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An Alarm based Driver Drowsiness Detection system

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Abstract- Normally when a person doesn't get proper rest, they fall asleep while driving and this leads to fatal accidents. The objective of the detection system is to overcome the problem related to accidents when drivers experiencing fatigue which leads to a need to design a system that keeps the driver focused on the roads. This is a different approach for measuring the drowsiness .The eye lid closure is computed to detect drowsiness. So, when the closure of eye exceeds a certain threshold then the driver is identified to be drowsy. A deep learning method namely CNN technique is used to estimate the driver status and controls the car accordingly. Several OpenCV libraries (including Haar-cascade) are used for implementation.

Keywords- Haar cascade classifier; Convolution Neural Network (CNN)

I. INTRODUCTION

Road transport system takes place an essential part for humans. Due to increase in vehicle transport, accidents are occurring frequently. Climatic changes, work pressure and unhealthy diet are few reasons for human inconscient which leads to accident during driving. In order to avoid such accidents, an eminent detection system to alert the driver is a major requirement. Nearly 40 to 50% of the crashes happened due to the drowsiness of the driver. When the driver becomes fatigue he may close his eye lids frequently. An alert system is developed based on the frequency of eye lid blink.

It is capable of detecting drowsiness on drivers and then based on the current situation it will help to stop or awake the driver by alerting using an alarm. In an alert system, it may be able to differentiate the normal eye blink with the drowsiness eye blink. In this system some threshold value is used to identify the eyelid blink. Eyelid blinking exceeds the threshold value then the system will automatically indicate the driver. Normally, Deep learning algorithms are suitable for drowsiness detection. Because it is the subdivision of

Machine Learning and Artificial Intelligence technique which is used to model the way human gain with certain types of knowledge. In an alert system, in order to identify the driver eye lid blink various classifiers are used in deep learning techniques. A classifier is an algorithm for classifying or categorizing various data into one or more subset. In alert system, classifiers are used to categorise the objects such as face movement, eyelid movement, eye, mouth etc. Depends on the user application, classifiers and features are identified. To get the more accuracy on the feature extraction of the data, Convolutional Neural Network (CNN) is used.

Most common use of CNN is to analyse the various visual images. The real time application of CNN is object recognition, feature extraction, computer vision, medical imaging, classification, segmentation, image reconstruction, natural language processing etc. Thousands of features can be detected using CNN. This features are used in the alert system. The various benefits of CNN is computational efficiency, accuracy of the data, memory saving.

Section II elaborates the related work of driver drowsiness. In Section III the proposed methodology

of the work is discussed. Section IV discusses the result and discussion. In Section V conclusion and future works is explained.

II.RELATED WORK

The main focus is to develop an efficient, economical, real time driver drowsiness detection system.

Satish, K. et al. [1] presented a survey on alert system for driver drowsiness. The face of the driver is captured and eye retina is detection along with facial feature extraction are done including blinking values are calculated. The hand pressure on car steering wheel is calculated by integrating Arduino module is integrated with elastomeric sensors. The result from the threshold values is considered as input for alerting the driver.

Deng.W et al. [2] developed a system a named Dricare that detects fatigue of drivers using video images. They considered blinking and the duration of eye closure and yawning as the features. An algorithm namely MC-KCF was applied to track the face of rider which incorporates CNN and MTCNN techniques. This novel detection method is applied for facial regions with 68 key points that evaluate the state of the driver. Their algorithm combined both eyes and mouth features and achieved around 92% accuracy.

Navastara.D et al. [3] proposed Funnel-structured cascade algorithm for face detection and retrieve the eye's location from the facial landmark features. They extracted the features of the eyes using a Uniform Local Binary Pattern (ULBP) and the Eyes Aspect Ratio (EAR). Once features are extracted, this system classifies eye as closed or open using Support Vector Machine (SVM) method. The proportion of eye closure (PERCLOS) is used for detection. The proposed method achieved about accuracy of 95.5%.

Galarza.E et al. [4] used a Human Computer Interacted system that was implemented in a Smartphone. The driver's gesture like eye and lip movement is monitored by the system. During pre-processing phase, the system removes accessories like glass, cap etc. It was developed as a smart phone based application with Android operating system. This system produced 93.37% of accuracy in surveillance.

