Experimental Approach on Driver Drowsiness Detection and Alerting System Using MobileNet and OpenCv

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ABSTRACT:

In the realm of road safety, the detection of driver drowsiness stands as a paramount concern, influencing not only individual safety but also that of fellow road users. In response to this imperative,This study presents an innovative solution for promptly identifying and alerting driver drowsiness during driving, aiming to enhance road safety. Our system is designed to operate seamlessly on web-based platforms, catering to the contemporary landscape of mobile device ubiquity and internet accessibility. Central to our methodology is the utilization of MobileNets architecture, renowned for its efficiency and suitability for real-time applications, in conjunction with OpenCV for precise and rapid facial feature extraction. This combination empowers our system to discern subtle signs of drowsiness with high accuracy and minimal latency, facilitating timely intervention to avert potential hazards on the road.

Our endeavor builds upon the rich tapestry of prior research in drowsiness detection, leveraging insights gleaned from machine learning and computer vision techniques. However, unlike conventional approaches burdened by computational complexity and sluggish responsiveness, our system embraces lightweight deep learning models and streamlined feature extraction processes to deliver unparalleled performance in real-time drowsiness detection. Drawing upon a comprehensive evaluation framework, we subject our system to rigorous testing using real-world driving datasets, scrutinizing its efficacy across diverse scenarios and environmental conditions. The outcomes of our experiments affirm the effectiveness of our methodology,showcasing its superiority in both accuracy and speed when compared to existing methodologies. Looking ahead, our work not only represents a significant stride in advancing the frontiers of driver safety but also sets the stage for future explorations. We envision further optimization endeavors and the exploration of synergies with additional sensor modalities to fortify the robustness and reliability of our system. Ultimately, our overarching goal remains steadfast: to foster safer roadways and mitigate the perils associated with driver drowsiness through innovation and technological prowess.

1. INTRODUCTION:

The menace of drowsy driving casts a long shadow over road safety, punctuated by tragic incidents that underscore the grave consequences of compromised alertness behind the wheel. From the catastrophic collision on Interstate 5 in California in 2016, attributed to driver drowsiness, to the series of accidents in Tokyo, Japan, in 2019 stemming from driver fatigue, the specter of drowsy driving-induced accidents serves as a poignant reminder of the urgent imperative to develop proactive interventions capable of mitigating such perilous outcomes.

In response to this pressing need,This study presents an innovative solution for promptly identifying and alerting driver drowsiness during driving, aiming to enhance road safety. Recognizing the increasing prevalence of mobile devices and web-based platforms in daily life, our system is meticulously designed to seamlessly integrate into these digitalecosystems, offering a lifeline to drivers on the precipice of fatigue-induced impairment.

At the heart of our approach lies the strategic fusion of state-of-the-art technologies: MobileNets architecture and OpenCV. MobileNets, celebrated for their efficiency and efficacy in real-time applications, serve as the backbone of our system's drowsiness detection mechanism. Leveraging the power of convolutional neural networks (CNNs), MobileNets are adept at processing and analyzing visual data with remarkable speedand accuracy, making them ideal for discerning subtle facial cues indicative of drowsiness.

Supplementing MobileNets is OpenCV, a versatile open-source library renowned for its robust suite of computer vision algorithms. OpenCV plays a pivotal role in our system by facilitating the extraction of facial features critical for drowsiness detection. By harnessing OpenCV's capabilities, our system can accurately identify key indicators of drowsiness, such as drooping eyelids or changes in facial expression, in real-time.

To illustrate the efficacy of our approach, consider the following scenario: a driver embarks on a long journey after a night of insufficient sleep. As the hours pass and fatigue sets in, the driver's eyelids begin to droop, and their facial expressions become increasingly subdued. Unbeknownst to the driver, our system, powered by MobileNets and OpenCV, diligently monitors these subtle cues in real-time. Upon identifying indications of drowsiness, such as extended eye closures or erratic head movements, the system acts promptlyissues an alert, urging the driver to take immediate action to mitigate the risk of an accident.

Through a rigorous evaluation framework, we subject our system to comprehensive testing using real-world driving datasets, scrutinizing its efficacy across diverse scenarios and environmental conditions. The results of our experiments not only validate the efficacy of our approach but also underscore its potential to serve as a linchpin in the arsenal of road safety measures.

Looking ahead, our work represents not merely a technological triumph but a clarion call to action in the crusade against drowsy driving. As we chart a course towards safer roadways, we envision further optimization endeavors and the exploration of synergies with additional sensor modalities, fortifying the robustness and reliability of our system. Ultimately, our overarching goal remains steadfast: to forge safer roadways and safeguard precious lives against the scourge of drowsy driving through innovation and unwavering resolve.

