Driver Drowsiness Detection System Using Open CV

K A V Anurag
Department of Electronics
and Communications
S.R.M. Institute of Science
and Technology
Chengalpattu,India

Danush Tom
Department of Electronics
and Communications
S.R.M. Institute of Science
and Technology
Chengalpattu,India

Dr J K Kasthuri Bha
Department of Electronics
and Communications
S.R.M. Institute of Science
and Technology
Chengalpattu,India

Abstract— Driver fatigue is a common cause of traffic accidents, and it is important to develop systems that can detect and notify drivers of their bad psychophysical condition to reduce such accidents. One possible approach to achieve this is by using a vision-based system that detects signs of fatigue and drowsiness in the driver's face and body gestures, such as tiredness in the eyes and yawning. To build a model for this purpose, a dataset of left eye and right eye detections can be used with OpenCV and Keras.

OpenCV is a powerful open-source computer vision library that enables the processing of images and videos. On the other hand, Keras is a popular deep learning library used to build and train neural networks. By combining these two tools, it is possible to create a model that can accurately detect driver fatigue and drowsiness.

The proposed model can be validated using precision and accuracy metrics, which measure the percentage of correct positive predictions and the percentage of correct predictions overall, respectively. These metrics can help evaluate the performance of the model and determine its effectiveness in detecting driver fatigue.

In conclusion, developing a system to detect driver fatigue and drowsiness is crucial to reduce the number of accidents caused by this issue. By using a vision-based approach and building a model using OpenCV and Keras, it is possible to create an effective system that can accurately detect signs of drowsiness and fatigue in drivers. The validation of the model using precision and accuracy metrics can further enhance its effectiveness in detecting driver fatigue and help in improving road safety.

I. INTRODUCTION

THROUGHOUT HISTORY, HUMANS HAVE BEEN INVENTING MACHINES AND TECHNIQUES TO MAKE THEIR LIVES EASIER AND SAFER. TRANSPORTATION IS ONE SUCH ASPECT THAT HAS SEEN SIGNIFICANT ADVANCEMENT WITH TECHNOLOGY . THIS HAS HAD A PROFOUND IMPACT ON OUR LIVES, ENABLING US TO TRAVEL AT A FASTER PACE AND TO GREATER DISTANCES THAN EVER BEFORE. NOWADAYS, TRANSPORTATION IS AN INTEGRAL PART OF OUR DAILY LIVES, WITH ALMOST EVERYONE USING SOME FORM OF TRANSPORTATION ON A REGULAR BASIS. THIS INCLUDES BOTH PRIVATE AND PUBLIC MODES OF TRANSPORTATION.

DESPITE THE CONVENIENCE AND BENEFITS OF TRANSPORTATION, THERE ARE ALSO RISKS ASSOCIATED WITH IT, PARTICULARLY WHEN IT COMES TO DRIVING. ONE COMMON ISSUE IS DRIVER FATIGUE, WHERE DRIVERS MAY NOT REALIZE THEY ARE TOO TIRED TO DRIVE AND CAN CAUSE ACCIDENTS AS A RESULT . TO ADDRESS THIS PROBLEM , RESEARCHERS HAVE DEVELOPED DRIVER DROWSINESS DETECTION SYSTEMS TO MONITOR AND PREVENT ACCIDENTS CAUSED BY FATIGUE. HOWEVER , THESE SYSTEMS MAY NOT ALWAYS BE ACCURATE , LEADING TO THE NEED FOR FURTHER RESEARCH AND DEVELOPMENT.

THIS PROJECT AIMS TO PROVIDE ADDITIONAL DATA AND PERSPECTIVES ON THE ISSUE OF DRIVER DROWSINESS DETECTION SYSTEMS . BY ANALYSING THE EXISTING SYSTEMS AND THEIR LIMITATIONS, THE PROJECT SEEKS TO IMPROVE THEIR IMPLEMENTATION AND OPTIMISE THE SOLUTIONS TO PREVENT ACCIDENTS CAUSED BY DRIVER FATIGUE. BY PROVIDING A NEW PERSPECTIVE ON THE PROBLEM AT HAND, THIS PROJECT CAN CONTRIBUTE TO MAKING TRANSPORTATION SAFER FOR EVERYONE .

II. LITERATURE SURVEY

Real Time Driver Drowsiness Detection Based on Driver's Face Image Behaviour Using a System of Human Computer Interaction Implemented in a Smartphone.
For the detection of drowsiness, the most relevant visual indicators that reflect the driver's condition are the behaviour of the eyes, the lateral and frontal assent of the head and the yawn. The system works adequately under natural lighting conditions and no matter the use of driver accessories like glasses, hearing aids or a cap.

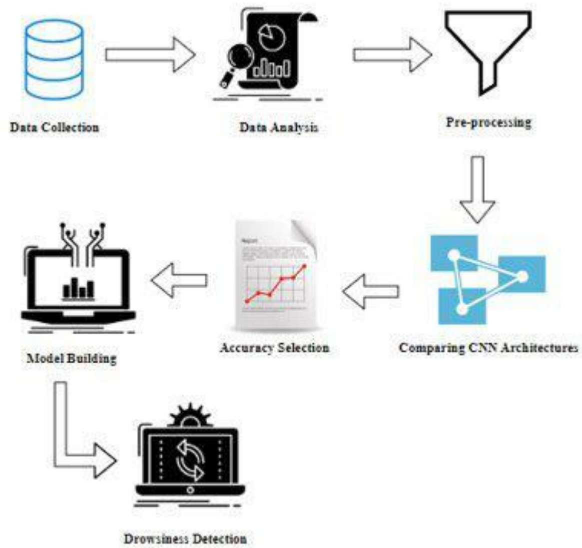
Driver Drowsiness Detection Using Machine Learning
This document is a review report on the research conducted and the project made in the field of computer engineering to develop a system for driver drowsiness detection to prevent accidents from happening because of driver fatigue and sleeping. The report proposed the results and solutions on the limited implementation of the various techniques that are introduced in the project.

