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REAL TIME DRIVER – DROWSI CARE SYSTEM BY CNN ALGORITHM USING DATASETS

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Abstract - *The face is the most important body part, that gives us the most valuable information. This information helps us to find whether the driver is in the state of fatigue or not. In this paper, we propose Drowsi Care System, which detects the driver's drowsiness by using the facial data as parameters such as yawning and the frequency of blinking are checked with the normal state using image processing, by not equipping any device on the drivers body. Due to the Drawbacks of previous proposed system, we propose a updated face-tracking algorithm to improve the different features in the system. Here we use facial regions to evaluate the driver's drowsiness. By using the information of driver's eyes and mouth, Drowsi Care System will alert the driver and other people in the vehicle by blowing an alarm. By using this system we can attain more safety to people.*

Key words — Convolution neural network, Drowsiness detection, face tracking.

1. INTRODUCTION

In this modern era, an increase in the requirement of higher transportation necessitates a higher car-parc growth. Now-a-days the automobiles are been majorly used by the people. In the year of 2017, the count of about 97 million automobiles were sold globally, 0.3% more than that of 2016[1]. In the year 2018, the total estimation of totally utilized vehicles are not less than 1 billion[2]. Even automobile has changed an individual lifestyle and improved the range of convenience in performing daily activities, it also indulged with numerous adverse effects, such as accidents that risk the individual life in danger. A report by National Highway Traffic Safety Administration[3] shows that 7,277,000 accidents are occurred only in U.S in 2016, that results 37,461 deaths and 3,144,000 injuries. In these cases 30% of the accidents are been occurred because of drowsiness state of the driver. Thus drowsiness driving is a significant threat in traffic accidents. In recent times, the drowsiness driving detection system has become an interesting and challenging topic. The detection methodologies are widely categorised as objective and subjective detection. In the subjective method, a driver must be participated in evaluation, which associates with driver's subjective approach such as filling in questionnaires and self - questioning. And by this data we estimate the vehicles being driven by tired drivers, and helping the drivers to schedule their plans accordingly. And in objective detection method we use the drivers physiological state and driving-behaviour characteristics in real-time[4]. The data that is collected are used to evaluate the level of driver's fatigue. Furthermore, the objective detection is again divided into two types: contact and non-contact. Compared with contact method non-contact approach is much cheaper and much convenient because it doesn't require any Computer vision technology in the cars.

This method is advantageous because of its easy installation and its low cost. The non -contact method is been widely used in detecting driver's drowsiness. The SmartEye[5] and Attention technologies[6] are used to determine the drivers drowsiness based on the information of driver's head position and the movement of his eyes.

In our paper, A non-contact method called Drowsi Care System is used to detect the level of driver's drowsiness. In this method we use a Camera inside the vehicle and there is no need of any tech that driver need to carry in/on his body. Our method of approach analyze and detect each image frame to detect driver's state of fatigue.

There are three challenges that our Drowsi care System addresses. Firstly, the difference in the driver's height varies the faces position in the video also varies. Then, when the driver drive's the vehicle, the position of his/her head may be moving. Therefore, trajectory of the head tracking in time is important with the positions of the head varies.to intimate the driver in real time, we use kernelized correlation filters(KCF) algorithm[7] based on system's evaluation.

In, Oriented gradient features[8] KCF algorithm only uses a single Felzenszwalb histogram, a less efficient face tracking algorithm in a complex environment. And a manual method is used in KCF to mark the target tracked in the frame. In KCF, the tracker cannot be retrieved immediately in the tracker, and it cannot track the object once it left the specified area and again returns.

Secondly, the mouth and eyes of the driver plays a critical role in detecting drivers drowsiness in our Drowsi Care system tracking. Therefore, in detecting the driver's fatigue the identification of key facial features of the driver

is important. For detecting the key points a deep convolution neural network is proposed[9]. For detecting the positions of several key points there are some traditional models[9]-[11],but they are unable to find the regions of drivers eyes and mouth.

