JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Automated Driver's Drowsiness Detection System

[1]Manila Gupta, [2]Rayyan Lambe, [3]Muskan Khan, [4]Abdul Hadi Khan

[2-4]Students, [1]Assistant Professor

[1-4]Department of Computer Engineering,

[1]Rizvi College of Engineering, Mumbai, India

Abstract: The "Automated Drivers Drowsiness Detection System" project aims to develop a system that can automatically detect drowsiness in drivers to enhance road safety. The system will utilize various sensors, such as cameras and physiological sensors, to monitor driver behavior and vital signs. Through real-time data analysis, it will identify signs of drowsiness, such as yawning, drooping eyelids, and changes in heart rate, and trigger alerts or interventions to keep the driver awake and alert. This project addresses a critical issue in road safety by leveraging technology to reduce the risk of accidents caused by drowsy driving.

1. INTRODUCTION

The "Automated Drivers Drowsiness Detection System" is a groundbreaking project that aims to revolutionize road safety measures. It addresses the critical issue of driver fatigue, a leading cause of road accidents worldwide. This system is designed to monitor, detect, and alert drivers of their drowsiness levels in real-time, thereby significantly reducing the risk of accidents caused by drowsy driving.

The system employs state-of-the-art technology and machine learning algorithms to analyze various physiological and behavioral indicators of drowsiness. These include eye movement patterns, facial expressions, and steering behavior. The system's ability to adapt to individual drivers and function effectively under diverse driving conditions sets it apart from existing solutions.

With its user-friendly interface providing immediate visual and auditory alerts, drivers can take timely corrective actions, ensuring their safety and that of others on the road. The potential applications of this system extend beyond road safety, with possibilities in professional driver training and integration with existing vehicle safety systems.

2. Methodology:

2.1. The different types of methodologies have been developed to find out drowsiness.

2.1.1. Physiological level approach: This technique is an intrusive method wherein electrodes are used to obtain pulse rate, heart rate and brain activity information. ECG is used to calculate the variations in heart rate and detect different conditions for drowsiness. The correlation between different signals such as ecg (electrocardiogram), EEG (electroencephalogram), and EMG (electromyogram) are made and then the output is generated whether the person is drowsy or not.

2.1.2 Behavioral based approach: In this technique eye blinking frequency, head pose, etc. of a person is monitored through a camera and the person is alerted if any of these drowsiness symptoms are detected.

2.2. The various technology that can be used are discussed as:

2.2.1 TensorFlow: IT is an open-source software library for dataflow programming across a range of tasks. It is a symbolic math library, and is also used for machine learning applications such as neural networks. It is used for both research and production.

TensorFlow computations are expressed as stateful dataflow graphs. The name TensorFlow derives from the operations that such neural networks perform on multidimensional data arrays. These arrays are referred to as "tensors".

2.2.2 Machine learning: Machine learning is the kind of programming which gives computers the capability to automatically learn from data without being explicitly programmed. This means in other words that these programs change their behavior by learning from data. Python is clearly one of the best languages for machine learning. Python does contain special libraries for machine learning namely scipy, pandas and numpy which great for linear algebra and getting to know kernel methods of machine learning. The language is great to use when working with machine learning algorithms and has easy syntax relatively.

2.2.3 OpenCV: OpenCV stands for Open Source Computer Vision. It's an Open Source BSD licensed library that includes hundreds of advanced Computer Vision algorithms that are optimized to use hardware acceleration. OpenCV is commonly used for machine learning, 4 image processing, image manipulation, and much more. OpenCV has a modular structure. There are shared and static libraries and a CV Namespace.

In short, OpenCV is used in our application to easily load bitmap files that contain landscaping pictures and perform a blend operation between two pictures so that one picture can be seen in the background of another picture. This image manipulation is easily performed in a few lines of code using OpenCV versus other methods. OpenCV.org is a must if you want to explore and dive deeper into image processing and machine learning in general.

2.2.4) Kivy: Kivy is an open source Python library for developing mobile apps and other multitouch application software with a natural user interface (NUI). It can run on Android, iOS, Linux, OS X, and Windows. Distributed under the terms of the MIT license, Kivy is free and open source software. Kivy is the main framework developed by the Kivy organization, alongside Python for Android, Kivy iOS, and several other libraries meant to be used on all platforms.

3. System Description:

3.1. Face Detection: For the face Detection it uses Haar feature-based cascade classifiers is an effective object detection method proposed by Paul Viola and Michael Jones in their paper, "Rapid Object Detection using a Boosted Cascade of Simple Features" in 2001. It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images.

