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Driver Drowsiness Detection using Haar-Cascade Face Detection Method with Visual Behaviour

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ABSTRACT

Drowsy driving is a contributing factor in majority of the car accidents occurring across the world. As a result, the most important approach for preventing these accidents is driver sleepiness detection, which can help us to reduce many road accidents. The goal of this project is to create a Sleepiness Detection System that detects whether a driver's eyes are closed for a few seconds, and then alerts the driver via an alarm. In this project, deep learning is used to suggest a new frame that classifies the driver's eye condition, i.e. open or closed. When a driver is determined to be sleepy, the proposed system sounds a beep on reaching a certain saturation point of the drowsiness measure. The proposed work is evaluated on Images of eye dataset consisting of images and it shows an accuracy of percent using CNN model.

Keywords: Driver Drowsiness, Eye Detection, Alert Alarm, Features Extraction.

INTRODUCTION

Every human being needs sleep; lack of sleep causes inactivity, improper reflexes, loss of focus, and deviation, which decreases the capability to make proper decisions, especially when driving a vehicle. According to WHO records, approximately 1.25 million people are injured or killed in accidents each year. Some of these accidents result from neglecting traffic rules, such as overspeeding, disregarding signals, and lane violations, while others are due to technical issues like brake failures and tire problems. To mitigate these issues, our project focuses on a solution to reduce fatal cases by providing a smart drowsiness detection system. In this system, the driver is continuously monitored through a webcam. The model employs image processing techniques, primarily focusing on the driver's face and eyes. It extracts the driver's face and predicts eye blinking from the eye region. An algorithm is used to track and analyze the driver's face and eyes to measure PERCLOS (Percentage of Eye Closure). If the blinking rate is high, the system alerts the driver with a sound.

RELATED WORK

The percentage of road accidents caused by driver distraction tops the list. Among the many causes of driver crashes, fatigue, fatigue from fatigue is the most common cause. Many studies have been conducted to explore fatigue with the use of tools, behavioural and biological services. To solve this problem, many systems use automotive components, bio-signal technology, machine learning and computer vision. A method by Kyong Hee Lee et al. It turns out that it is possible to determine how long a driver slept by removing his face. Image data from NTHU-DDD was used to test this method. Head posture, blinking, and mouth posture are considered characteristic. The angle of the driver's head helps determine the yaw and pitch angle. PERCLOS is used for flashing. The FACS unit is used to monitor yawning. The face is detected on the screen and displayed on the screen without all other perceptions such as yawning, winking, head yawning and voice angle. Timing for each character. If the parameter value exceeds the threshold, drowsiness is said to be detected. The second approach includes behavioural testing and machine learning techniques to improve the system. This system was proposed by Mkhuseli Ngxande et al. Machine learning techniques such as support vector machines, convolutional neural networks, and latent Markov models are used to measure behaviours such as blinking, yawning, and head movement. Use all three machine learning methods and evaluate the results. The support vector machine method has the highest accuracy, but similar to the latent Markov model, it is costly and the accuracy is second only to the support vector machine. Convolutional neural network methods provide high accuracy at low cost. They also gathered a lot of information that is publicly available through the search. Another approach by Ashish Kumar et al. Visual behaviour is also covered ie. Eyes, mouth and nose. Identify faces using histograms of direction gradients and linear support vector machines. The detection algorithm is applied to 2D image frames extracted from movies. After detection, facial features are marked with the help of landmarks. Feature extraction is used for classification. Calculate the nose length ratio (NLR), eye ratio (EAR), mouth ratio (MOR). When the value of these parameters exceeds the threshold, the drive is classified as fatigue. The system uses the generated data to produce accurate results. Many researchers use machine learning to monitor visual behaviour in search of sleep. Other topics include bio signalling devices or vehicle devices without the cooperation of machine learning algorithms. Machine algorithms such as Bayesian classifiers, support vector machines (SVM), hidden Markov models (HMM), and convolutional neural networks (CNN) are used. Each method has good accuracy for different facial features; Methods Supporting Vector Machines, Extended Markov Models, Bayesian Classifiers are more expensive than Convolutional Neural Networks. The larger the sample, the higher the cost and computational need.

THE PROPOSED SYSTEM

The block diagram of the drowsiness detection system while driving is shown in Figure 1. First record live video with webcam. The camera will be placed in front of the driver to capture the front view. Extract frames from video to get 2D images. Detect faces in frames using the Haar-Cascade face detection method. When a face is detected, facial features such as the position of the eyes and face are marked on the image. The position of the eyes and face can be evaluated according to facial symptoms. Using feature extraction and machine learning techniques, a decision can be made about the drowsy driver. Convolutional Neural Networks for eye classification to detect a drowsy driver considering blinks. As an additional feature of the system, the feature extraction method is used to detect either eyes are closed or open which also helps determine if the driver is comfortable. If sleep is detected, an alert is sent to the driver to alert him. Details of each block are discussed in the next section. Dataset of Eyes are collected by web image scrapping method which is used to train the model to detect open or closed eyes. This file contains images of eyes closed and open, with and without glasses, low angle, high angle and non-angle.

