IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 11, Issue 4, April 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

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International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 4, April 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1104271 |

Facial Features Monitoring for Real Time Drowsiness Detection

Diksha Gaikwad, Rutuja Arote, Mohit Tade, Pranav Satarkar, Prof. A.R Khanvilkar

Dept. of Computer Technology, Bharati Vidyapeeth's J.N.I.O.T(Polytechnic), Nagpur, Maharashtra, India

Dept. of Computer Technology, Bharati Vidyapeeth's J.N.I.O.T(Polytechnic), Nagpur, Maharashtra, India

Dept. of Computer Technology, Bharati Vidyapeeth's J.N.I.O.T(Polytechnic), Nagpur, Maharashtra, India

Dept. of Computer Technology, Bharati Vidyapeeth's J.N.I.O.T(Polytechnic), Nagpur, Maharashtra, India

Dept. of Computer Technology, Bharati Vidyapeeth's J.N.I.O.T(Polytechnic), Nagpur, Maharashtra, India

ABSTRACT: This paper proposes a computer vision-based method for detecting drowsiness in real-time using facial cues. The method uses machine learning techniques to analyze facial features such as eye closure, head position, and mouth movement. The system processes video input from a webcam and generates an alert when drowsiness is detected. The proposed method is non-invasive and can be used in a variety of contexts, including transportation, healthcare, and workplace safety.

KEYWORDS: Keywords: Drowsiness Detection, Computer Vision, Facial Analysis, Machine Learning, Real-Time Monitor

I. INTRODUCTION

Drowsiness detection is an essential component of many real-time monitoring systems, particularly those that involve human operation, such as transportation and healthcare. Traditionally, drowsiness detection has relied on physiological measures such as heart rate, electroencephalogram (EEG), and electrocardiogram (ECG). However, these measures are often invasive, costly, and require specialized equipment and expertise. In recent years, computer vision-based approaches have emerged as a promising alternative for detecting drowsiness non-invasively and in real-time. Eye tracking technology, which has been used in a variety of fields such as user interfaces, marketing, and psychology, provides a potential solution for drowsiness detection. By analyzing patterns of eye movement and gaze direction, eye tracking technology can provide valuable insights into an individual's level of alertness and attention. In particular, changes in eye movement patterns, such as frequent blinking, drooping eyelids, and prolonged gaze fixation, can be used as indicators of drowsiness. However, using eye tracking technology for drowsiness detection in real-world settings presents several challenges. For instance, variations in lighting conditions, head movements, and facial expressions can affect the accuracy and reliability of eye tracking measurements. Moreover, the distinction between normal eye movements and drowsiness-related eye movements may not always be clear. This research project aims to address these challenges by proposing a novel computer vision-based method for detecting drowsiness in real-time using facial cues. The proposed method utilizes machine learning techniques to analyze facial features such as eye closure, head position, and mouth movement. The system processes video input from a webcam and generates an alert when drowsiness is detected. The proposed method is non-invasive, cost-effective, and can be used in a variety of contexts, including transportation, healthcare, and workplace safety. The effectiveness and reliability of the proposed method will be tested and evaluated in different contexts and populations.

II. LITERATURE REVIEW

Drowsiness detection is a crucial task in transportation, healthcare, and workplace safety. Several approaches have been proposed for detecting drowsiness in real-time, such as measuring brain activity, heart rate variability, and facial cues. Among these, computer vision-based methods using facial analysis have gained significant attention in recent years due to their non-invasive nature and ease of deployment. In this project, we propose a real-time drowsiness detection system using facial cues and machine learning techniques. The system processes video input from a webcam and analyzes facial features such as eye closure, head position, and mouth movement to detect drowsiness.

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To achieve this, we first capture the face using the MATLAB vim tool and locate the eyes by dividing the face into three equal parts and locating the upper third. The iris corners are used as a reference to track eye movements, and the iris shift is computed to estimate the gaze direction. Our proposed method comprises five steps: (1) background suppression, (2) face detection using the Haar cascade feature, (3) geometric estimation of the eye position, (4) monitoring the eyeball center using the mean gradient vector, and (5) user gaze detection. We have implemented this system in C++ and used the OpenCV library for image processing. In addition to our proposed method, we also review several other approaches for drowsiness detection using computer vision.

