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Drowsiness Alert System Using Machine Learning

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Abstract : Tiredness has been the significant cause of horrible accidents which is causing deaths and fatalities injuries. Intelligent vehicle systems could be used to detect when the person is drowsy. Here, we use a machine learning approach to see if the driver is tired. The procedure of locating the driver's eyes and determining whether they are open or closed is illustrated in this paper. The system operates by using data, obtained for the binary-formatted image to identify the face edges, which determines where a person's eyes may be exist. We provides a sleepy driver alert system that was created by evaluating the video stream process (VSP) using an inborn reflex construct that applies the geometrical distance of the attention and the eye aspect ratio (EAR). An algorithmic technique based on facial landmarks is also applied for reliable eye recognition. The module alerts the voice surveillance system and displays a warning message alongside the crash impact and site details when it detects driver drowsiness. The suggested work uses facial expressions to implement an emotion detection technique based on Support Vector Machines (SVM). The algorithm performed more accurately than existing research when tested in conditions of varying luminance.

Keywords - SVM,EAR,VSP.

1. INTRODUCTION

One of the biggest issues for road safety is drowsiness. Microsleep can often render drivers unconscious, which can result in catastrophic accidents. Tiredness, mental health issues, or insufficient sleep are the usual causes of falling asleep at the wheel. The UAE Ministry of Interior reported 2931 vehicle accidents in 2020. To 3488 records, the figure rose in 2021. Drowsiness, abrupt swerving, or failing to maintain a safe space between vehicles were the main causes of distracted driving in the majority of these traffic incidents . To plan and develop systems that can watch drivers and evaluate their degree of attention while driving, it is imperative in this situation to take advantage of emerging technology. Since this issue concerns many nations, academics from around the world have been working on developing. Systems called Driver sleepiness Detection (DDD) are able to identify the early warning indications of driver sleepiness. According to the literature, drowsiness detection systems can be grouped into three categories based on the measures that are used to detect the drowsiness signs, biological based, vehicle-based, and image-based systems. In the first category, biological-based measures rely on monitoring the body’s physiological signals including, Electro Encephalo Graphy(EEG), Electro Cardio Graphy(ECG),Electro Myo Graphy (EMG), Electro-OculoGraphy (EOG) signals, and blood pressure [6–9]. In this kind of system, drowsiness is identified by identifying the signal's departure from the properties of the standard state and determining if the new signal suggests tiredness. Vehicle-based metrics in the second category rely on tracking changes in the vehicle's movement.

2. PROBLEM STATEMENT

Developing a model Drowsiness Detection system that will focus on closely monitoring the driver's eyes in order to determine whether or not they are open for longer than a predetermined period of time. Frameworks for identifying flow sluggishness and assessing the driver's condition requires expensive equipment and intricate calculations; not comfortable to wear while driving is inappropriate for use when driving, such as Electroencephalography (EEG) and Electrocardiography (ECG), which is the process of identifying mental recurrence and calculating each person's heart rate independently. A framework for detecting driver laziness that uses a camera positioned in front of the driver is more suitable for use, but the indicators of languor itself should be identified initially in order to produce a sleepiness identification calculation that truly sturdy a precise camera setup, lightning speed and bearing in mind the driver's slanted facial expressions.

3. METHODOLOGY

The Driver Drowsiness system outlined in the provided description utilizes invasive machine vision-based techniques to monitor and detect signs of drowsiness in a driver. The foundation of this system lies in real-time video input captured through a webcam positioned in front of the driver's face. By leveraging the capabilities of OpenCV, a widely-used open-source computer vision library, the system first identifies the driver's face using advanced facial landmark detection, consisting of 68 distinct points on the face. This serves as the initial step in assessing the driver's state. Moving on, the system places particular emphasis on the driver's eyes, focusing on determining whether they are open or closed. Utilizing the facial landmarks, the Euclidean eye aspect ratio is computed. This ratio aids in distinguishing between open and closed eyes, a crucial parameter in assessing the driver's alertness. Additionally, the system employs PERCLOS (Percentage of Eyelid Closure Over the Pupil Over Time) analysis. PERCLOS is a metric that quantifies gradual eyelid closures over a specific duration, offering valuable insights into the driver's level of drowsiness. The core functionality of the system involves drowsiness detection and the subsequent activation of an alarm to alert the driver. If the system detects signs of drowsiness based on the analysis of eye closures or PERCLOS scoring, it promptly triggers an alarm. This alarm serves as a timely warning for the driver, prompting them to take immediate actions to combat drowsiness and maintain vigilance while driving, ultimately enhancing road safety. To implement these functionalities, the system leverages key Python libraries. OpenCV (CV2) plays a pivotal role in face and eye detection, as well as video analysis. The OS module facilitates seamless communication with operating system functions, contributing to the system's robustness. Keras, a high-level neural network library compatible with TensorFlow, is utilized to develop machine learning components essential for drowsiness detection. Lastly, NumPy is employed to effectively handle arrays and perform essential matrix and linear algebra operations, complementing the overall system architecture and enhancing its computational efficiency. In summary, this integrated approach involving computer vision techniques and machine learning components ensures a comprehensive and effective drowsiness detection system to enhance driver safety and reduce the risk of accidents due to drowsy driving.