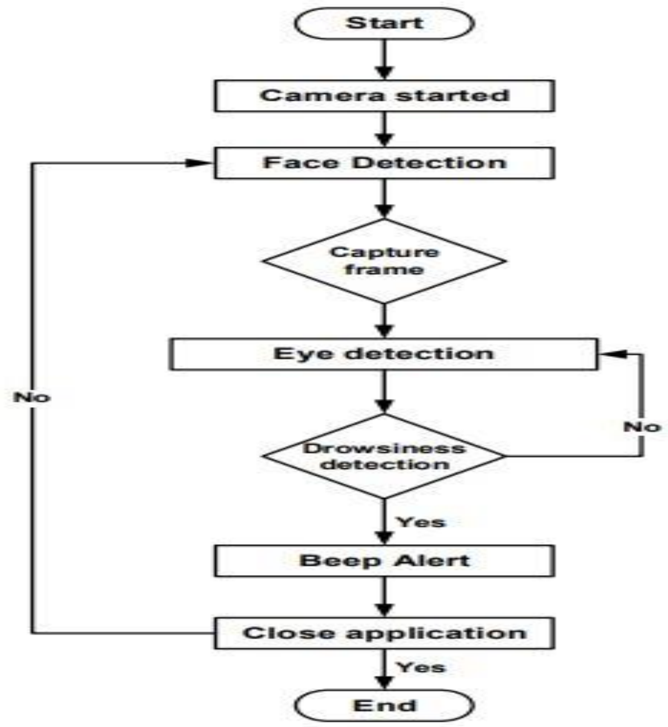

Figure 1. Block Diagram of proposed drowsiness detection system

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Classification of Eyes by Convolutional Neural Network (CNN):

The proposed method uses a convolutional neural network (CNN) to detect driver drowsiness. CNN consists of layers such as convolution layers, pooling (maximum, minimum, and average) layers, ReLU layers, and all layers. Convolutional layers have cores (filters), and each core has width, depth, and height.

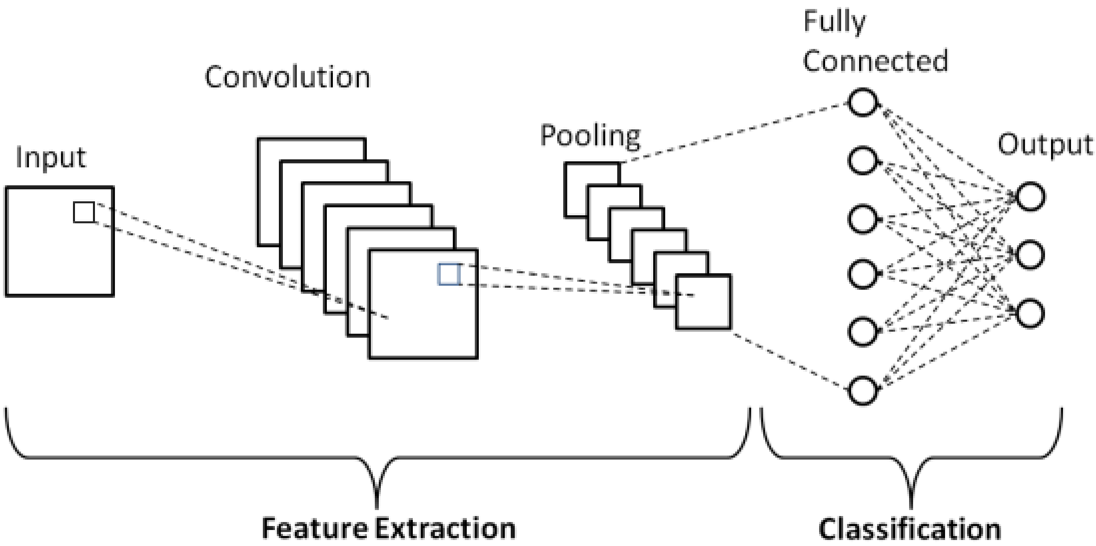

Figure 2. CNN Architecture

The input image is treated as a two-dimensional matrix by a convolutional layer. The number of nodes in the first and second layers is 32, and the number of nodes in the third layer is 64. All these convolutional methods use a 3x3 filter matrix. This layer creates a unique map by calculating the scalar product of the kernel and the region of the map. CNNs use layers (maximum or average) to reduce the size of the map to speed up computation. In this process, the input image is divided into different regions and then operations are performed on each region. In maximum pooling, the maximum value is selected for each region and placed in the corresponding position in the output. ReLU (Rectified Linear Unit) is a non-linear unit. A rectifier linear unit (ReLU) is used as the activation function because it makes the test and does not saturate, it also gives non-linearity to the activation. A ReLU layer applies the max function to all values in the input data and replaces all negative values with zero

RESULT AND DISCUSSION

- Real-Time Eye State Detection: It captures video frame from a web camera in a real time
- Face and Eye Detection: It uses Haar Cascade classifiers to detect faces and eyes in each video and generates rectangular frame.
- Pre-processing Eye Images: For each detected eye region, it preprocesses the image by resizing it to 80x80 pixels and normalizing the pixel values.
- Model Prediction: The pre-processed eye image is fed into the trained model for prediction. The model predicts whether the eyes are closed or open based on the image.

