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Accident Detection and Driver Drowsiness Detection System

Om Ashtekar[1], Atharva Ahire[2], Pooja Gaykwad[3], Saraswati Thorat[4], Dr. Nilesh Korade[5]

Department of Computer Engineering JSPM's Rajarshi Shahu Collage of Engineering Pune, India[1,2,3,4,5]

omashtekar5@gmail.com[1],ahireatharva3@gmail.com[2],poojagaykwad61@gmail.com[3],saraswatithorat2151@gmail.com[4],nbkorade_comp@jspmrscoe.edu.in[5]

Abstract: The fatigue state of the driver is one of the important factors that cause traffic accidents. Vision based facial expression recognition technique is the most prospective method to detect driver fatigue. Therefore, a system that can detect oncoming driver drowsiness and issue timely warning could help in preventing many accidents and consequently save money and reduce personal suffering. By mounting a small camera inside the car the face of driver can be monitored. Firstly the face is detected by using skin color algorithm and then eyes are detected by using Circular Hough transform. This paper describes a method to track the eyes and detect whether the eyes are closed or open. If the eyes are found closed for 8 consecutive frames, the system draws the conclusion that the driver is falling asleep and issues a warning signal. In this paper non-intrusive technique is used in which no sensors are used on vehicle part as well as on body of the driver which was used in intrusive technique cause irritation in long time driving. The designed system is working properly in diverse conditions such as changes in light, shadow, and slightly dark background. The system will records image of driver then face and eyes will be detected. Results of eyes detection, each frame value will be analyzed if eyes are closed for 4 seconds. If eyes close for 4 seconds then system will decide that driver is sleepy and alarm will sound. From the experiment, average result for detection is 954 ms, best position of camera is above the driver on the dashboard and for bright condition.

Keywords- Driver Fatigue, Face Detection, Eye Detection, Driver monitoring system, Drowsiness Detection

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I.INTRODUCTION:

Road accidents are a significant cause of fatalities worldwide, often resulting from driver fatigue, inattention, or external hazards. To mitigate these risks, the Accident Detection and Driver Drowsiness Detection System integrates modern technologies such as computer vision, machine learning, and IoT to enhance road safety.The Driver Drowsiness Detection component uses real-time monitoring of the driver's facial expressions, eye movements, and head posture to detect signs of fatigue or drowsiness. By utilizing cameras and artificial intelligence, the system can issue alerts to keep the driver awake and prevent potential mishaps.The Accident Detection System machine learning algorithms to identify sudden vehicle collisions or abnormal driving patterns. Once an accident is detected, the system can automatically send an emergency alert along with the vehicle's location to predefined contacts, emergency services, or hospitals, enabling faster response times and potentially saving lives.By combining both drowsiness and accident detection, this system serves as a proactive approach to reducing road accidents and ensuring driver safety.with the growing adoption of AI-driven safety measures, such intelligent systems are becoming essential components in modern automobiles, paving the way for smarter and safer transportation. Drowsiness related crashes. Lowering the number of drowsiness-related accidents would not only save society a significant amount financially, but also reduce personal suffering. The prevention of such accidents is a major focus of effort in the field of active safety research. Two main categories are image-based passive methods and classification using adaptive boosting. Image-based passive methods can be broadly classified in three categories: Template-based methods, appearance-based methods and feature-based methods. The template-based approaches make use of a designed generic model of the object of interest, and template matching is then used to search the image for that object. Feature-based methods explore the characteristics (such as edges, color distributions, etc.) of the object of interest in an image, to identify some distinctive features around that object. Drowsiness is the feeling of extreme tiredness or weakness that can make it difficult for a person to perform ordinary task. Fatigue affects everyone differently. Drivers themselves are often unaware of their own deteriorating condition or, even when they are aware, are often motivated to keep driving. In short, driving and similar tasks are often tolerant of brief lapses of alertness. Because human eyes express the most direct reaction when dozing, eye blinking is usually used as the basis for driver drowsiness detection by researchers. Color is known to be a useful cue to extract skin regions, and it is only available in color images . Using skin-color as a feature for tracking a face has several advantages. Color processing is much faster than processing other facial features. Tracking human faces using color as a feature has several problems like the color representation of a face obtained by a camera is influenced by many factors (ambient light, object movement, etc.), different cameras produce significantly different color values even for the same person under the same lighting conditions and skin color differs from person to person . A disadvantage of the color cue is its sensitivity to illumination changes and, especially in the case of RGB, sensitivity to illumination intensity. One way to increase tolerance toward intensity changes in images is to transform the RGB image into a color space whose intensity and chromaticity are separate and use only chromaticity part for detection. In fact, the eyes can be considered salient and relatively stable feature on the face in comparison with other facial features. Therefore, when we detect facial features, it is advantageous to detect eyes before the detection of other facial features.

