DROWSINESS DETECTION SYSTEM

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***Abstract* - Drivers who do not take regular breaks when driving long distances run a high risk of becoming drowsy a state which they often fail to recognize early enough according to the experts. This paper presents a solution for detecting driver drowsiness state in real time, based on eye condition. The system tends to use a camera to capture a series of image. These capture image may be stored as a individual frames in our system. The frame so formed are provided as input to face detection software. Then our required feature(eye) is extracted from the image. On each eye the system establishes a condition and suggest a specific number of frames with the same eye condition that may be registered.**

Keywords- Drowsiness detection, face detection, eye detection.

I. INTRODUCTION

Drowsy driving means operating motor vehicle when a person is unstable to remain alert due to lack of sleep. Drowsy driving / sleep destitute driving, fatigued driving or tired driving. Studies suggest that you are more likely to die from drowsy driving than from texting while driving, distracted driving or drunk driving combined. Exhausted drivers who doze off at the wheel are responsible for about 40% of road accidents, says a study by the Central Road Research Institute (CRRI) on the 300-km Agra-Lucknow Expressway. In short, the majority of accidents happen due to the drowsiness of the driver.

Causes of drowsiness can be as follows:-

a. Depression
b. Grief
c. Irregular work schedule
d. Stress
e. Travel across time zones

So to prevent the accident caused due to drowsiness a system that is Driver Drowsiness Detection System is built. Computer science and engineering contributes their responsible for development and betterment of the society by providing their valuable service in the various field and Drowsiness detection is such an example. This model helps the driver to alert him/her if he/she fall asleep.

This paper describes the model used to develop the system and its future scope so that it can be implemented successfully.

II. MODEL ARCHITECTURE

The model we used was built with Keras using Convolutional Neural Networks (CNN). A convolutional neural network is a special type of deep neural network that works very well for the purposes of image separation. CNN basically consists of an input layer, an output layer and a hidden layer that can contain multiple layers of layers. Convolution operations are performed on these layers using a filter that enables 2D matrix replication in the layer and filter.

The structure of the CNN model consists of the following layers:

Layer of transformation; 32 locations, kernel size 3
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Layer of transformation; 64 nodes, kernel size 3
Fully connected layer; 128 locations
The final layer is also a fully connected layer with 2 nodes. In all layers, the Relu activation function is used without the output layer where we used Softmax.

III. REQUIREMENTS

1. **OpenCv**: It is an library that gives computer a real-time vision. The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms.assic and state-of-the-art computer vision and machine learning algorithms. These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc.

2. **Keras:** Keras is an API designed for human beings, not machines. Keras follows best practices for reducing cognitive load: it offers consistent simple APIs, it minimizes the number of user actions required for common use cases, and it provides clear& actionable error messages. It also has extensive documentation and

developer guides.

3. **TensorFlow:** TensorFlow is a free and open-source software library for machine learning. It can be used across a range of tasks but has a particular focus on training and inference of deep neural networks. Tensorflow is a symbolic math library based on dataflow and differentiable programming.

4. **Pygame:** Pygame is a cross-platform set of Python modules designed for writing video games. It includes computer graphics and sound libraries designed to be used with the Python programming language.

5. **Requests:** Requests is a Python HTTP library, released under the Apache License 2.0. The goal of the project is to make HTTP requests simpler and more human-friendly.

6. **Fast2sms api:** MS Gateway API. Our Bulk SMS API work with PHP, JAVA, C#, C, Python, Ruby, Javascript, NodeJS, etc. Secure, robust and easy to integrate APIs to send Promotional, Transactional & Quick Transactional SMS via REST API.

IV. ALGORITHM

The algorithm is as follows:

Step 1: Take image input

With a webcam, we will take images as input. So to access the webcam, we made an infinite loop that will capture each frame. We use the method provided by OpenCV, cv2.VideoCapture(0) to access the camera and set the capture object (cap). cap.read() will read each frame and we store the image in a frame variable.

Step 2: Detect Face in the Image and Create a Region of Interest (ROI):

To detect the face in the image, we need to first convert the image into grayscale as the OpenCV algorithm for object detection takes gray images in the input. We don't need color information to detect the objects. We will be using haar cascade classifier to detect faces. This line is used to set our classifier face = cv2.CascadeClassifier(' path to our haar cascade xml file'). Then we perform the detection using faces = face.detectMultiScale(gray). It returns an array of detections with x,y coordinates, and height, the width of the boundary box of the object. Now we can iterate over the faces and draw boundary boxes for each face.

Step 3: Detect the eyes from ROI and feed it to the classifier

The same procedure to detect faces is used to detect eyes. First, we set the cascade classifier for eyes in leye and reye respectively then detect the eyes using left_eye = leye.detectMultiScale(gray). Now we need to extract only the eyes data from the full image. This can be achieved by extracting the boundary box of the eye and then we can pull out the eye image from the frame.

Step 4: Classifier will Categorize whether Eyes are Open or Closed

We are using CNN classifier for predicting the eye status. To feed our image into the model, we need to perform certain operations because the model needs the correct dimensions to start with. First, we convert the color image into grayscale using r_eye = cv2.cvtColor(r_eye, cv2.COLOR_BGR2GRAY). Then, we resize the image to 24*24 pixels as our model was trained on 24*24 pixel images cv2.resize(r_eye, (24,24)). We normalize our data for better convergence r_eye = r_eye/255 (All values will be between 0-1). Expand the dimensions to feed into our classifier. We loaded our model using model = load_model('models/cnnCat2.h5') . Now we predict each eye with our model lpred = model.predict_classes(l_eye). If the value of lpred[0] = 1, it states that eyes are open, if value of lpred[0] = 0 then, it states that eyes are closed.