Junaedi, S et al. [5] proposed a method which is computer vision-based method that detects driver's drowsiness. They use camera to capture the video and their algorithm detects eye of the face in each frame. The iris part of eye is extracted and they calculated the proportion of eye closure namely PERCLOS measure. They used Yaw DD video dataset proposed for their evaluation.

Sathyanarayana et al. [6] proposed an algorithm which used eyebrow for detection. They used three databases namely Jaffe, Cohn Kanade and AR for their evaluation. They achieved a detection rate of 96%.

Boumehed, M. et al. [7], detected the state of the driver using IR camera. Based on symmetry concept face and eyes are detected. An eye state is determined by Hough transform module. The implemented their algorithm on DSP which works on real-time.

Hachisuka, S et al. [8] captured the driver face with a camera that is placed in dashboard. They extracted 17 different features from the face. Among the features, eyebrow rise is considered as important feature. 3D coordinates of the feature is obtained by Active Appearance Model. K-Nearest Neighbor machine learning algorithm is used for detecting the accuracy. Root Mean Square Error was found to be less than1.

Assari, M. A et al. [9] proposed infra red light based hardware system that is based on infrared light. In their approach face is detected using background subtraction technique. They used horizontal projection and template matching to extract the facial features. The system have produced better result even with beard, moustache and glasses in real time.

Hu, S. et al. [10] used Support Vector Machine (SVM) which extracted EOG data with eyelid parameters. The dataset is segregated into 3 levels and features related to drivers sleep condition are considered. The dataset is validated using SVM and produced higher accuracy.

III.PROPOSED METHODOLOGY

In our system that drowsiness of driver is detected using Conventional Neural Networks (CNN) technique and once the driver's state of drowsiness is detected, songs will be played on recommendation

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based on driver's interest. The image is taken as input from a camera and the face of the image is detected .Then a Region of Interest (ROI) is created and eye is detected from ROI and this image is fed to the classifier. The classifier categorizes eyes as open or closed and computes the score to check the drowsiness of the person. In order to detect faces and eyes, Haar cascade classifier is used. The CNN classifier is used to predict the eye status. After preprocessing is done to extract exact dimensions, the image is fed to the model. Initially, the color image is converted into grayscale, and then image dimensions are resized. Then the status of the eye can be predicted and score will be determined according to it whether closed or open.

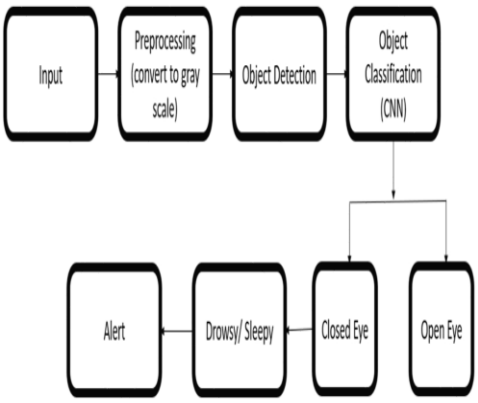


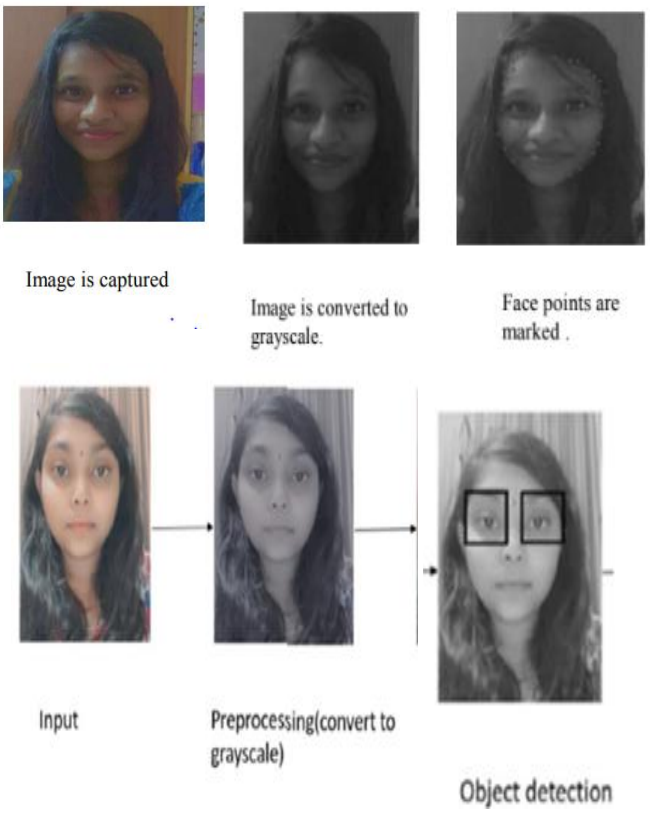
Fig.1 Architecture of the alert-based driver drowsiness system.