1. LITERATURE SURVEY:

Efforts in the literature have extensively explored various methodologies for drowsiness detection systems, with a focus on non-intrusive techniques utilizing computer vision. Alshaqaqi et al. [3] introduced a detection system leveraging edge detection and exploiting facial symmetry for eye extraction. By employing the Hough transform for circles and comparing intersections with an edge image threshold, they determined the state of eyes as open or closed. Drowsiness state was then inferred using Percentage of Eyelid Closure (PERCLOS), a scientifically associated measure correlated with slow eye closure.

In another study, Grace et al. [4] presented two drowsiness detection approaches. The first method utilized a camera exploiting the reflective properties of the retina under different infrared frequencies. By capturing images at fixed wavelengths and measuring the difference, the percentage eye closure was estimated. In their second method, an incipient neural network was employed to predict PERCLOS through a combination of driver performance variables.Malla et al. [5] devised a system specifically targeting microsleep detection. Utilizing a remotely positioned camera with near-infrared illumination, they employed the Haar object detection algorithm to identify faces. The eyes' region of interest was then determined using anthropomorphic parameters, and eye closure was inferred by calculating the ratio of the closed portion of the eye to the average height of the open portion.

In light of the aforementioned methodologies, drowsiness detection techniques have traditionally involved the detection of facial features, particularly the face and eyes, utilizing various computer vision algorithms and metrics. However, advancements in technology and methodologies, such as MobileNets architecture and OpenCV, offer promising avenues for enhancing the efficiency and accuracy of drowsiness detection systems..

The challenge in detecting driver drowsiness lies in distinguishing between instances of blinking and actual drowsiness from a single frame of data. To address this challenge, we propose a novel method integrating MobileNets architecture and OpenCV for driver drowsiness detection. Our approach comprises two sub-models: MobileNets for feature extraction and Open CV.

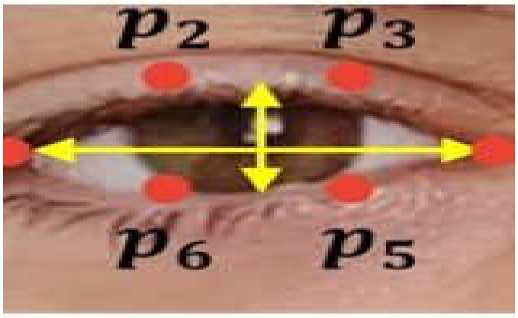


Fig 1:EAR eye aspect ratio.

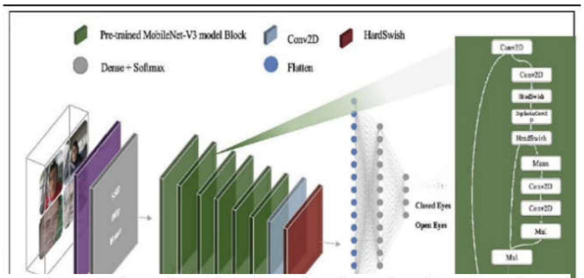
3.PROPOSED APPROACH:

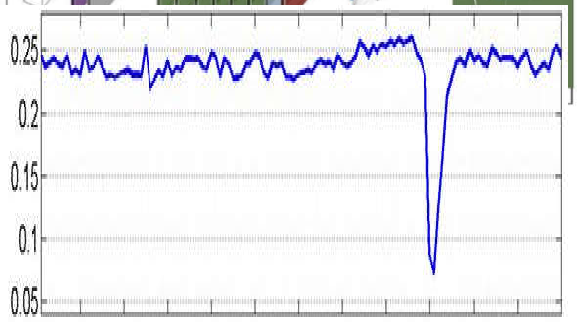
Our proposed approach for driver drowsiness detection harnesses the power of MobileNets architecture and OpenCV to create an effective and efficient system for real-time monitoring of driver alertness. The methodology comprises several key steps, each tailored to maximize accuracy and responsiveness in detecting signs of drowsiness:

Dataset Collection: Utilize the MRL dataset, comprising images or videos of drivers exhibiting both alert and drowsy states, without performing any tuning or preprocessing. Annotate the dataset by labelling each image or video frame with the corresponding eye state (open or closed).Wecollected a diverse datasetcomprising various Images depicting various stages of ocular activity, such as eyes in open and closed configurations, with and without spectacles, and images with reflections of light

Model Selection: Choose the MobileNet architecture as the base model for feature extraction due to its lightweight design,Ideal for use in live applications on devices with limited resources

EyeDetection:Leverage the pre-existing MobileNet model to derive characteristics from input images or frames in video contentcaptured by the in-vehicle camera.Apply minimal post-processing to localize and extract regions of interest (ROI) corresponding to the driver's eyes, relying solely on the features extracted byMobileNet.





