IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

IMPLEMENTATION OF A ROAD SAFETY SYSTEM FOR DROWSY DRIVING USING DEEP LEARNING

[1]Tanmay Pramanick, **[2]Ganesh Nikumbh**, **[3]Giriraj Pachorkar**, **[4]Sagar Shinde**

H. P. Bhabad – Assistant Professor

[(1,2,3,4)] Department of Computer Science and Engineering
Sandip Institute of Engineering and Management, Nashik, India

Abstract: Drowsiness is a huge reason for road accidents and Data Science is the best possible cure for it. This detection system is a road safety technology that can prevent accidents from happening that are caused by the drivers who fell asleep while driving. According to the survey, 21 percent of all fatal accidents are due to drowsy driving. 60 percent of drivers or about 167 million people in the world have driven a vehicle feeling drowsy or in a fatigue in the past years. This turns out to be a huge problem not only for the driver but also for the pedestrians and other drivers. This system is a safety system that alerts the driver whenever he feels drowsy. The eyes movement of the driver is monitored live and whenever the driver feels asleep or closes eye for more than 2 seconds, then it will detect and alert the driver using a buzzer, vibrator or a water sprinkler. Basically, our aim is to prevent accidents from happening using image processing and deep learning.

Keywords: **Driver Drowsiness Detection System, Eyes Detection, Face Detection, Fatigue Detection, Visual Behaviour, Road Safety System.**

I. INTRODUCTION

Nowadays, Drowsy driving is a huge problem. The risk factor of drowsy driving are alarming. Drowsy driving is the dangerous combination of driving while sleepiness or fatigue. Usually, this happens when a driver haven't slept enough or due to untreated sleep disorders, medications, drinking alcohol, and night shift work. An infinite number of people drive on the highway day and night. Taxi drivers, bus drivers, truck drivers and many people travelling long-distance without from any sleep. Due to which it becomes very dangerous to drive while feeling sleepy or drowsy.

Several manufacturers like Audi, Mercedes and Volvo, currently offers this system that monitors vehicle's movements like wheel angle, lane deviation, time driven and road conditions.

The majority of accidents happen due to the drowsy behaviour of the driver. So, to prevent these accidents from happening, we have built this system using Python, which will detect and alert the driver when he feels sleepy or drowsy. Falling asleep while driving is clearly dangerous but being sleepy affects your ability to drive safely even if you don't fall asleep

.

Drowsiness

- Makes you unable to pay attention to the road.
- Slows your reaction time, if you want to push brake or steer suddenly.
- Affects your ability to make good decisions at the moment.

Fig.1. Drowsy behaviour of the driver

The main aim of this system is to implement a driver drowsiness detection system by monitoring the eyes and face moments, it is believed that the symptoms of drowsy can be detected early enough to prevent accidents. On the whole, by capturing the eyeblinks, we can decide if the eye blinks are more than normal interval, then we can detect if the driver is sleepy or drowsy.

Driver drowsiness contributes to many car crashes and fatalities in the world. Machine Learning algorithms have shown to help in detecting driver drowsiness using Image Processing and Deep Learning Models.

Deep Learning

Deep Learning is a subset of Machine Learning (ML) where artificial neural networks algorithms inspired by the human brain, learn amounts of data. Deep learning allows machines/systems for solving complex problems, while using a data set that is very different, unstructured and connected to each other.

Machine Learning

Machine Learning is nothing but an application of AI that gives systems the power to automatically learn and improve from the previous experience without being explicitly programmed.

1.1 Objective

- To provide a real-time monitoring system using image/video processing, face/eye detection techniques.
- To ensure the safety of the driver as well as the co-passengers.
- To ensure the safety of the pedestrians as well as other drivers on the road.

1.2 Application

- To support early detection of drowsiness.
- Image classification plays an essential role in many image processing applications.
- To achieve robust and accurate segmentation.

1.3 Advantages

- It has a lot of machine learning and deep learning toolboxes.
- The abnormal drowsy behavior of the driver is corrected in real time.
- Component establishes interface with other drivers easily.
- Not only the life of the driver, but also the life of pedestrians can be saved by alerting him using this system.

1.4 Disadvantages

- The system sometimes fails to work, if the driver is wearing sunglasses, but it can be solved by using an Infrared Sensor or a Laser, with a good camera.