II. LITERATURE SURVEY

Hamed Laouz, "Accident Detection Driver Drowsiness Detection System" [1] Traffic accidents always cause great material and human losses. One of the most important causes of these accidents is the human factor, which is usually caused by fatigue or drowsiness. To address this problem, several approaches were proposed to predict the driver state. Some solutions are based on the measurement of the driver behavior such as: the head movement, the duration of the blink of the eye, the observation of the mouth expression ... etc., while the others are based on the measurements of the physiological signals to get information about the internal state of the driver's body. These measurements are collected using different sensors such as Electrocardiogram (ECG), Electromyography (EMG), Electroencephalography (EEG), and Electrooculogram (EOG). In this paper, we presented a literature review on the recent related works in this field. In addition, we compared the methods used in each measurement approach. Finally, a detailed discussion according to the methods efficiency as well as the achieved results will be given.

Pranoto Hidaya Rusmin, "Design and Implementation of Driver Drowsiness Detection System on Digitalized Driver System", [2] In Indonesia, based on data from police, from the 2007-2010 at least 218 253 number of accidents occur. Approximately 65% of accidents occur due to human negligence. At the time of Eid 23 August to 7 September 2011, the number of accidents that occur most often caused by drowsy drivers (1,018 cases), followed by airworthiness vehicles (449 cases), roadworthiness (387 cases), and speed (155 cases). Drowsiness detection system created to reduce the risk of accident while driving. The system will records image of driver then face and eyes will be detected. Results of eyes detection, each frame value will be analyzed if eyes are closed for 4 seconds. If eyes close for 4 seconds then system will decide that driver is sleepy and alarm will sound. From the experiment, average result for detection is 954 ms, best position of camera is above the driver on the dashboard and for bright condition.

Mandalapu Sarada Devi, "Driver Drowsiness Detection

Using Skin Color Algorithm and Circular Hough Transform" [3] The fatigue state of the driver is one of the important factors that cause traffic accidents. Vision based facial expression recognition technique is the most prospective method to detect driver fatigue. Therefore, a system that can detect oncoming driver drowsiness and issue timely warning could help in preventing many accidents and consequently save money and reduce personal suffering. By mounting a small camera inside the car the face of driver can be monitored. Firstly the face is detected by using skin color algorithm and then eyes are detected by using Circular Hough transform. This paper describes a method to track the eyes and detect whether the eyes are closed or open. If the eyes are found closed for 8 consecutive frames, the system draws the conclusion that the driver is falling asleep and issues a warning signal. In this paper non-intrusive technique is used in which no sensors are used on vehicle part as well as on body of the driver which was used in intrusive technique cause irritation in long time driving. The designed system is working properly in diverse conditions such as changes in light, shadow, and slightly dark background.

Amin Azizi Suhaiman, "Development of an intelligent drowsiness detection system for drivers using image processing technique" [4] —Most traffic accidents are caused by negligence of the driver in managing rest time when driving; driver was sleepy and so could not control the vehicle. Therefore, it is necessary to have a device that can detect sleepiness and warn the driver beforehand so that the driver can avoid the accident. The development of this drowsiness detection system is using the heartbeat as a source of data to be retrieved using Photoplethysmography sensor. The system then classifies and determines the drowsiness level of the driver based on his/her heartbeat. This system uses Arduino Nano and Odroid XU4 as the processing unit and has LCD to display the output. The developed system has the success rate up to 96.52%. From this work, it has been proven that a person's sleep condition will affect the heart rate.