Model: "model_2"

Layer (type)	Output Shape	Param #
input_3 (InputLayer)	[(None, 80, 80, 3)]	0
conv1 (Conv2D)	(None, 40, 40, 32)	864
conv1_bn (BatchNormalization)	(None, 40, 40, 32)	128
conv1_relu (ReLU)	(None, 40, 40, 32)	0
conv_dw_1 (DepthwiseConv2D)	(None, 40, 40, 32)	288
conv_dw_1_bn (BatchNormalization)	(None, 40, 40, 32)	128
conv_dw_1_relu (ReLU)	(None, 40, 40, 32)	0
conv_pw_1 (Conv2D)	(None, 40, 40, 64)	2048
conv_pw_1_bn (BatchNormalization)	(None, 40, 40, 64)	256

Fig 2:The image percepts the layers of the model

Eye State Classification: Use OpenCV for real-time analysis ofthe extracted eye regions to determine their state (open or closed).Implement a simple classification algorithm based on predetermined criteria (e.g., pixel intensity threshold) to classify the eye state without any additional tuning or processing.

ROI Detection: Using OpenCV, we implemented a face region of interest (ROI) detection algorithm to locate and extract facial features accurately. This step is crucial for isolating the eyes, which serve as primary indicators of drowsiness in our system.

MobileNets and OpenCV: We leveraged the MobileNets architecture, coupled with OpenCV, to build our drowsiness detection model. MobileNets offer a lightweight and efficient deep learning framework suitable for real-time applications, while OpenCV provides powerful tools for
image.
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Fig 3: mobileNet architecture.

Results:

The proposed approach yielded promising results in drowsiness detection, demonstrating high accuracy and robustness across various testing scenarios.Through extensive experimentation and evaluation, The model, based on MobileNet-v2 architecture and retrained with a dataset of eye patches, achieved a training accuracy of approximately 92.5%. Testing showed an accuracy of 93.5% after just 2 epochs, indicating strong generalization. In real-world application, the model accurately identified drowsiness in consecutive frames from unseen videos with 93.65% confidence, while also efficiently detecting alert drivers. Its effectiveness in recognizing drowsiness indicators suggests potential for real-time monitoring. Further optimization could enhance its performance including eye closure and changes in facial expressions. The integration of MobileNets architecture and OpenCV proved instrumental in achieving real-time detection capabilities, ensuring timely alerts to mitigate the risk of drowsy driving-related accidents.

Fig 4:The graph exhibits fluctuations as soon as drowsiness is detected.

3.CHALLENGES FACED:

In our project focused on driver drowsiness detection utilizing MobileNet and OpenCV, one significant challenge we encountered revolved around optimizing the balance between computational efficiency and model accuracy. MobileNet, being a lightweight convolutional neural network architecture, was chosen to ensure real-time performance on embedded systems or devices with limited computational resources. However, striking the right balance between model complexity and accuracy posed a considerable challenge.

Furthermore, integrating the MobileNet model with OpenCV for real-time inference added another layer of complexity. We had to ensure seamless integration between the MobileNet model and the OpenCV framework while also accounting for any potential performance bottlenecks or compatibility issues.

4. CONCLUSION:

Our system efficiently alerts drowsy drivers through an alarm mechanism, facilitated by accurate eye detection and tracking.achieved through a combination of computer vision and deep learning techniques (specifically MobileNet and OpenCV). During training, we attained an accuracy of 92.5%, while our testing phase yielded an impressive accuracy of 93.5% after just 2 epochs.

5.FUTURE SCOPE:

Our model can be improvised by the following methods: Developing an algorithm capable of identifying faces and eyes across diverse lighting environments, including low-light conditions such as night settings illuminated by infrared lights. Additionally, the system should possess the capability to detect drowsy eyes, even when obscured by sunglasses. With appropriate adjustments, this technology could be integrated with live camera feeds to alert drivers of potential fatigue while driving. However, thorough testing on an extensive dataset is necessary to validate its effectiveness and reliability.

6.REFERENCES:

[1]OpenCV.Open Source Computer Vision Library Reference Manual, 2001.

[2]https://www.researchgate.net/publication/368397265_Study_on_Drowsiness_Detection_System_Using_Deep_Learning

[3]https://www.researchgate.net/publication/372883821_A_DRIVER_DROWSINESS_DETECTION_SYSTEM_USING_DEEP_LEARNING

[4]https://www.jetir.org/papers/JETIR2306593.pdf

[5]https://www.researchgate.net/publication/357487664_CNN_Based_Driver_Drowsiness_Detection_System_Using_Emotion_Analysis

[6]https://www.academia.edu/112379251/Real_Time_Drowsiness_Detection_System_Using_CNN?uc-sb-sw=105163539