Thirdly, determining the drowsiness level of the driver is crucial for Drowsi care System. When a driver is tried, his face is evident for there drowsiness. From the study of Walter[12] , the degree of drowsiness can be detected by the rate of driver's eye closure. Based on this principle, PERCOLS(percentage of eyelid closure over the pupil over time) is been proposed by the Grace et al.[13] and proposed Copilot for measuring the level of fatigue of the driver. yawning constantly is also a sign of fatigue. In General, the driver may exhibit different facial expressions, which may cause difficulties in detecting the facial expressions.

Here we use CNN algorithm to assess the position of the eye whether it is closed or opened. Here we keep track of eye and the frequency of eye closure and the yawing time, to detect yawning we assess the information regarding mouth opening.by evaluating these information if the threshold is crossed the Drowsi Care System will alert the driver and all other people on board with an alarm. The rest of the paper organized as follows Section 2 contains the related works regarding the different meta search engines. Section 3 briefs about the existing systems and its disadvantages. Section 4 describes the proposed system and its architecture. Section 5 consists of the description of the Genetic Algorithm for the proposed system. Section 6 contains implementation results and Section 7 contains the conclusion.

2. RELATED WORKS

By verifying the various papers that are related to the proposed work gives more insight into the usage and their techniques. This also gives an idea that how proposed system should be improved. Visual object tracking a major part in computer vision. It plays a major role in the Human-computer interaction, recognition of behavior, surveillance and robotics. Visual object tracking estimates the position of the target in each frame of the image sequence, where the initial state of the target is been given to the target in previous frame. Kanade and Lucas[19] proposed a system that tracks the moving targets using pixel relationship by comparing the adjacent frames of video sequence and the pixels displacement changes. This algorithm has a drawback of only detecting the medium sized target between two frames. Here we use CNN to offset the KCF limitations. Thus ,the algorithm can track the driver's face in real-time using our system.

The facial key-points recognition gives us the crucial information by locating eyes, eyebrows, lips and nose in the face. By using deep learning techniques, for the first time Sun et al[9] introduced an algorithm that detect 5 human facial keypoints. And Zhou[11] introduces FACE++ it can able to recognize 68 keypoints, but this algorithm is very complicated.

And drivers drowsiness detection is basically divided into two types : contact approaches [32]-[34] and non-contact approaches [5], [6], [35], [36]. In the type of contact approaches, the driver has to wear or touch something to get the parameters for detecting the fatigue level. Warwick [32] proposed the BioHarness 3 on driver's body to check whether the driver is in active state or in the fatigue state. Li [3] proposed to use of a smart watch to detect driver fatigue based on electroencephalographic (EEG) signal. Jung[34] set an embedded sensor in the steering wheel to monitor the drivers electrocardiogram (ECG) signal. Due to the cost and the installation, and there are some limitation which cannot be implemented. So, the non-contact approach detects the fatigue of the driver without need of any equipment in/on the body of the driver. For example, Omidyeganeh [35] uses camera to detect the driver drowsiness got by the driver's facial appearance, but this cannot be implemented in real-time. Different from this methods our Drowsi care system is implemented in real-time, we employ simple evaluations and formulae, which helps us to detect the drowsiness of the driver much easier.

3. PROPOSED SYSTEM

The eyes are the important part of the face to detect the fatigue of the driver. The existing system doesn't use any datasets to detect the drowsiness of the driver. But in our proposed system we are using datasets to train the system, so that the accuracy in detecting the drowsiness will be increased in our system. And our system provides an accuracy of 95% which will help us to detect the drowsiness of the driver with more accuracy. In our system the camera is used to detect the face of the driver were the frame is been generated around the drivers face. By detecting the face of the driver the we will get the eyes data of the driver.

And after getting the information of the eye we will compare it with pickle files that are generated through datasets that are collected. The generation of pickle files are made by permutation and combinations of different files in the datasets. This datasets consists of four basic folders those are Right Opened Eye, Left Opened Eye, Right Closed Eye, Left Closed eye. By using these datasets the pickle formatted files are generated. By using those files we compare the pickle format files with the drivers eyes. And we will detect the drowsiness of the driver. So, this type of detection will increase the accuracy in the detection upto 95%.

And we also use the mouth opening of the driver to detect the drowsiness. And by using these two parameters we will easily increase the accuracy in detecting the fatigue of the driver by using our Drowsi Care system. And we use CNN algorithm to train the datasets so, that the detection of the drowsiness will be increased.

