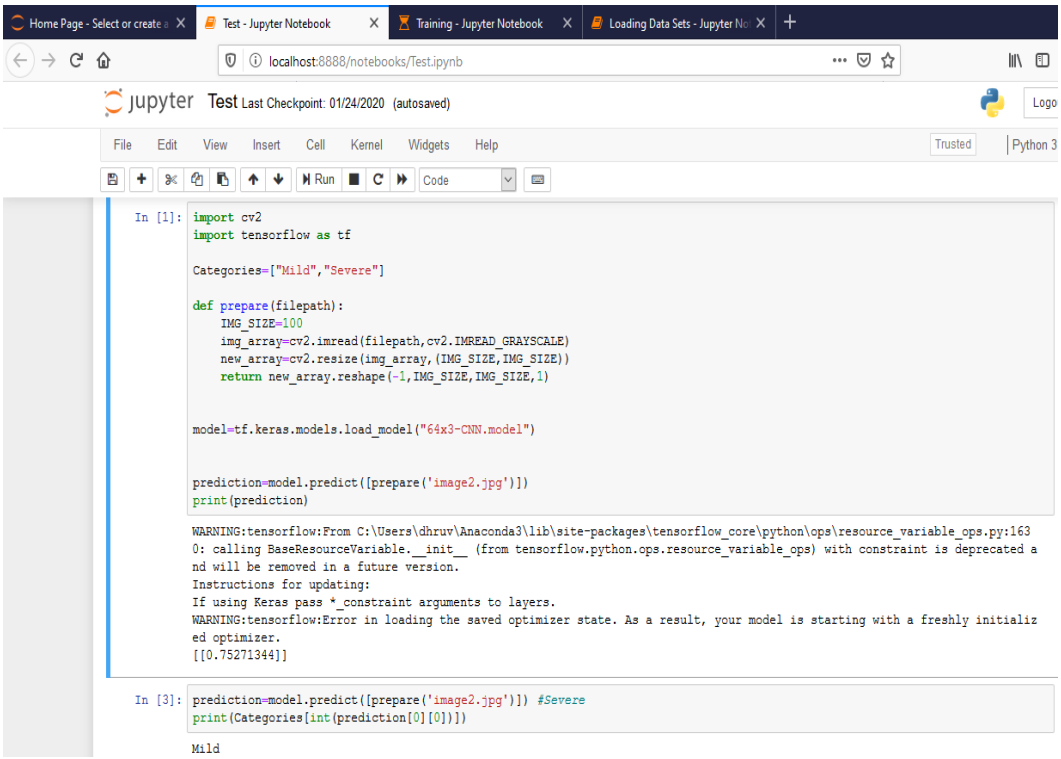


Fig 3.2.3. Testing the data set.

CONVOLUTIONAL NEURAL NETWORK

- Convolutional Neural Network is a machine learning algorithm used for the image classification problems.
- It is a binary classification algorithm used when the target variable is dichotomous (0 or 1).
- It measures the relationship between dependent and independent variables.
- The variables must follow a binomial distribution.
- The dependent variables should have mutually exclusive and exhaustive categories.
- It is a predictive analysis algorithm which uses probability for prediction.
- It uses a pooling and an activation function for feature extraction of an output layer.
- There will be a brief breaking down of the flattening process and how to move from pooled to flattened layers.
- In a fully connected layer, every neuron from input layer should be connected to every other layer in the hidden layer.
- The output layer after pooling, feature extraction gives non-linearity which labels the image as 0 or 1.

3.2.4 Home Page: The Landing page which loads upon once the web application loads from its corresponding IP Address Domain Name. This page contains two modules: Register and Sign.

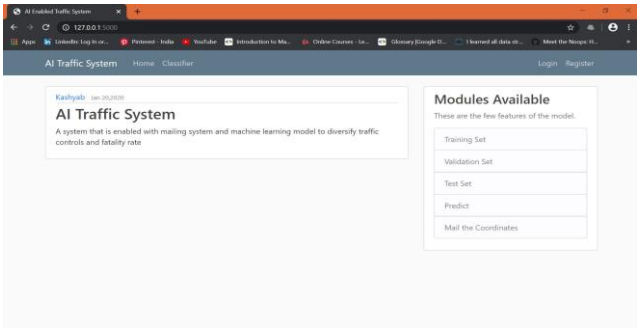


Fig.3.2.4 Homepage of the web application

4. Results

In (Fig.No.4.1) sample of the input data sets and it's respective diagrams are shown below:

Fig.4.1 Sample Input dataset

For example: To model the data for predicting the accuracy, the code is as follows:

```
model=tf.keras.models.load_model("64x3-CNN.model")
prediction=model.predict([prepare('image2.jpg')])
print(prediction)
```

The type of injury is being predicted by the system after loading, training and testing the data set. The graph represents the predicted values of both mild and severe. These values are accurate and are analyzed using prediction model. Once the image is received or uploaded, the image goes across a series of actions that includes the neural network and let know the end-user that the accident is classified into a mild or severe or normal category.