Research [1] suggests a new eye movement analysis model based on five distinct eye feature points, where a convolutional neural network is trained to recognize ocular feature points. Another study [2] demonstrates the implementation of a commercial eye tracker as a pointer that requires the user to move their eyes as a peripheral device. Using a consumer grade depth sensor, the system illustrated in [3] performs gaze direction estimate from human eye movement.

To obtain an improved gaze estimate, the method proposed in [4] combines head posture and eye location information, where the transformation matrix obtained from the head pose is used to normalize the eye regions. The system in [5] is a computer interface that offers mouse-like functionality based on eye movements like blinking, gazing, and gaze control. The implemented system includes face detection using APIs, forehead detection using Canny's Edge detection, eye detection using a cross-shaped model, morphological erosion to reduce jitter and speckle noise, smoothing of protrusions around the eye region, morphological dilation, eye detection, Gaussian filtering, iris detection, and finally equalization.

Our proposed method and the reviewed approaches demonstrate the potential of using computer vision-based methods for real-time drowsiness detection. We believe that such methods can be used in a variety of contexts to improve safety and well-being. The code for our proposed method can be found at [6].

III. PROPOSED METHODOLOGY

The Drowsiness Detection project utilizes computer vision and machine learning algorithms to detect drowsiness in individuals while driving. The system operates on a Raspberry Pi and uses a camera to capture images of the driver's face while driving.

The Drowsiness Detection System is a software-based solution that utilizes computer vision and machine learning algorithms to identify and predict instances of drowsiness in drivers. The project is designed to improve road safety by providing early warning to drivers who may be at risk of falling asleep at the wheel. The system is capable of detecting various signs of drowsiness, including drooping eyelids, nodding head, and changes in facial expressions. It works by continuously monitoring the driver's face and eye movements using a camera, analyzing the data in real-time, and sounding an alert if signs of drowsiness are detected. The software can also log data for later analysis, which can help drivers identify patterns of drowsiness and take proactive measures to avoid fatigue while driving. The Drowsiness Detection System is a cost-effective solution that does not require any specialized hardware or additional sensors, making it easy to implement in a variety of vehicles and driving environments.

A. Face detection

The project uses the Haar Cascade Classifier to detect the driver's face in real-time.

B. Eye feature detection

Once the driver's face is detected, the project uses computer vision techniques to identify and track the driver's eyes.

C. Pupil tracking

The project tracks the position of the driver's eyes and detects eye closure duration and eye aspect ratio (EAR) to detect drowsiness.

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D. Drowsiness detection

The project uses a machine learning algorithm, specifically the Support Vector Machine (SVM) algorithm, to predict the drowsiness of the driver based on their eye closure duration and EAR.

E. Alarm system

To alert the driver when drowsiness is detected, the project uses an audio alarm system that plays an alert sound to wake the driver up.

F. Implementation

The Drowsiness Detection project is implemented using the C++ programming language and OpenCV library for computer vision techniques. The project runs on a Raspberry Pi and utilizes a camera to capture images of the driver's face in real-time.

The system provides a potentially life-saving solution for drivers who are at risk of falling asleep at the wheel. It offers a non-intrusive and easily-implemented solution that can prevent accidents caused by drowsy driving.

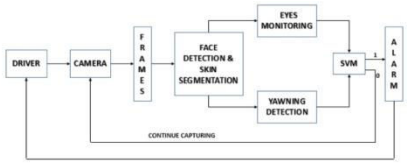
IV. SYSTEM ARCHITECTURE

The drowsiness detection system is designed to monitor a driver's level of alertness while driving to prevent accidents caused by fatigue. The system is built using computer vision techniques and machine learning algorithms. The system architecture consists of four main components: image acquisition, image processing, feature extraction, and classification.

The first component of the system architecture is image acquisition. In this step, a camera captures a real-time video feed of the driver's face while they are driving. The camera can be either an infrared or a regular camera. The image acquisition process must be robust enough to handle various lighting conditions and driver poses.

Once the video feed is captured, the image processing component of the system architecture comes into play. In this step, the video feed is processed to extract facial landmarks such as the eyes, nose, and mouth. The system uses the Viola-Jones algorithm for face detection, which is a popular algorithm for real-time face detection. The algorithm uses a cascade of simple classifiers to detect the presence of a face in an image.