In our proposed system we use a webcam inside the car to detect the drowsiness of the driver. As the webcam is a fixed tool, driver need not to carry any equipment with him when he was on board. This type of approach is known as non-contact approach. By using the webcam we collect the facial features the driver. After collecting the data, those data are been sent to the tracking mechanism where it uses CNN algorithm and by using this algorithm we will compare with the pickle files that are been generated by the datasets.

And each datasets consists of collection of many images of open right eyes, closed right eyes, open left eye, closed left eye, mouth, which helps the CNN algorithm to detect the fatigue of the driver.

The parameters that we consider in our system is 1.Eye and 2.Mouth and after if the driver was in a state of then it will blow an alarm and if the driver was not in a state of fatigue then no alarm is blown. And if the alarm is blown it will not stop unless the driver resunes normal. Likewise our Drowsi care system will detect the fatigue of the driver and will help in decrease the most of the accidents that are caused by drowsiness. Our proposed system architecture is been clearly explained in the figure1.

And in our proposed system we used open cv to record the video. And in the video the each frame is captured and its been sent for validation if continuously more frames are crossing the threshold value then it create an exception. By using this exception we can intimate the driver that he was in the state of drowsiness. And if the alarm is blown the driver and also the people in the car is also been warned about the fatigue nature of the driver that will save the driver and passengers from the accidents.

The Usecase diagram that represents the data that is been transferred between the driver and the Drowsi care System is been clearly mentioned in the figure 2. In this figure User and System are included. And the user is related to the data collection and the alarm and the DCS (Drowsi Care System) includes image processing, convolution neural networks(CNN), testing, drowsiness detection, when the user sends the data to the DCS then system will do the image processing by using CNN algorithm and it will conduct tests with the new video frames and it will detect the drowsiness of the driver, Based upon the detection if the threshold value is crossed then alarm get activated.