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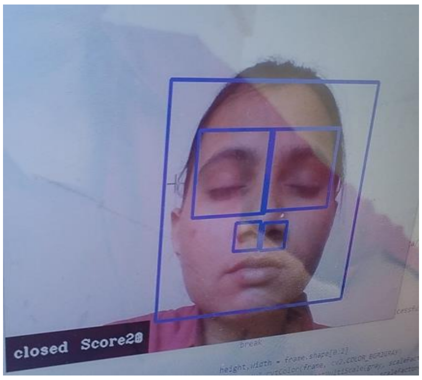

Figure 3. Closed eye successfully being detected closed.

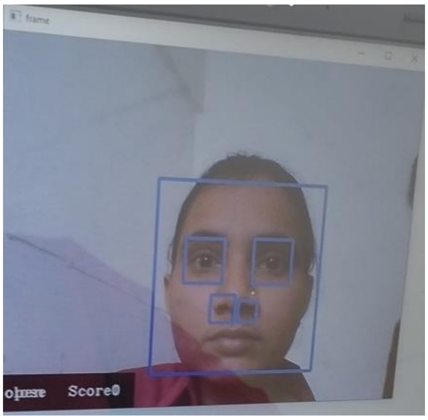

Figure 4. Open eye successfully being detected open.

Method of Evaluation	Accuracy
Training Accuracy	0.98
Test Accuracy	0.91

TABLE I: Classification accuracy on training and test dataset

CONCLUSION

- If the predicted probability of close eyes is greater than 0.30 (30 percent), we consider the eyes to be close we display close on the video frame. If the score exceeds a threshold of 15, the system triggers an alert message in the form of an alarm and the system classifies the person as drowsy, suggesting that the eyes have been closed for an extended period.
- If the predicted probability of open eyes is greater than 0.90, indicating a high prob ability of open eyes and we display open on the video frame. If the score goes below 0 (possibly due to rapid eye blinking), we set it back to 0 and the system classifies the person as non-drowsy. In this case, the system does not trigger an alert, and the person is considered alert and awake

REFERENCES

[1] Kyong Hee Lee, Whui Kim, Hyun Kyun Choi, Byung Tae Jang, “A Study on Feature Extraction Methods Used to Estimate a Driver’s Level of Drowsiness”, International Conference on Advanced Communications Technology (ICACT), 2019.

[2] Ashish Kumar, Rusha Patra, “Driver Drowsiness Monitoring System using Visual Behaviour and Machine Learning”, IEEEConference, 2018.

[3] Cyun-Yi Lin, Paul Chang, Alan Wang, Chih-Peng Fan, “Machine Learning and Gradient Statistics Based Real-Time DriverDrowsiness Detection”, 2018 IEEE International Conference on Consumer Electronics-Taiwan (ICCE-TW).

[4] Ching-Hua Weng, Ying-Hsiu Lai, Shang-Hong Lai, “Driver Drowsiness Detection via a Hierarchical Temporal Deep BeliefNetwork”, In Asian Conference on Computer Vision Workshop on Driver Drowsiness Detection from Video, Taipei, Taiwan,

[5] Nov. 2016

[6] Anjith George, Aurobinda Routray, “Real-time Eye Gaze Direction Classification Using Convolutional Neural Network”, IEEE,2016.

[7] Media Research Lab, http://mrl.cs.vsb.cz/, 2018.

[8] Venkata Rami Reddy Chirra, Srinivasulu Reddy Uyyala, Venkata Krishna Kishore Kolli, “Deep CNN: A Machine Learning Approach for Driver Drowsiness Detection Based on Eye State”, Revue d'Intelligence Artificielle Vol. 33, No. 6, December, 2019, pp.461-466.

[9] Mkhuseli Ngxande, Jules-Raymond Tapamo, Michael Burke, “Driver drowsiness detection using Behavioral measures and machine learning techniques: A review of state-of-art techniques”, 2017 Pattern Recognition Association of South Africa and Roboticsand Mechatronics International Conference (PRASA-RobMech).

[10] T. Vogelpohla, M. Kühn, T. Hummel, M. Vollrath, “Asleep at the automated wheel—Sleepiness and fatigue during highly automated driving”, https://doi.org/10.1016/j.aap.2018.03.013, Accident Analysis and Prevention, 2018.

[11] Xuan-Phung Huynh, “Detection of driver drowsiness using 3D deep neural network and semi-supervised gradient boosting machine”, in Asian Conference on Computer Vision Workshop, 2016

[12] A. George and A. Routray, “Real-time Eye Gaze Direction Classification Using Convolutional Neural Network,” Int. Conf.SignalProcess. Commun., pp. 1–5, 2016

[13] Weir Wille, W.W. (1994). Overview of Research Driver Drowsiness Definition Driver Detection,14th International Technical Conference on Enhanced Safety of Vehicles.

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