Zheren Ma1 , Brandon C. Li2 , and Zeyu Yan1 "Wearable Driver Drowsiness Detection Using Electrooculography Signal" [5] Every year, more than 100,000 automobile crashes are caused by driver drowsiness. Various technologies have been developed to address this issue, including vehicle-based measurements, behavior change detection, and physiological signal analysis. Both vehiclebased measurements and behavior change detection require bulky components. They also identify the driver's drowsiness too late for effective accident prevention. The physiological signal changes in an early stage and can be used to detect the on-set of driver drowsiness. In this paper, the development of a wearable drowsiness detection system is introduced. This system measures the electrooculography (EOG) signal; transmits the signal to a smartphone wirelessly; and could alarm the driver based on a prediction algorithm that can estimate 0.5-second-ahead EOG signal behavior. This system is compact, comfortable, and cost effective. The 0.5-secondahead estimation capability provides the critical time for a driver to correct the behavior, and ultimately saves lives.

Yunjia Lei Abdesselam Bouzerdoum, Erfan Gholizadehazari, "Instruction Set Extension of a RiscV Based SoC for Driver Drowsiness Detection" [6] This paper describes the design and implementation of a driver drowsiness detection (DDD) system using a modified RiscV processor on a field-programmable gate array (FPGA). To detect drowsiness, Convolutional Neural Network (CNN) is implemented on a RiscV processor. The CNN is trained to classify four primary driver's expressions, including distraction, natural, sleep, and yawn. The trained CNN accuracy is 81.07% on validation data. Furthermore, due to FPGA memory limitations, written C code for the trained CNN is optimized in numerous ways. Optimizations include the usage of dynamic fixed-point data types and dynamic memory allocations. On the other hand, the processor is modified by adding three custom instructions, including custom store, conv2d(2 × 2), and multiply and accumulation (MAC) to enhance the computation rate. As a result, the processor with custom store, conv2d(2 × 2), and MAC as custom instructions achieved the best result in terms of latency, with an improvement factor of 1.7 over the base processor and 1.25 over the processor with only custom store and multiply and accumulation (MAC) in exchange of slight increase in area.

Qianyang Zhuang, Zhang Kehua , Jiayi Wang, And Qianqian

Chen "Driver Fatigue Detection Method Based on Eye States With Pupil and Iris Segmentation" [7] Fatigue driving has become one of the most common causes for traffic accidents. In this article, we proposed an effective fatigue detection method based on eye status with pupil and iris segmentation. The segmented feature map can guide the detection to focus on pupil and iris. A streamlined network, consisting of a segmentation network and a decision network, is designed, which greatly improves the accuracy and generalization of eye openness estimation. Specifically, the segmentation network that uses light U-Net structure performs a pixel-level classification on the eye images, which can accurately extract pupil and iris features from the video's images. Then, the extracted feature map is used to guide the decision network to estimate eye openness. Finally, the detection method is test by the National Tsing Hua University Drowsy Driver Detection (NTHU-DDD) Video Dataset and the precision of fatigue detection achieves 96.72%. Experimental results demonstrate that the proposed method can accurately detect the driver fatigue in-time and possesses superior accuracy over the state- of-the-art techniques.

Chao Zhang1 , Xiaopei Wu 1 , Xi Zheng 2 , And Shui Yu, "Driver Drowsiness Detection Using Multi-Channel Second Order Blind Identifications" [8] It is well known that blink, yawn, and heart rate changes give clue about a human's mental state, such as drowsiness and fatigue. In this paper, image sequences, as the raw data, are captured from smart phones which serve as non-contact optical sensors.

Video streams containing subject's facial region are analyzed to identify the physiological sources that are mixed in each image. We then propose a method to extract blood volume pulse and eye blink and yawn signals as multiple independent sources simultaneously by multi-channel second-order blind identification (SOBI) without any other sophisticated processing, such as eye and mouth localizations. An overall decision is made by analyzing the separated source signals in parallel to determine the driver's driving state.

The robustness of the proposed method is tested under various illumination contexts and a variety of head motion modes. Experiments on

15 subjects show that the multi-channel SOBI presents a promising framework to accurately detect drowsiness by merging multi-physiological information in a less complex way.

I-Chen Sang And William R. Norris, "A Robust Lane Detection Algorithm Adaptable to Challenging Weather Conditions" [9] Driver assistance systems and autonomous vehicle navigation have become important topics in vehicular technology.