II. LITERATURE REVIEW

1) In 2008, Hong Su et. al. [15]
They used new technique of modeling in which they calculated the drowsiness by multiple eye lid Movement. Which was based on information fusion technique called PLSR. Its precision and robustness have increased the capability of detecting and predicting the state of drowsiness by fusing multi features together. After using this method on few participants, the feasibility of this drowsiness detecting method proved to be 86% accurate.

2) In June, 2010, Bin Yang et. al. [16]
They described the camera-based drowsiness detection for drivers in real driving conditions. By this they got that measures of driver's eye can detect drowsiness in simulator or experiment. They evaluated the fatigue prediction measures and collected the huge dataset of 90 hours. Which shows that the drowsiness detection works good as long as blink detection works properly.
But there are still some problems with bad lighting and for person wearing sun glasses.

3) In 2011, M.J. Flores et. al. [17]
They described the drowsiness detection with the help of infrared illuminating for intelligent vehicle. They proposed the module for advance driver assistance and which detects the drowsiness automatically and also gives distraction to the driver. They used artificial intelligence to detect the drivers face and eye to analyze the drowsiness in driver. As it was infrared it was able to capture the driver's drowsiness in low light conditions also.

4) In June, 2012, A. Cheng et. al. [18]
They described drowsiness detection using computer vision technology. They presented it with the help of eye tracking and image processing. Problems caused by illumination and driver posture was also solved with the help of this method. In this method they calculated the drowsiness with of help of six measures such as eyelid closure, maximum closure duration, blink frequency, average opening level of the eyes, opening velocity of the eyes, and closing velocity of the eyes. After doing the experiments in real life they got the accuracy of 86%.

5) In 2013, G. Kong et. al. [19]
This method analyzed the eye state and head pose for detecting drowsiness. They monitored visual eye and head pose continuously for detecting alertness of driver. Most of the methods uses eye closure or head nodding to detect non alert driver patterns. This method uses visual features eye index (EI), pupil activity (PA), and head pose to determine
Non alertness of driver. A vector machine classifies a video segment into alert and non-alert driving events. Experimental results shows that this method works good with high accuracy and also won't give alarms unnecessarily.

6) In June, 2014, Eyosiyas et. al. [20]
They described a new method using HMM based dynamic modelling. HMM stands for Hidden Markov Model which is based on dynamic modelling to detect drowsiness. They used driving simulations for experiments and results verified the effectiveness of t the proposed method.

7) In August 2014, García et. al. [21]
They described it using low cost 3-D sensors. They presented the solution using 3-D information using range camera. They combined both 2-D and 3-D techniques to estimate the region of interest. They captured the cloud of 3D point and 2D projection form sensors and the points corresponding to head are determined and extracted for further analysis. They determined the head pose using Euler's angle and iterative closest point algorithm. It allows automatic study of specific factors and the detection of special event related to the driver, e.g., driver drowsiness, inattention, or head pose.

III. FUTURE SCOPE

In upcoming days, with more time and with more comprehensive research, this proposed system can be made more accurate. Also new algorithms can be added so as to give the more accurate result. This system takes a number of the sensors for a brief period of your time from the lane departure warning systems to trace the lane markings and the car's position in your lane. Many versions of driver drowsiness detection system features will track how often you depart from your lane over a short period of time to determine if you may be drowsy.

1V. PROPOSED SYSTEM

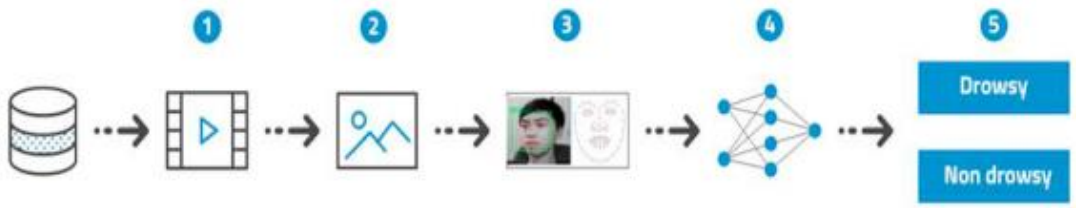

Fig.2. An outline of the proposed drowsiness detection.

A driver who fell asleep while driving, loses control of the vehicle, which often results in an accident with either another vehicle or any still objects. In order to prevent these destructive accidents, the state of drowsiness of the driver should be monitored and alerted using an alarm.

The proposed system continually monitors the driver's mouth, eyes, face and head through the real-time camera which is focused at the driver's face. The changes in mouth and eyes are inspected and then processed to discover the tiredness or drowsiness of the driver and also to send alarm using a buzzer.