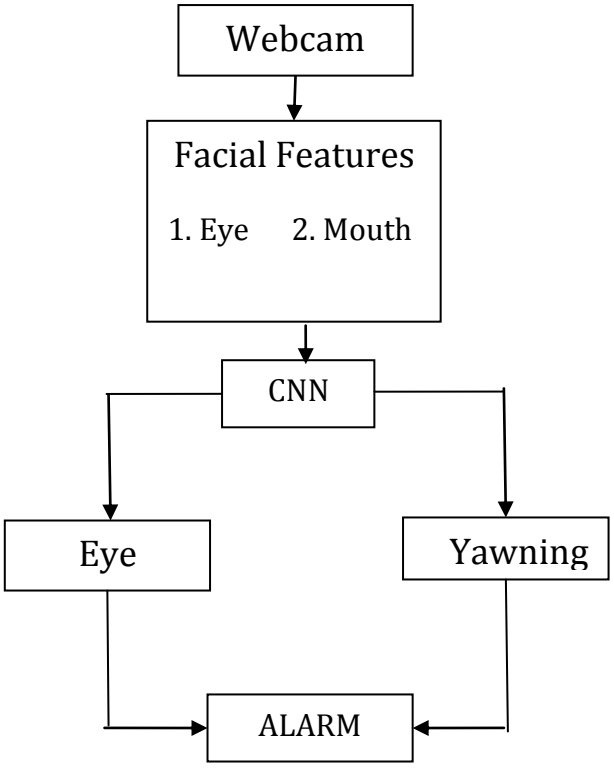

FIG - 1: Architecture diagram of Drowsi Care System

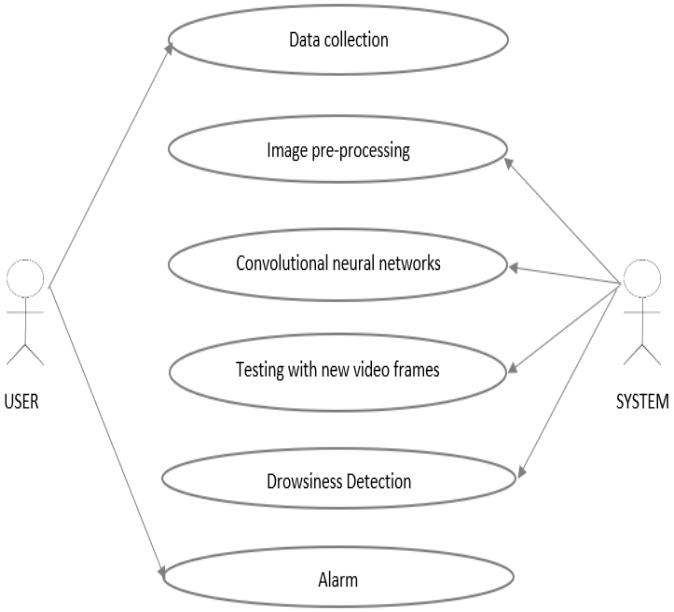

FIG - 2: Use Case diagram of Drowsi Care System.

4. DROWSI CARE SYSTEM ALGORITHM

The Drowsi Care Detection System gives the great solution for detecting driver's fatigue condition and alerts him. The Convolution Neural Network(CNN) algorithm is one of the deep learning algorithms which is used in this system. This algorithm accepts the input in the image format and gives importance in various aspects in order to differentiate each images. In this system, the datasets for the opened right eyes, opened left eyes, closed right eyes and closed left eyes are collected. Each of the above datasets contains thousands of images in it. Each of the images in the opened right eyes is permutated with the each of the images in the opened left eyes. Each of the images in the closed right eyes is permutated with the each of the images in the closed left eyes. All the permutated images will be stored in to two pickle files namely the open eyes pickle and closed eyes pickle files. Since the memory size of the permutated image is very high, the pickle file format is used which helps to reduce the memory consumption. These pickle files are then trained for efficient detection of the drowsiness of the driver.

Face detection

The face detection operation can be done by importing the opencv packages of python

```
if len(dets) > 0:
    for k, d in enumerate(dets):
        shape = predictor(frame_resized, d)
        shape = shape_to_np(shape)
        leftEye= shape[lStart:lEnd]
        rightEye= shape[rStart:rEnd]
        leftEAR= eye_aspect_ratio(leftEye)
        rightEAR = eye_aspect_ratio(rightEye)
        ear = (leftEAR + rightEAR) / 2.0
        leftEyeHull = cv2.convexHull(leftEye)
        rightEyeHull = cv2.convexHull(rightEye)
        cv2.drawContours(frame, [leftEyeHull])
        cv2.drawContours(frame, [rightEyeHull])
if ear>.25:
    print (ear)
    total=0
    alarm=False
    cv2.putText(frame, "Eyes Open ")
        else:
          total+=1
          if total>20:
            if not alarm:
              alarm=True
              d=threading.Thread(target=start_sound)
              d.setDaemon(True)
              d.start()
              print ("alert")
              cv2.putText(frame, "drowsiness detect")
          cv2.putText(frame, "Eyesclose")
```

FIG - 3: Drowsi Care System Algorithm

5. IMPLEMENTATION RESULTS

Driver's drowsiness and fatigue nature can be detected by using Drowsi care system. The system comprises of a camera attached with an alarmwhich is placed in front of driver and fixed inside the car. The camera records the video of the driver's facial expressions for observing the drowsiness.The continuous video frames captured by the camera will be compared with the trained data sets. The trained data sets consists of collection of various images with open and closed right and left eyes along with mouth during yawning. If the continuous video frames that are captured by the camera matches with the images in the trained data sets then an alarm will be blown. The alarm indicates that the driver is in fatigue state or he is about to sleep i.e indicates the drowsiness. This alerts the driver and other co-passengers in the vehicle and the alarm will stop only when driver facial expressions comes to normal.Thus Drowsi care system prevents accidents and ensures safe driving by detecting driver's drowsiness.

FIG - 4: Detection of Eye Close and Eye Open

FIG - 5: Detection of Drowsiness

6. CONCLUSION

We propose a new system for finding the driver's fatigueness based on the eyes and yawn deduction by using the datasets. We design and propose the new algorithm called Drowsi Care System to track the driver's eyes and mouth using the CNN algorithm. The DCS Algorithm can be used in different regions and can give the stable performance. The DCS algorithm can produce the success rate of 95% in reducing the accidents happening because of drowsiness. The DCS algorithm is a real-time application hence it performs in high operational speed.

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