3.1 SYSTEM SPECIFICATION

3.1.1 Hardware Specification

- 256 GB SSD
- CPU QUAD CORES

3.1.2 Software Specification and Packages/ Libraries Used

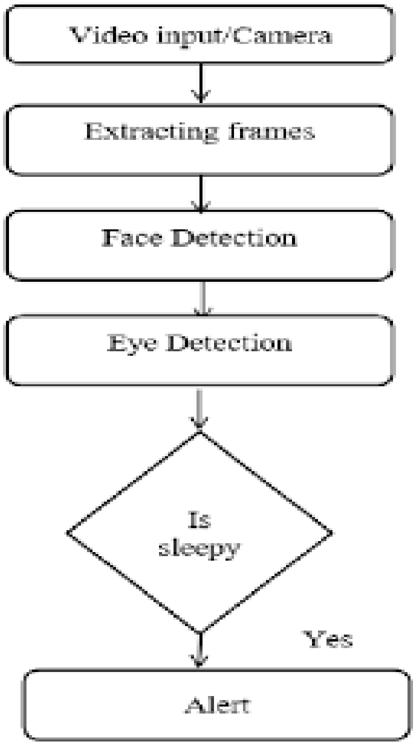
- Tensorflow
- Open CV
- Numpy
- Dlib
- Playsound
- Imutils
- Argparse
- time
- Python 3.7
- Anaconda
- Jupyter Notebook

3.2 DATASET

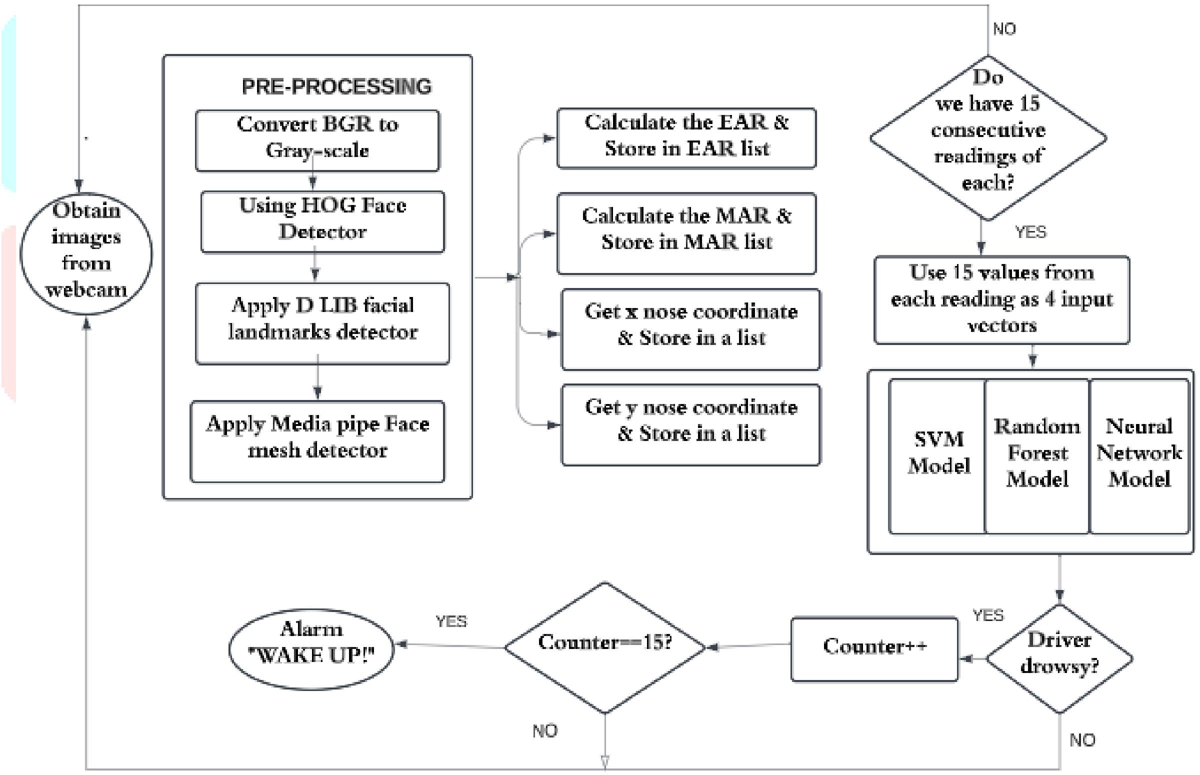
We have used kaggle dataset, Trained using machine learning algorithm. The data set has driver images, each taken in a car with a driver doing something in the car (texting, eating, talking on the phone, makeup, reaching behind, etc). This dataset is obtained from Kaggle. Both training and testing data. In training data we have both closed and open eye images. To train the data we have used 2000 closed eyes and 4000 open eyes images. Trained data has been tested with 1000 test images. The obtained dataset (DDD) has been used for training and testing CNN architecture for driver drowsiness detection in the Detection and Prediction of Driver Drowsiness for the Prevention of Road Accidents. Here we are using SVM classifier to get accurate results. Here we use image processing techniques to detect the drowsiness of a person.

