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COGNIDRIVE INTELLIGENT DROWSINESS DETECTION SYSTEM UNSING DEEP LEARNING

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ABSTRACT:

Drowsiness and fatigue of automobile drivers reduce the drivers' abilities of car manage, herbal reflex, recognition and notion. Such diminished vigilance stage of drivers is found at night time driving or overdriving, causing twist of fate and pose extreme danger to mankind and society. Therefore, it is very tons essential in this recent fashion in vehicle industry to include driving force help system which could hit upon drowsiness and fatigue of the drivers. This undertaking offers a nonintrusive prototype computer vision gadget for monitoring a driving force's vigilance in real time. Eye tracking is one of the key technologies for destiny motive force help systems for the reason that human eyes contain lots statistics approximately the driver's condition which includes gaze, attention stage, and fatigue degree. One problem commonplace too many eyes monitoring strategies proposed to this point is their sensitivity to lighting fixtures situation exchange. This has a tendency to seriously restrict their scope for car packages. Real-time detection and monitoring of the attention is an energetic region of research in laptop imaginative and prescient community. Localization and monitoring of the attention can be beneficial in face alignment. This challenge describes actual time eye detection and tracking approach that works underneath variable and sensible lighting fixtures situations. It is primarily based on a hardware device for the real-time acquisition of a driving force's snap shots the use of digital camera and the software program implementation for monitoring eye that can avoid the accidents.

KEYWORDS: Driver drowsiness detection, Eye tracking, Features extraction, Deep learning, Notification system

INTRODUCTION

Road accidents are frequently caused by sleepiness at some point throughout the driving process. In many nations, road accidents are quickly becoming a major issue, since they have risen to become one of the primary causes of mortality and accidents. The majority of people believe that drunk driving is a major cause of accidents, but many are unaware of the dangers of drowsy riding. It also impairs vigilance, attention, and awareness, making it difficult to engage in several cognition-based totally sports (including riding). It also reduces concentration, impairs judgment, and increases the risk of crashing. Apart from drunken riding and rush driving accidents, road injuries caused by driver weariness are more severe and result in death. Drowsy driving accidents are more dangerous since the driver loses focus, resulting in severe injuries or death. People who travel in automobiles are not the only ones who suffer. Pedestrians may be affected as well. It's difficult to know with precision what caused a fatal incident involving drowsy driving. Several signs at the crash scene, according to investigators, show the character fell asleep at the wheel. Drowsy driving-related injuries, for example, frequently occur in vehicles in which the driver is alone, and the accidents appear to be critical or deadly, particularly at night, when drivers drive under stress on roads and, as a result, lose control of their vehicles and become accident victims. The classification of motive force behaviour is regarded as a complicated problem since it is a multi-dimensional problem that is subjected to multiple driving force and visitor kingdom peculiarities. The traffic country is calculated using a number of characteristics such as road conditions, vehicle kinematics, and driver behavior. All of these variables can be determined using a set of hard and fast riding rules created through time for specific drivers and settings. As a result, motivational force should be acquired in terms of eye monitoring and methods. To analyse and comprehend driving style, a variety of aspects must be considered, including environmental factors, street conditions and vehicle, incident kind and identification, and biological and physiological status. Fig 1 shows the existing system for driver drowsiness detection system

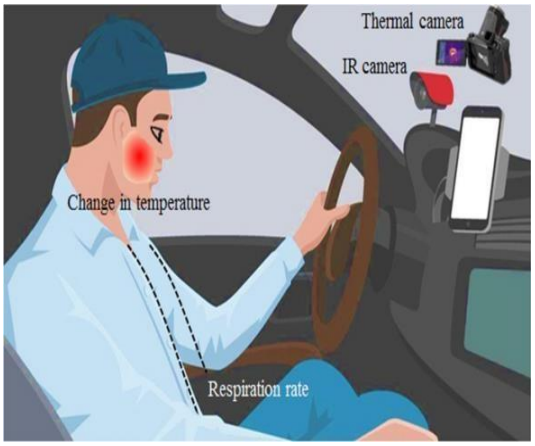

Fig 1: Sensor based driver drowsiness detection system

RELATED WORK

Vu, toan h., an dang et.al,…develop a deep neural network (DNN) for detecting driver drowsiness in videos. The proposed DNN model that receives driver's faces extracted from video frames as inputs consists of three components - a convolutional neural network (CNN), a convolutional control gate-based recurrent neural network (ConvCGRNN), and a voting layer. The CNN is to learn facial representations from global faces which are then fed to the ConvCGRNN to learn their temporal dependencies. The voting layer works like an ensemble of many subclassifiers to predict drowsiness state. In particular, previous works require face alignment to locate and learn relevant features from specific facial regions. However, performing face detection and alignment on every frame has many challenges such as different illumination conditions, hard human poses, and occlusions. Additionally, it increases overall processing time.