Among all of the functions, lane detection is one of the most important. A variety of approaches have been proposed in this field. While learning-based methods achieve impressive accuracy in detecting complex lane markings under clear daylight conditions, adapting these models to diverse weather conditions remains a challenge. On the other hand, geometric-based approaches require parameter tuning for different scenarios but require fewer computational resources.

A self-tuned algorithm with high generalizability across diverse weather conditions is proposed in this paper. The algorithm integrates fuzzy logic-based adaptive functions with edge identification and line detection modules, enabling image adjustments in response to challenging weather conditions.

The proposed tracking function utilizes previous detection results to fine-tune the selected Range of Interest (ROI), optimizing both accuracy and processing time. By incorporating these adaptive features into common geometric- based frameworks, the algorithm achieves higher detection rates compared to previous studies during challenging weather conditions.

Furthermore, the proposed work exhibits better generalizability and significantly shorter processing time when compared to state- of-the-art learning-based models, as demonstrated through extensive testing on multiple datasets.

Noor Jannah Zakaria 1, Mohd Ibrahim Shapiai , Rasli Abd Ghani1 , Mohd Najib Mohd Yassin, Mohd Zamri Ibrahim,

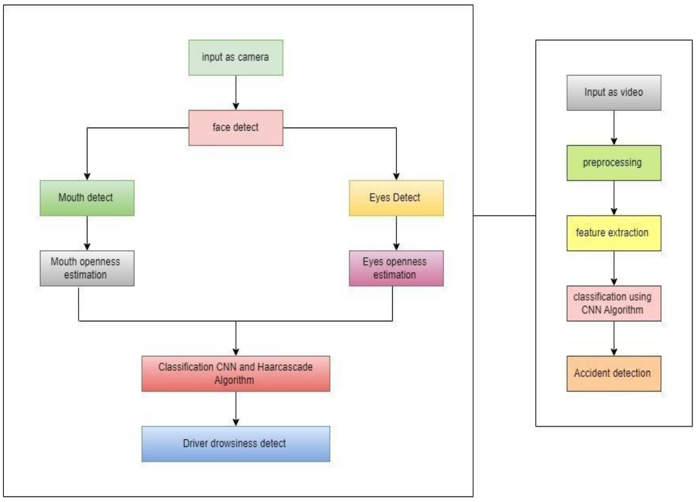
And Nurbaiti Wahid, "Driver Drowsiness Detection Based on Respiratory Signal Analysis" [10] Driver drowsiness is a major contributor to road traffic accidents.

A system capable of detecting drowsiness and consequently warning drivers at an early stage could significantly reduce the number of drowsiness-related road accidents. Although different measures can indicate driver drowsiness, eye activity measures are known to indicate drowsiness in the early stages.

This study systematically reviewed empirical studies (with reported performance measures) on driver drowsiness detection (DDD) systems that use eye activities to indicate drowsiness. The objective of this review was to provide researchers and practitioners with in-depth information on DDD systems based on eye activities.

Forty-one studies were identified using the preferred reporting items for systematic.

III. SYSTEM ARCHITECTURE



Description:

1. Preprocessing:

He system takes input from a camera. It detects the face of the driver. The system further detects the mouth and eyes separately. Mouth openness estimation and eyes openness estimation help determine drowsiness. CNN (Convolutional Neural Network) and Haar Cascade Algorithm are used for classification If drowsiness is detected, an alert can be generated to wake up the driver.

2. Feature Deletion:

In the field of image processing, feature extraction is the foundational step in identifying key visual elements from raw images or video data that can indicate the occurrence of a road accident. When a camera captures footage from a traffic surveillance system, a dashcam, or a mobile phone, the first step is to process those images to extract meaningful visual patterns that distinguish a normal driving scene from one involving a collision or crash.

3. Classification:

In image-based accident detection, classification is the process of automatically determining whether an image (or a sequence of video frames) represents an accident scene or a normal driving scene. This is done by using a trained machine learning (ML) or deep learning (DL).

4. Output

The system provides real-time monitoring and response mechanisms based on image processing, deep learning (CNN), and sensor data. The expected outputs include drowsiness alerts, accident detection notifications, and emergency response activation.