1. Preprocessing

Using Open CV, grayscale image is obtained from colr image in preprocessing phase. By using this OpenCV, first it takes the image of the face and stores the image in the frame variable. From the image ROI samples with the dataset are identified. The grayscale image is used as an input for object detection.

2. Object Detection

Haar Cascade Classifier is used to detect both face and eye from the input image. It trains huge amount of input images. Faces are identified either from the input image or from the real time input video. This algorithm draws edge features of face and eye. It returns x and y coordinate values as well height and width of the boundary box of the object.



3. Object Classifier

Once the boundary box is detected for the face, the eye status is predicted using CNN classifier. CNN model takes 24*24 pixel image. If the image size exceeds, compress the dimensions of the image. Now, this model predicts each eye and classifies whether the eye is open or closed.

4. Drowsiness Detection

After the completion of predicting the eye whether eye is open or closed, the score is calculated which will start to determine the duration of eye closure. If both eyes are closed, the score is increased and when eyes are open, the score is decreased. When it reaches the threshold (say 15), an alarm (favourite song or music) is played to wake up the driver.

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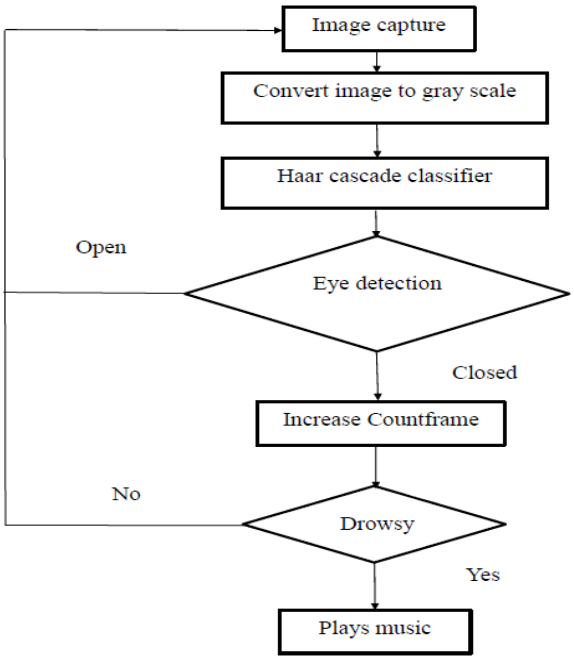

Figure 3: Flowchart the alert-based driver drowsiness system

IV.RESULT DISCUSSION

Figure 4: Output

Initially, the score is set to 0. When the eye lid of the driver starts to close, the count is incremented. If the driver continues to close the eyes, the count keeps on increasing. When it reaches the set threshold value 15, a beep sound is raised. If the driver opens the eyelids before reaching the threshold value, then the count starts decreasing.

V.CONCLUSION AND FUTURE WORK

Nowadays drowsiness is the major cause for the accidents. To avoid the accidents, deep learning algorithm is used which estimates the driver status of drowsiness and helps to control the car with an alarm. Using Haar cascade classifier, the face, left eye and right eye ROI are identified. To identify the drowsiness, CNN classifier is used which predicts the eye lid movement .Based on the threshold value, an alarm will be raised to alert the driver and prevent the accident. As a future work, a mobile software application can be developed for accident detection. If an accident happens, a SMS can be send for location tracking.

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