In our work, we work directly with global faces. Face detection and face tracking are combined together to extract driver's faces from video frames, which is simple, accurate, and very fast. The proposed model firstly extracts facial representations from global faces by its CNN part, then its ConvCGRNN part is to learn their temporal relations while remaining spatial properties before feeding to a voting layer. Specifically, the model sequentially makes predictions by processing frame by frame instead of making window-based predictions. Thus, it is very fast, consuming much less computational cost, and capable to work in real-time. [1]

Niloy, Amit Raha, et.al**,.** The main objective of this research paper is to review different driver drowsiness detection techniques in detail so that people can easily decide which detection techniques are better and also to help in making decision on drowsiness accurately as this review is based on the recent techniques. Driver drowsiness is the momentous factor in a huge number of vehicle accidents. This driver drowsiness detection system has been valued highly and applied in various fields recently such as driver visual attention monitoring and driver activity tracking. Drowsiness can be detected through the driver face monitoring system. Nowadays smartphone-based application has developed rapidly and thus also used for driver safety monitoring system. In this paper, a detailed review of driver drowsiness detection techniques implemented in the smartphone has been reviewed. The review has also been focused on insight into recent and state-of-the-art techniques. The advantages and limitations of each have been summarized. A comparative study of recently implemented smartphone-based approaches and mostly used desktop-based approaches has also been discussed in this review paper. And the most important thing is this paper helps others to decide better techniques for the effective drowsiness detection. [2]

Ngxande, mkhuseli, jules-raymond tapamo, et.al,. The convolutional neural network (CNN) has rapidly gained popularity in many social aspects and has been applied across a range of areas, including self-driving cars, collision detection, identification of criminal activities, and to aid the granting of bank loans. Historically, these tasks were generally performed by humans, but the advancement of machine learning is leading to the automation of these processes. This work evaluates the performance obtained when training convolutional neural network models on commonly used driver drowsiness detection datasets and testing on datasets specifically chosen for broader representation. Results show that models trained using publicly available datasets suffer extensively from over-fitting, and can exhibit racial bias, as shown by testing on a more representative dataset. We propose a novel visualisation technique that can assist in identifying groups of people where there might be the potential of discrimination, using Principal Component Analysis (PCA) to produce a grid of faces sorted by similarity, and combining these with a model accuracy overlay. Drowsiness detection systems that are currently implemented are typically available only in high-end vehicles, which disadvantages citizens using public transport. As a result, a number of researchers have aimed to develop similar systems on mobile phones, which are more easily accessible. [3]

Gielen, jasper, and jean-marie aerts, et.al…In this work, the use of features extracted from distal skin temperatures and heart rate is tested for detecting drowsiness in driving simulations. In the first part of the analysis, we demonstrated that Tnose, Twrist, and HR vary throughout the measurement in a specific pattern in participants who became drowsy. Initially, the temperature measured at the nose and the wrist increased to a maximal value. Subsequently, a gradual decrease in these temperature variables was observed. When studying the heart rate of the driver throughout

each simulation, a significant decrease was observed in both drowsy and nondrowsy participants. However, the decreasing trend was more distinct in the group of drowsy drivers. Secondly, we showed that both populations of drivers (drowsy and non-drowsy) could be classified based on these observed trends in the data of Tnose, Twrist, and HR. Despite the simplicity of these classifications, their performance indicates the potential for future research. The main advantage of the applied methodology is that it is based on knowledge about physiological processes related to sleep onset. Specifically, heat loss via the extremities and controlling of the heart rate regulates the decrease in core body temperature before and during sleep. A secondary classification approach was tested by using the information of all three different variables at the same time. From this analysis, we conclude that including the heart rate in our classification approach does not improve the performance significantly. Lastly, the current results were compared to the state-of-the-art in drowsiness monitoring and several limitations and suggestions for future research have been discussed.[4]