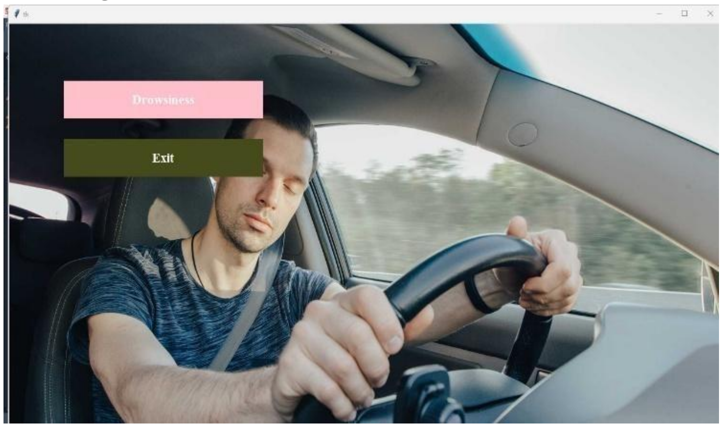
IV. METHODOLOGY

Convolutional Neural Networks (CNNs) are a type of deep learning model specifically designed for image recognition and classification. CNNs are widely used in computer vision applications, including driver drowsiness detection and accident detection. This methodology describes the use of Convolutional Neural Networks (CNN) and Haar Cascade Classifier for real- time accident detection and driver drowsiness detection. CNN is used for image classification, while Haar Cascade is used for object detection (face, eyes, and mouth).

Haar Cascade is a machine learning-based object detection method used for real-time face, eye, and mouth detection. It is based on Haar-like features, which are patterns of light and dark areas in an image. Haar Cascade is a machine learning-based object detection algorithm used to detect objects in images and videos. It is primarily used for face detection, eye detection, and object tracking in real-time applications. The algorithm works by identifying patterns in images using Haar-like features and classifying them using a cascade of classifiers.

V. RESULTS

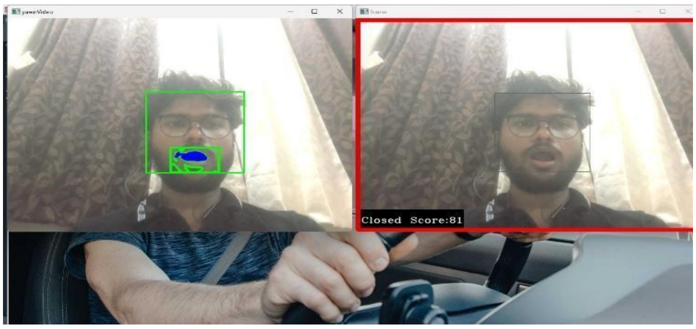
Main Page

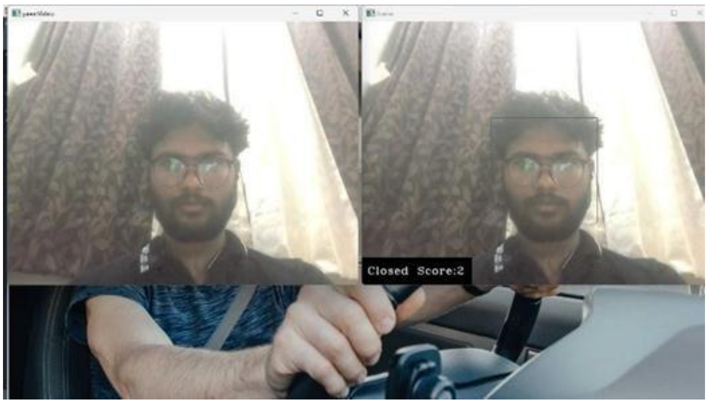


Login\Registration

Gui_Master

Driver Drowsiness Detect





VI. CONCLUSION

In this paper, we have presented a review on different measurement approaches of driver's drowsiness and fatigue detection systems. Then, we performed an analytical comparison of those approaches. We noticed that methods for measuring the driver behavior give high-resolution results in the case of good lighting but these results become less good in the light of night because it suffers from the detection of facial expressions. On the other hand, the physiological signal measurements give a stable result in most cases. The only drawback of this measure is that it is an intrusive method for the driver. Despite the difficulty of implementation and the requirements of much data to be collected for both measures. The hybrid metric appears promising to remedy the flaws of the two measures, and may yield impressive results.

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