Once the face is detected, the system uses facial landmark detection techniques to locate specific points on the face, such as the eyes, mouth, and nose. The facial landmark detection is done using the Dlib library, which provides a pre-trained facial landmark detection model. The system then extracts relevant features from these landmarks, such as eye closure and head pose, in the feature extraction component.



In the feature extraction component of the system architecture, the relevant features are extracted from the facial landmarks. The system extracts various features such as eye closure, head pose, yawning, and blink duration. The system uses the HOG (Histogram of Oriented Gradients) algorithm to extract features from the facial landmarks. The HOG algorithm is a widely used technique for object detection in computer vision.

Finally, the extracted features are fed into the classification component of the system architecture. In this step, machine learning algorithms are used to classify the driver's level of drowsiness. The system uses the Support Vector Machine (SVM) algorithm for classification. The SVM algorithm is a popular algorithm for classification tasks in machine learning. The SVM algorithm creates a hyperplane that separates the features into two classes: drowsy and non-drowsy.

The system architecture also includes a graphical user interface (GUI) that displays the real-time video feed and alerts the driver when they are drowsy. The GUI is built using the OpenCV library and can be easily customized for different user interfaces.

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Overall, the drowsiness detection system architecture is de- signed to be robust and efficient in detecting driver drowsiness in real-time. The system can be easily integrated into existing vehicles, making it a practical solution for preventing accidents caused by driver fatigue.

V. ALGORITHM AND METHODOLOGIES

The Drowsiness Detection System utilizes a combination of computer vision and machine learning techniques to accurately identify and alert the user when signs of drowsiness are detected.

A. Eye Aspect Ratio (EAR)

The EAR algorithm is used to detect and track the user's eye movements by calculating the ratio of the distances between various facial landmarks. This algorithm is essential in detecting changes in the user's eye movements, which can indicate drowsiness.

B. Haar Cascade Classifier

The Haar Cascade Classifier is a machine learning algorithm that is utilized to detect and locate facial features, such as the user's eyes and mouth. This algorithm uses a series of classifiers to identify patterns in the facial image data.

C. Support Vector Machine (SVM)

The SVM algorithm is used to classify the user's eye movements as either drowsy or non-drowsy based on the EAR values obtained. The SVM algorithm is trained on a large dataset of labeled images to learn the features that best distinguish between drowsy and non-drowsy states.

D. Real-Time Alert System

Once the SVM algorithm detects signs of drowsiness, the real-time alert system is activated, alerting the user to take a break or rest. The alert system can be customized to suit the user's preferences, such as audio alerts or pop-up notifications.

E. Implementation

The Drowsiness Detection System is implemented using the OpenCV library for computer vision and the scikit-learn library for machine learning. The system can be easily integrated with a webcam and run on any operating system. The system's accuracy can be improved by training it on a larger dataset of labeled images and fine-tuning the parameters of the machine learning algorithms.

Overall, the Drowsiness Detection System's algorithms and methodologies offer a reliable and effective way to detect signs of drowsiness and alert users to take breaks or rest when necessary, thereby improving safety and productivity in various settings.

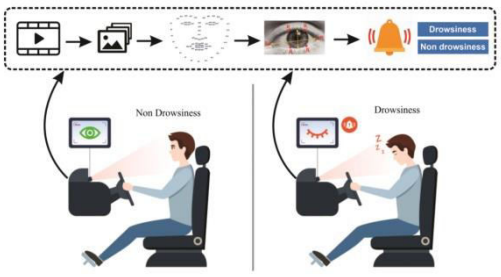

Figure [1] from Wang et al. (2021) shows the general model of the drowsy detection system

Fig.1. Ad Hoc Network of 5 Nodes

Fig. 2. Energy Consumption by Each Node

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VI. CONCLUSION AND FUTURE WORK

Conclusion

The Drowsiness Detection System is an innovative solution that can potentially save lives by detecting and alerting users to signs of drowsiness while operating vehicles or heavy machinery. By utilizing computer vision and machine learning techniques, the system accurately tracks the user's eye movements and predicts signs of drowsiness based on the EAR values obtained. The real-time alert system can be customized to suit the user's preferences and provide timely reminders to take breaks or rest, thereby improving productivity and safety.