Wijnands, jasper s, et.al… Driver drowsiness increases crash risk, leading to substantial road trauma each year. Drowsiness detection methods have received considerable attention, but few studies have investigated the implementation of a detection approach on a mobile phone. Phone applications reduce the need for specialised hardware and hence, enable a costeffective roll-out of the technology across the driving population. While it has been shown that three-dimensional (3D) operations are more suitable for spatiotemporal feature learning, current methods for drowsiness detection commonly use frame-based, multi-step approaches. However, computationally expensive techniques that achieve superior results on action recognition benchmarks (e.g. 3D convolutions, optical flow extraction) create bottlenecks for real-time, safety-critical applications on mobile devices. Here, we show how depth wise separable 3D convolutions, combined with an early fusion of spatial and temporal information, can achieve a balance between high prediction accuracy and real-time inference requirements. In particular, increased accuracy is achieved when assessment requires motion information, for example, when sunglasses conceal the eyes. Driver Drowsiness Detection dataset. Fine-tuning on large naturalistic driving datasets could further improve accuracy to obtain robust in-vehicle performance. Overall, our research is a step towards practical deep learning applications, potentially preventing micro-sleeps and reducing road trauma. [5]

3. EXISTING METHODOLOGIES

Real-time abnormal driving behaviours monitoring is a corner stone to improving driving safety. Existing works on driving behaviours monitoring using smartphones only provide a coarse-grained result, i.e. distinguishing abnormal driving behaviours from normal ones.

Detection using sensors:

To eliminate the need of pre-deployed infrastructures and additional hardware's, recent studies concentrate on using smartphones to detect abnormal driving behaviours. In particular, uses accelerometers, magnetometers and GPS sensors to determine whether high-risk motorcycle maneuvers or accidents occur and uses of accelerometers, gyroscopes and magnetometers to estimate a driver's driving style as Safe or Unsafe and usage of accelerometers to detect drunk driving and sudden driving maneuver, respectively. Therefore, none of existing works can realize fine-grained identification.

Detection using pre-deployed infrastructure:

Existing system uses an EGG equipment which samples the driver's EGG signals to detect drowsiness during car driving. This system uses infrared sensors monitoring the driver's head movement to detect drowsy driving and also GPS, cameras, alcohol sensor and accelerometer sensor are used to detect driver's status of drunk, fatigued, or reckless. However, the solutions all rely on pre-deployed infrastructures and additional hardware's that incur installation cost.

4. PROPOSED METHODOLOGIES

Driving at night has become a tricky situation with a lot of accidents and concerns for the transport authorities and common man especially because of the increasing heavy vehicle movement. The drivers are forced to drive with minimal rest which takes a toll on their driving capability after a few days of continuous driving leading to reduction in their reflexes and thus causing accidents. In most of the cases of accidents, fatigue is found to be the reason for nodding off. The term fatigue refers to a combination of symptoms such as impaired performance and a subjective feeling of drowsiness. Even with the intensive research that has been performed, the term fatigue still does not have a universally accepted definition. From the viewpoint of individual organ functionality, there are different kinds of fatigue, such as the following cases: 1) local physical fatigue (e.g., in a skeletal or ocular muscle); 2) general physical fatigue (following heavy manual labor); 3) central nervous fatigue (sleepiness); 4) mental fatigue (not having the energy to do anything). In this proposed system, we can implement the system for detecting the faces using Linear discriminate analysis and also track the eyes states with improved accuracy. In case of abnormal behaviour that is drivers eyes found to be closed as a corrective action alarm signal will be raised. The system enters into analysis stage after locating the driver's head and eyes properly in image captured through camera.

This image is then pre-processed using various Image Processing techniques for drowsiness detection. After pre-processing, facial features are extracted in both (Wearing mask and no mask) states. Eye features are detected based on inter and intra class variants for all peoples. Finally provide alert system in the form of voice, SMS and Email alert admin with face recognition.