Here we will work with face detection. Initially, the algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. Then we need to extract features from it. For this, Haar features shown in the below image are used. They are just like our convolutional kernel. Each feature is a single value obtained by subtracting sum of pixels under the white rectangle from sum of pixels under the black rectangle. Fig. 3.4 represents five haar like features & example is shown in Fig.3.5

Fig. 3.4

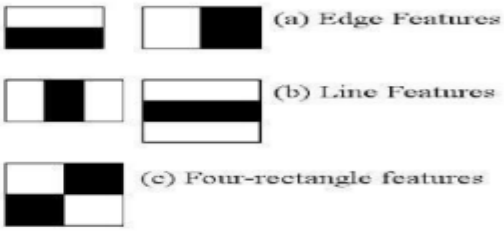

Fig. 3.5

A cascaded Adaboost classifier with the Haar-like features is exploited to find out the face region. First, the compensated image is segmented into numbers of rectangle areas, at any position and scale within the original image. Due to the difference of facial feature, Haar-like feature is efficient for real-time face detection. These can be calculated according to the difference of sum of pixel values within rectangle areas. The features can be represented by the different composition of the black region and white region. A cascaded Adaboost classifier is a strong classifier which is a combination of several weak classifiers. Each weak classifier is trained by Adaboost algorithm. If a candidate sample passes through the cascaded Adaboost classifier, the face region can be found. Almost all of face samples can pass through and nonface samples can be rejected

3.2. Eye detection: In the system we have used facial landmark prediction for eye detection Facial landmarks are used to localize and represent salient regions of the face, such as:

- Eyes
- Eyebrows
- Nose
- Mouth
- Jawline

Facial landmarks have been successfully applied to face alignment, head pose estimation, face swapping, blink detection and much more. In the context of facial landmarks, our goal is detecting important facial structures on the face using shape prediction methods. Detecting facial landmarks is therefore a twostep process:

- Localize the face in the image.
- Detect the key facial structures on the face ROI.

3.3. Recognition of Eye's State: The eye area can be estimated from optical flow, by sparse tracking or by frame-to-frame intensity differencing and adaptive thresholding. And Finally, a decision is made whether the eyes are or are not covered by eyelids. A different approach is to infer the state of the eye opening from a single image, as e.g. by correlation matching with open and closed eye templates, a heuristic horizontal or vertical image intensity projection over the eye region, a parametric model fitting to find the eyelids, or active shape models. A major drawback of the previous approaches is that they usually implicitly impose too strong requirements on the setup, in the sense of a relative face-camera pose (head orientation), image resolution, illumination, motion dynamics, etc. Especially the heuristic methods that use raw image intensity are likely to be very sensitive despite their real-time performance. Therefore, we propose a simple but efficient algorithm to detect eye blinks by using a recent facial landmark detector. A single scalar quantity that reflects a level of the eye opening is derived from the landmarks. Finally, having a per-frame sequence of the eye-opening estimates, the eye blinks are found by an SVM classifier that is trained on examples of blinking and nonblinking patterns.

3.4. Eye State Determination: Finally, the decision for the eye state is made based on EAR calculated in the previous step. If the distance is zero or is close to zero, the eye state is classified as “closed” otherwise the eye state is identified as “open”.

3.5. Drowsiness Detection: The last step of the algorithm is to determine the person's condition based on a pre-set condition for drowsiness. The average blink duration of a person is 100-400 milliseconds (i.e. 0.1-0.4 of a second). Hence if a person is drowsy his eye closure must be beyond this interval. We set a time frame of 5 seconds. If the eyes remain closed for five or more seconds, drowsiness is detected and alert pop regarding this is triggered.

4. Results and Discussions:

Implementation of drowsiness detection with Java and OpenCV was done which includes the following steps: Successful runtime capturing of video with camera. Captured video was divided into frames and each frame were analyzed. Successful detection of face followed by detection of eye. If closure of eye for successive frames were detected, then it is classified as drowsy condition else it is regarded as normal blink and the loop of capturing image and analyzing the state of driver is carried out again and again. In this implementation during the drowsy state the eye is not surrounded by circle or it is not detected, and corresponding message is shown.

4.1. Future Work: Our model is designed for detection of drowsy state of eye and give and alert signal or warning in the form of audio alarm. But the response of driver after being warned may not be enough to stop causing the accident meaning that if the driver is slow in responding towards the warning signal then accident may occur. Hence to avoid this we can design and fit a motor driven system and synchronize it with the warning signal so that the vehicle will slow down after getting the warning signal automatically.

5. Conclusion:

In summary, the Automated Driver Drowsiness Detection System is a groundbreaking project that aims to enhance road safety by using advanced technology to combat the dangers of drowsy driving. Through the integration of image processing, facial recognition, machine learning algorithms, and real-time alert systems, this system can detect signs of driver drowsiness and provide timely warnings, potentially saving countless lives and reducing the risk of accidents. It's a testament to the collaborative effort of a diverse team with various skills, highlighting the importance of technology in conjunction with driver education and responsible driving habits.

However, while this system is a significant step forward, it is important to emphasize that technology alone cannot entirely eliminate the problem of drowsy driving. Driver awareness, education, and responsible driving practices remain critical factors in ensuring road safety. The ongoing development and improvement of this system, along with efforts to establish industry standards and regulations, can collectively contribute to a future where drowsy driving is no longer a leading cause of accidents, making our roads safer for everyone.