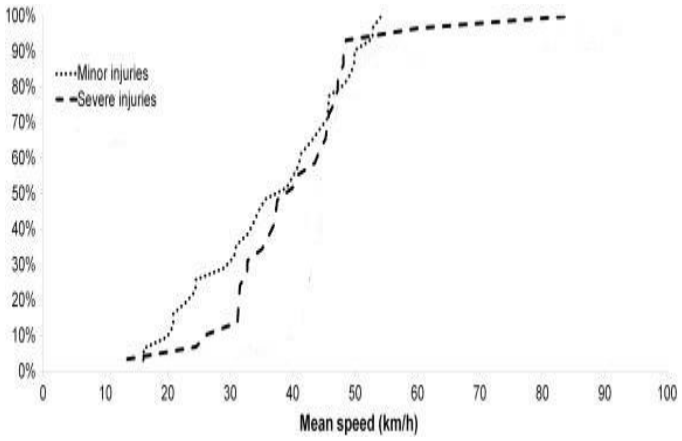


Fig.4.3. Graphical representation of the type of injury.

The most fundamental functions in a web application or a web site is the ability to send emails to the users. Flask-Mail extension provides an interface to set up Simple Mail Transfer Protocol with the application and to send mail from the views-controller. Flask-Mail is configured through the usual Flask configured API. When sending messages inside unit testing, or in a non-production environment, it's resourceful to be able to suppress mail sending. If the setting testing is set to true, emails are suppressed.

After modeling the data, sample result is obtained as shown below:

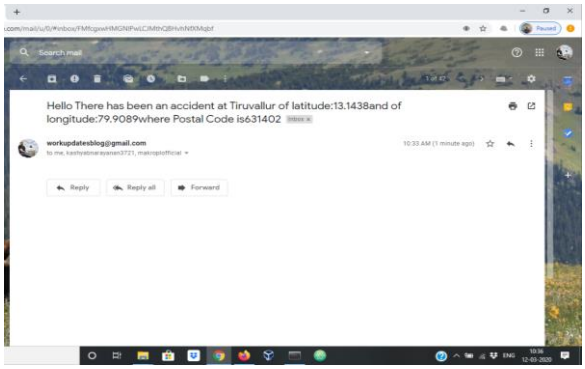
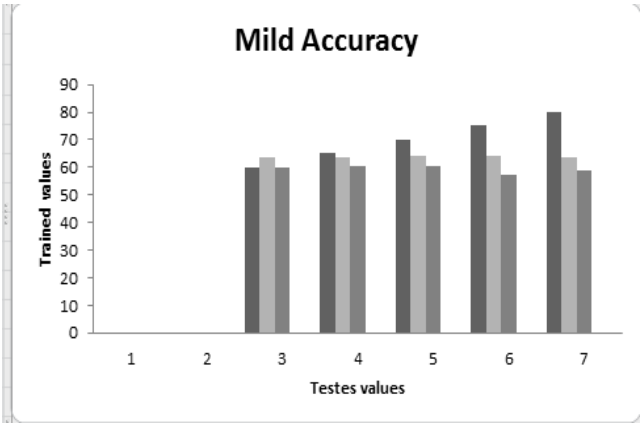


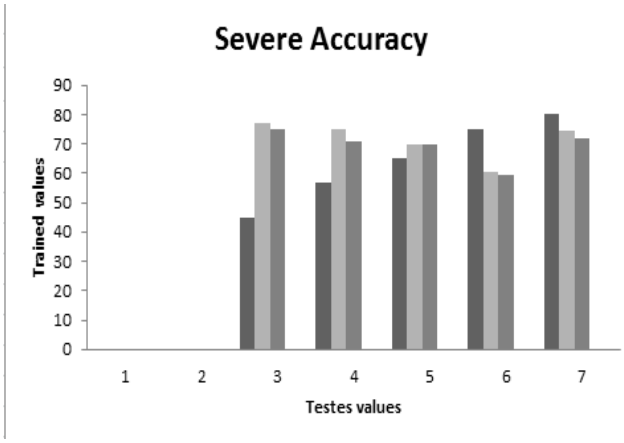
Fig.4.2. Notification Mail.

The table consists of the accuracy rate for identifying them as mild or severe .The neural values are default and by filtering them into different layers these values are used for training and testing.

CNN	Mild Accuracy	
	Train	Test
60	63.57	59.67
65	63.86	60.45
70	63.93	60.25
80	63.64	58.89

CNN	Severe Accuracy	
	Train	Test
45	77.26	75.17
57	74.78	70.65
65	69.81	69.73
80	74.33	71.77





5. Conclusion

This proposed work is an efficient system to detect the accidents and send help to those affected by notifying emergency services available in the nearby hospitals in a short interval of time. With the ever growing use of technology and the new found interest for machine learning will only help to develop much more efficient system which would have more accuracy in detecting accidents and classifying them. The proposed system is useful for analyzing and classifying the accidental data in Artificial Intelligence ecosystem and to improve the area using the convolutional neural network. As a result, the output will yield take less time in helping the people involved in accident and the result will be very fast thereby increasing the overall efficiency.

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