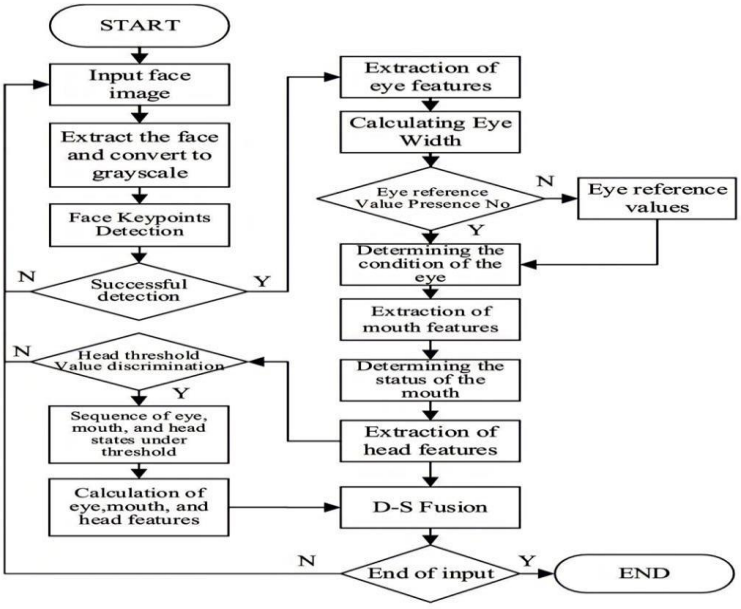

Fig 2 shows the proposed system architecture

The algorithm steps are follows:

Eye aspect ratio (EAR) is the ratio of eye width to eye length and can be used to measure the opening and closing of the eyes.
EAR value changes with the size of the eye; when the eye is open, EAR value is larger, and when the eye is closed, EAR value tends toward 0.
Firstly, the eye contour is located, and then the EAR value is calculated by the eye key point, and the eye state of the detected person is judged by the change in EAR value.
The positioning of the left eye key points are $p60-p67$
The formula for EAR calculation is as follows:

$$EAR=\frac{\|P61-P67\|+\|P63-P65\|}{2\|P60-P64\|}$$

From the equation, calculate the eye opening points and described in fig 3.

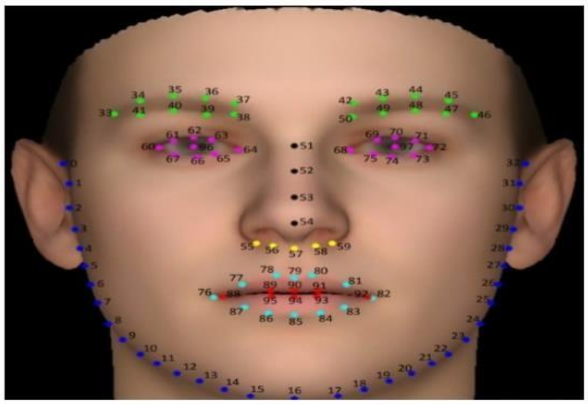

Fig 3: Facial features points

After multiple tests and data checks, it was found that detection accuracy and stability were higher when the EAR value was set to 0.15, so the threshold was set to 0.15. When EAR is less than
0.15, it can be judged that the eye's state is closed.

EXPERIMENTAL RESULTS

In this study we can develop the framework in Python as Front end and MYSQL as back end. Then using the real time face datasets to detect the eye-opening states. The performance can be evaluated in terms of False Rejection Rate. In the context of driver drowsiness detection systems, the false rejection rate (FRR) refers to the rate at which the system incorrectly identifies a non-drowsy driver as being drowsy. It's a critical metric because it directly impacts the effectiveness and reliability of the system in ensuring driver safety. A low FRR means that the system accurately detects drowsiness when it is present without unnecessarily alarming or inconveniencing the driver. High FRR values can lead to instances where drowsy drivers are not appropriately identified, potentially resulting in accidents or other safety hazards. Therefore, minimizing the FRR is essential for the overall performance and usability of driver drowsiness detection systems.

Fig 4: Drowsiness detection details

From fig 4 describes the proposed system provides low level false rejection rate in drowsiness detection in real time environments.

CONCLUSION

Drowsiness and fatigue of automobile drivers reduce the drivers' abilities of vehicle control, natural reflex, recognition and perception. Such diminished vigilance level of drivers is observed at night driving or overdriving, causing accident and pose severe threat to mankind and society. The proposed 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 HAAR Cascade algorithm, eyes are detected through proposed 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 distance is greater than threshold value, eyes are closed otherwise open. An alarm is triggered if eyes are found to be closed for consecutive frames. The proposed method was tested in video sequence recorded in vehicle as well as in lab environment. The proposed system works in real time with minimal computational complexity. Therefore, it is also suitable for implementing in surveillance environment. The system produces 90% accurate results for different faces.

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