Step 5: Count until a score to verify if the person is drowsy.

The score is basically a value we will use to determine how long the person has closed his eyes. So if both eyes are closed, we will keep on increasing score and when eyes are open, we decrease the score. We are drawing the result on the screen using cv2.putText() function which will display real time status of the person.

Step 6: An alarm start beeping until the driver opens his eyes.

A threshold is defined for example if score becomes greater than 15 that means the person's eyes are closed for a long period of time. This is when we beep the alarm using sound.play()

Step 7: A message is sent to the drivers relative.

Step 8: Keep detecting eyes while vehicle is turned on

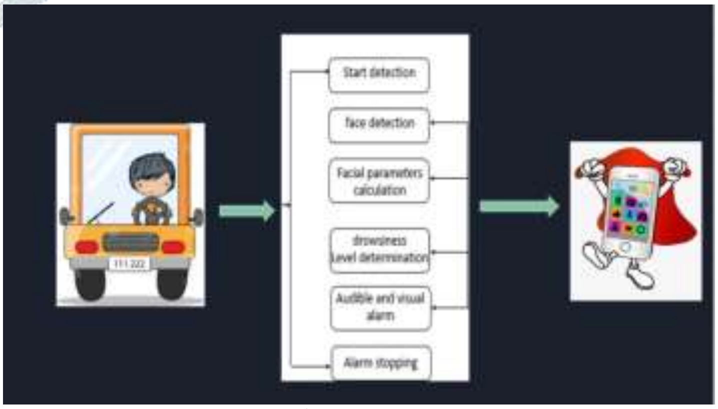


Fig1: Activity Diagram for the proposed Model

V. EXPERIMENT EVALUATION

This System was successfully implemented and tested in certain conditions. The model responded well and some of its working snapshots are as follows:

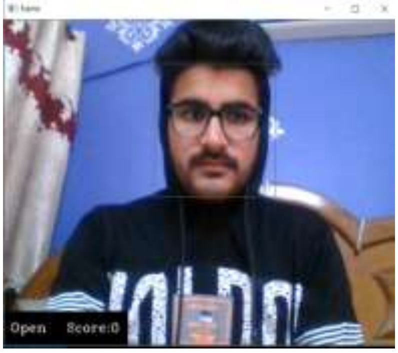


Fig2 Detection of face started

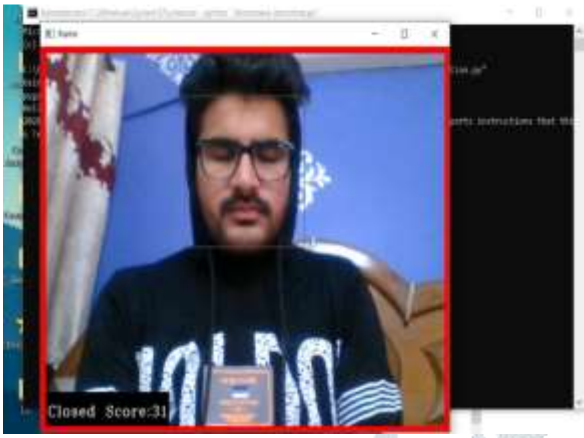
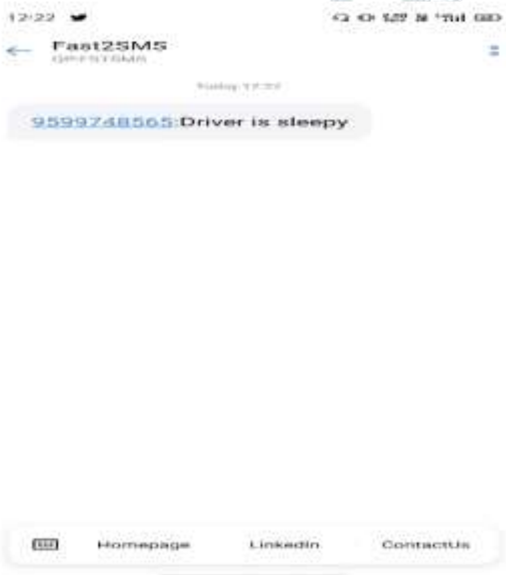


Fig3: Red box as eyes detected closed


12:22

Fast2SMS

Today 12:22

9599748565:Driver is sleepy

Fig4 : A snap of sms at the mobile phone

VI. FUTURE SCOPE

Since this project is just a small model that detect the person eyes to decide whether the person is drowsy or not but in the later time the model can be improvised. Here are some of the features that can be added in this model:

1) Adding lane detection to improve accuracy.
2) Adding yawn detection to improve accuracy.
3) Adding autopilot to prevent accident in case the drivers sleeps completely.

There can be many more improvements as the technology evolve.These are just some suggestions that can be used.

VII. CONCLUSION

This system can be used for driver's safety and its consequences. The system detects drowsiness of driver through eye conditions. It based on face detection using well known Viola Jones algorithm, eyes are detected through pro- posed crop Eye algorithm which segments the face in different segments in order to get left and right eye. Conditions of open and close eye are determined by intensity values, distance between eye brow and eye lash is calculated. If calculated dis- tance is greater than threshold value, eyes are closed other- wise open. The threshold 43 and above is set for Pakistani eye feature, it can vary from region to region. An alarm is trig- gered if eyes are found to be closed for consecutive five frames. The system produces 90% accurate results for 50 dif- ferent faces. However, its limitation is detecting the eyes of person wearing glasses. Also it does not produce accurate re- sults if any reflective object is found behind.

VIII. REFERENCES

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