4. MODULE DESCRIPTION

A drowsiness detection system is a sophisticated technology designed to enhance safety by monitoring the alertness of individuals, particularly drivers, and providing timely alerts in case of drowsiness. It encompasses several crucial modules, including image or video input, face detection, eye tracking, pupil monitoring, and blink rate analysis. These modules collectively assess the driver's condition, analyzing factors such as eye movement, pupil size, and head position to determine drowsiness. In addition, it integrates data from vehicle sensors to provide contextual information for accurate assessments. When drowsiness is detected, the system triggers alerts through audible, visual, or haptic means to prompt the driver to take necessary actions. It also offers data logging, reporting, and user-friendly interfaces, facilitating post-incident analysis and configuration. Furthermore, connectivity options enable integration with external systems for remote monitoring and management, making it a comprehensive solution for preventing accidents and enhancing road safety.



5. SYSTEM ARCHITECTURE



The system makes its initial determination of the driver's level of tiredness after 1 second of waiting for 15 feature vectors to fill the window and 15 classifier labels to be counted; this means that the initial determination necessitates the recording of 30 frames, from 15 to 30.15 labels should be used to populate the feature window. using the movable window as an example. The decisions made below, in contrast, are made virtually immediately. When. Whenever a new frame is captured, the feature window receives the matching feature vector. While the window's oldest feature vector is removed. In this instance, we currently a full window including the current (new) label, 14 prior labels, and 15 feature vectors. This corresponds to one frame's worth of time (1/30 s = 33 ms). A new choice necessitates the addition of one frame, lasting 33 milliseconds. So, taking into account that the pre-processing and classification times are brief, and our system's initial selection the subsequent decisions will be provided every 33 ms, showing that the first decision takes 1 s, whereas Response can be seen as real-time.

6. CONCLUSION AND FUTURE ENHANCEMENTS

6.1 Conclusion

A non-invasive system to localize the eyes and monitor fatigue was developed. Information about the eyes position is obtained through self-developed image processing algorithm. During the monitoring, the system is able to decide if the eyes are opened or closed An alert is sent out when the eyes are closed for an extended period of time. Furthermore, any eye localizing error that may have happened can also be automatically detected by the system while it is being monitored. In case of this type of error, the system is able to recover and properly localize the eyes. The following conclusions were made: Through image processing, drowsiness can be detected with extreme accuracy and consistency. An inconvenient and interference-free method of detecting drowsiness is provided by image processing. An image processing-based drowsiness detection system assesses a driver's level of alertness by tracking their continuous eye closures.

6.2 Future Enhancements

The future scope for tiredness sensing application is promising and can extend to various areas like workplace safety where the alarm can be incorporated into their workstations or gear, in healthcare to monitor patient's alertness level, in military and defense to ensure readiness and safety of military personnel, in consumer wearables to develop fatigue tracking features in smart watches and fitness bands for everyday users and in public safety by incorporating these sensors in public transportation systems to prevent accidents caused by tired operators.

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