The driver drowsiness detection system is based on an algorithm, which begins recording the driver's drowsy behavior as soon as the trip begins with the assistance of power on. Then, it recognizes changes in the driver's behaviour on long trips and, also the driver's level of fatigue.

V. METHODOLOGY

The eye blinks of the driver and estimating the driver's behaviour and alert the driver and co-passengers accordingly. We are implementing the system by capturing the live images of the eyes and process them into the processor which is used to process the video and convert it into frames and process accordingly.

Driver-monitoring systems typically use a camera focused on driver, equipped with infrared LEDs, so that it can see the driver's face, even at night, and see the driver's eyes.

5.1 Pre-requisites

The requirement for this Python project is a web-cam through which we will capture the images. You need to have Python (3.6 version) installed on your system, then using pip, you can install the necessary modules.

- OpenCV – pip install opencv-python (Precise Detection of Eyes/Face).
- TensorFlow – pip install tensorflow (to use TensorFlow as backend).
- Keras – pip install keras (to build deep learning model).

5.2 Model Architecture

The model we used have been built with Keras using Convolutional Neural Networks (CNN). A convolutional neural network is a special type of deep neural network which performs extremely well for image categorization purposes. Basically, CNN consists of an input layer, an output layer and a hidden layer. A convolutional operation is performed on these layers using a filter that performs 2D matrix multiplication on the layer as well as filter.

VI. ALGORITHM

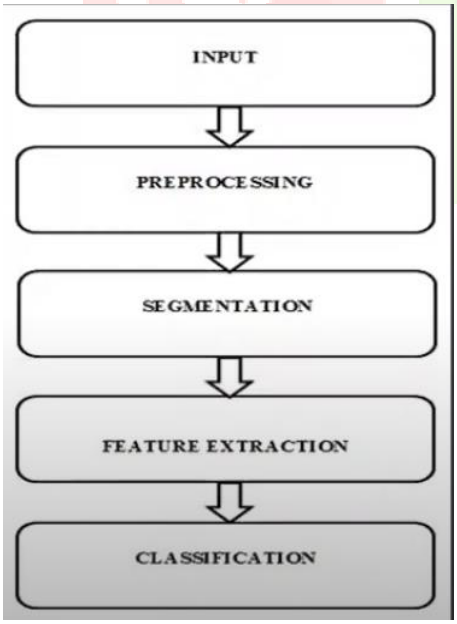

Fig. 3. Algorithm of Drowsiness Detection.

We will be processing images from webcam and process them into a Machine Learning Model, which will classify whether the person's eyes are 'Open' or 'Closed'.

The approach we will be using for this project are as follows :

I - Capture images as an input from web-cam.
II - Detection of face by creating a Region of Interest (ROI).
III - Detection of eyes from Region of Interest and process it to the classifier.
IV - Classifier categorizes whether the eyes are open or closed.
V - Calculate scores for checking if the person is drowsy or not.

6.1 Working of an Algorithm

I - Capture images as an input from web-cam.
With a web-cam, we will be taking images as an input, we made an infinite loop which will capture each frames.

II - Detection of face by creating a Region of Interest (ROI).
For detecting the face, we need to convert the images for object detection into grayscale as an input. We don't need colour data/images to detect the objects.

III - Detection of eyes from Region of Interest and process it to the classifier.
The same procedure is used to detect eyes. First of all, we have set the cascade classifier for eyes in the left eye and right eye respectively. Now we need to extract the data from the image. This can be achieved by extracting the boundary of the eye and we can process the images from the frame.

IV - Classifier categorizes whether the eyes are open or closed.
We are using CNN classifiers for predicting the status of the eyes. For processing the image into the model, we need to perform certain operations due to the model needs the correct dimensions to start with. First, we need to convert the image into grayscale.

V - Calculate scores for checking if the person is drowsy or not.
Basically, the score is a value we will be using to determine how long the person has closed his eyes.
If both the eyes are closed, it will keep on increasing the value and when eyes are open, it will decease the score.

VII. CONCLUSION :

- In this Project, we have built a drowsy driver alert system that you can implement in various ways.
- Combination of different detection methods should be used for effective and reliable drowsy driver detection.
- Chances of road accidents should be significantly reduced.
- This system has overcome few of the limitations of the previous existing systems.
- We used different deep learning models to detect faces and eyes using a CNN model for predicting the status.
- It has a wide scope in the future and can be improved in the future to meet excellence.
- In the future, this thesis will be a part of a road safety system being used in every vehicles and helps to save many lives.