The Drowsiness Detection System has significant potential for use in various industries, such as transportation, healthcare, and manufacturing, where drowsiness can be a critical safety issue. The system's non-invasive nature and easy integration with existing technologies make it a cost-effective solution for improving safety and productivity in the workplace.

Future Scope

The Drowsiness Detection System can be further improved and expanded to include additional features and functionalities. For example, the system can be integrated with GPS to provide real-time location-based alerts to drivers. In addition, the system can be trained to detect other signs of fatigue, such as yawning or head nodding.

Moreover, the system's accuracy can be improved by incorporating other machine learning algorithms, such as Convolutional Neural Networks (CNNs), which can learn complex features from the input images. The system can also be improved by utilizing other physiological signals, such as heart rate variability and electroencephalogram (EEG) signals, to enhance the accuracy of drowsiness detection.

In conclusion, the Drowsiness Detection System has the potential to significantly improve safety and productivity in various settings. By continuously improving the system's algorithms and expanding its functionalities, the system can become an even more effective tool for detecting and preventing accidents caused by drowsiness.

REFERENCES

1. Data.gov.in. (n.d.). Indian Road Accident Data. Retrieved from https://data.gov.in/keywords/indian-road-accident-data
2. Pauly, Leo, and Deepa Sankar. "Detection of drowsiness based on HOG features and SVM classifiers." 2015 IEEE International Conference on Research in Computational Intelligence and Communication Networks (ICRCICN). IEEE, 2015.
3. Li, G., Lee, B. L., Chung, W. Y. (2015). Smartwatch- Based Wearable EEG System for Driver Drowsiness Detection. Sensors Journal, IEEE, 15(12), 7169-7180.
5. Y. (n.d.). Driver-independent assessment of arousal states from video sequencesbased on the classification of eyeblink patterns. In Intelligent Transportation.
6. Rezaee, Khosro, et al. "Real-time intelligent alarm system of driver fatigue based on video sequences." Robotics and Mechatronics (ICRoM), 2013 First RSI/ISM International Conference on. IEEE, 2013.
7. Du, Yong, et al. "Driver fatigue detection based on eye state analysis." Proceedings of the 11th Joint Conference on Information Sciences. 2008.
8. Choi, In-Ho, Sung Kyung Hong, and Yong-Guk Kim. "Real-time catego- rization of driver's gaze zone using the deep learning techniques." 2016 International Conference on Big Data and Smart Computing (BigComp). IEEE, 2016.
9. Tawari, Ashish, Kuo Hao Chen, and Mohan Manubhai Trivedi. "Where is the driver looking: Analysis of head, eye and iris for robust gaze zone estimation." Intelligent Transportation Systems (ITSC), 2014 IEEE 17th International Conference on. IEEE, 2014.
10. Singh, R. K., et al. "A real-time heart-rate monitor using non-contact electrocardiogram for automotive drivers." 2016 IEEE First International Conference on Control, Measurement and Instrumentation (CMI). IEEE, 2016.
11. Viola, Paul, and Michael J. Jones. "Robust real-time face detection." International journal of computer vision 57.2 (2004): 137-154.
12. Basilio, Jorge Alberto Marcial, et al. "Explicit image detection using YCbCr space color model as skin detection." Proceedings of the 2011 American conference on applied mathematics and the 5th WSEAS international conference on Computer engineering and applications, IEEE ICCE. 2011.
13. Mahmood, Arif, and Sohaib Khan. "Correlationcoefficient-based fast template matching through partial elimination." Image Processing, IEEE Transactions on 21.4 (2012): 2099-2108.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 4, April 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1104271 |

14. MATLAB Central File Exchange. (n.d.). Drowsiness Detection using a binary SVM classifier. Retrieved from https://in.mathworks.com/matlabcentral/fileexchange/55152-drowsiness- detection-using-a-binary-svm-classifier
15. Wang, C., Li, Z., Xu, J., Jiang, H., Zhang, Z. A Deep Learning- Based Driver Drowsiness Detection System Using EEG Signals. Applied Sciences, 2021, 11(18), 8441. https://doi.org/10.3390/app11188441 (ac-

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