VIII. REFERENCES :

[1] U.S. Department of Transportation, "Intelligent Vehicle Initiative 2002 annual report," http://ntl.bts.gov/lib/23000/23500/23572/13821.pdf
[2] The Ministry of Economy, Trade and Industry, "Technological Strategy Map 2009" (in Japanese),http://www.meti.go.jp/policy/economy/gij utsu_kakushin/kenkyu_kai hatu/str2009/7_1.pdf
[3] http://articles.economictimes.indiatimes.com/2014- 09-14/news/53903974_1_motor-bill-motor-vehicle5-lakh-road-accidents
[4] A. Murata and Y. Hiramatsu, "Evaluation of drowsiness by HRV measures—Basic study for drowsy driver detection," in Proc. 4th Int. Workshop Comput. Intell. Appl., 2008, pp. 99–102.
[5] J. Batista, "A drowsiness and point of attention monitoring system for driver vigilance," in Proc. Intell. Transp. Syst. Conf., 2007, pp. 702–708.
[6] L. M. Bergasa, A. Member, J. Nuevo, M. A. Sotelo, R. Barea, and M. E. Lopez, "Real-time system for monitoring driver vigilance," IEEE Trans. Intell. Transp. Syst., vol. 7, no. 1, pp. 63–77, Mar. 2006.
[7] C. R. Jung and C. R. Kelber, "A lane departure warning system based on a linear–parabolic lane model," in Proc. IEEE Intell. Veh. Symp., 2004, pp. 891–895.
[8] J. M. Clanton, D. M. Bevly, and A. S. Hodel, "A low-cost solution for an integrated multisensor lane departure warning system," IEEE Trans. Intell. Transp. Syst., vol. 10, no. 1, pp. 47–59, Mar. 2009.
[9] "Lexus LS 600h," [Accessed: 12-May-2013], TESTDRIVEN, 2006. [Online]. Available: www.testdriven.co.uk/lexus-ls-600h/
[10] "Saab Driver Attention Warning System," [Accessed: 12-May-2013], The Saab Network, 2007. [Online]. Available: www.saabnet.com/tsn/ press/071102.html
[11] R. Kawamura,M. S. Bhuiyan, H. Kawanaka, and K. Oguri, "Simultaneous stimuli of vibration and audio for in-vehicle driver activation," in Proc. 14th Int. IEEE Conf. Intell. Transp. Syst., 2011, pp. 1710– 1715.
[12] N. Azmi, A. S. M. M. Rahman, S. Shirmohammadi, and A. El Saddik, "LBP-based driver fatigue monitoring system with the adoption of haptic warning scheme," in Proc. IEEE Int. Conf. Virtual Environ., Human- Comp. Interfaces Meas. Syst., 2011, pp. 1–4.

[13] "TecDay Real Life Safety," [Accessed: 12-May2013], DAIMLER, 2008. [Online]. Available: http://media.daimler.com/dcmedia/ 0-921-658892-1- 1147698-1-0-0-1147922-0-1-11702-0-0-1-0-0-0-0-0. Html? TS=1266506682902

[14] Vural, E., et al., Machine Learning Systems for Detecting Driver Drowsiness, in In-Vehicle Corpus and Signal Processing for Driver Behavior, K. Takeda, et al., Editors. 2009, Springer US. p. 97-110.

[15] Hong Su and Gangtie Zheng, "A Partial Least Squares Regression-Based Fusion Model for Predicting the Trend in Drowsiness" IEEE TRANSACTIONS ON SYSTEMS, MAN, AND CYBERNETICS—PART A: SYSTEMS AND HUMANS, VOL. 38, NO. 5, SEPTEMBER 2008.

[16] Fabian Friedrichs and Bin Yang, "Camera-based Drowsiness Reference for Driver State Classification under Real Driving Conditions" 2010 IEEE Intelligent Vehicles Symposium University of California, San Diego, CA, USA June 21-24, 2010.

[17] M.J. Flores J. Ma Armingol A. de la Escalera, "Driver drowsiness detection system under infrared illumination for an intelligent vehicle" Published in IET Intelligent Transport Systems Received on 13th October 2009 Revised on 1st April 2011.

[18] Zhang, Wei; Cheng, Bo; Lin, Yingzi," Driver drowsiness recognition based on computer vision technology." Published in: Tsinghua Science and Technology (Volume: 17, Issue: 3) Page(s):354 - 362 Date of Publication: June 2012.