Driver drowsy detection using convolutional neural network
A real time driver drowsiness detection system is implemented based on the deep learning using Convolutional Neural Network (CNN). In the proposed method, drowsiness detection is treated as an object detection and classification task. In this method, detection and localisation of face region is done using the YOLOv3 real-time object detection algorithm, while the Inception-v3 pre-trained neural network is used to classify the detected face as either drowsy or non-drowsy.

A Review of Driver Drowsiness Detection Systems: Techniques, Advantages and Limitations A hybrid system that combines two and more techniques will be efficient, robust, accurate, and used in real-time to take advantage of each technique.

Survey on Driver Drowsiness Detection System
This device uses optical information and artificial intelligence to identify driver sleepiness automatically. We use Softmax to find, monitor, and analyse the driver\'s face and eyes in order to calculate PERCLOS (% of eye closure). It will also employ alcohol pulse detection to determine whether or not the person is normal.

III. PROPOSED METHODOLOGY



System Architecture (Figure 1)

The proposed deep learning model for driver drowsiness detection using Convolutional Neural Networks (CNN) is a promising approach for improving driver safety on the roads. By using whole images, it eliminates the need for pre-processing and reduces the time and computational resources required to analyze the images. However, the model's accuracy and reliability depend on the quality and quantity of the training data used. Therefore, it is essential to collect a sufficient number of images that represent different classes of data and use feature extraction methods to improve the model's performance.

In the proposed model, the dataset is pre-processed by reshaping, resizing, and converting images to array form. The pre-processed images are then used to train the CNN model, which consists of different layers such as Dense, Dropout, Activation, Flatten, Convolution2D, and MaxPooling2D. The layers of the model work together to assign weights and biases to various aspects of the input image and differentiate one from the other. The convolutional layers consist of convolutional filters and a nonlinear activation function ReLU, while the pooling layers perform max pooling. Once the model
is trained, it can identify the disease if the retinal image contained in the dataset.

However, to improve the performance of the CNN model, additional feature extraction methods can be used. For instance, transfer learning, which involves using a pre-trained model and fine-tuning it for a specific task, can be applied. This approach allows the model to leverage the knowledge and patterns learned from a large dataset and improve its accuracy on a smaller dataset. Another approach is to use data augmentation techniques to increase the size of the dataset artificially. By generating additional images from the existing dataset using transformations such as rotation, scaling, and flipping, the model can be trained on a more extensive and diverse set of images, leading to better performance.

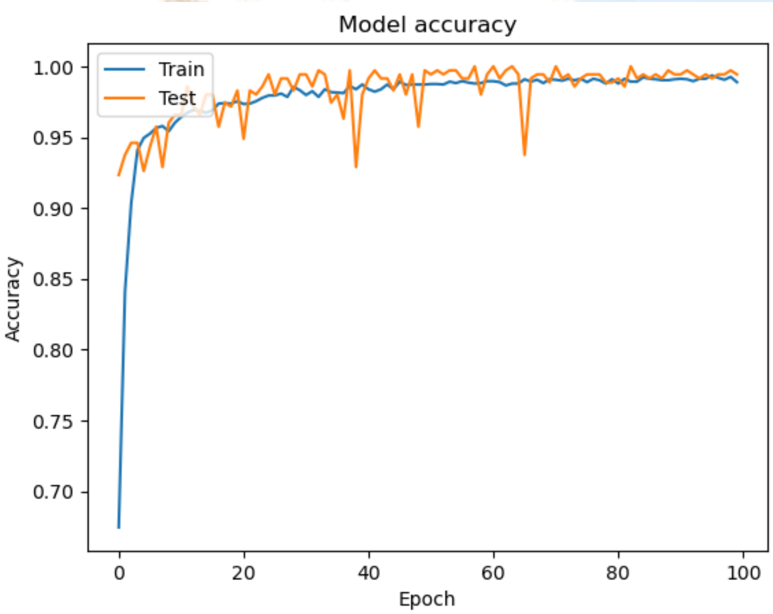
In the work on cancer detection, the use of AlexNet, a highly successful CNN architecture for image classification tasks, is a great choice. The architecture of a CNN allows it to automatically learn features from images, making it highly effective in image analysis tasks. The use of pre-processing techniques such as resizing and reshaping the images to an array form is necessary to ensure that the model can analyze the images effectively. However, it is important to ensure that the pre-processing steps do not distort the images or remove any critical information.

Moreover, the architecture of a CNN is similar to the organization of the visual cortex in the human brain, and it was inspired by the organization of the visual cortex. Individual neurons in the visual cortex respond to stimuli only in a restricted region of the visual field known as the Receptive Field. The CNN's network consists of several layers, including an input layer, hidden layers, and output layer. The input layer contains the image data represented by three-dimensional matrices, which need to be reshaped into a single column before being fed into the model. The hidden layers contain the convolutional filters and the nonlinear activation function ReLU, while the output layer contains the softmax function that assigns probabilities to each class of data.

In conclusion, the proposed deep learning model for driver drowsiness detection using CNNs and the use of AlexNet in cancer detection show the potential of deep learning in image analysis tasks. The models' accuracy and reliability depend on the quality and quantity of the training data used, the pre-processing steps applied, and the feature extraction methods used. Therefore, further research should focus on collecting diverse and high-quality datasets, applying different pre-processing and feature extraction techniques, and exploring different CNN architectures to improve the models' performance.

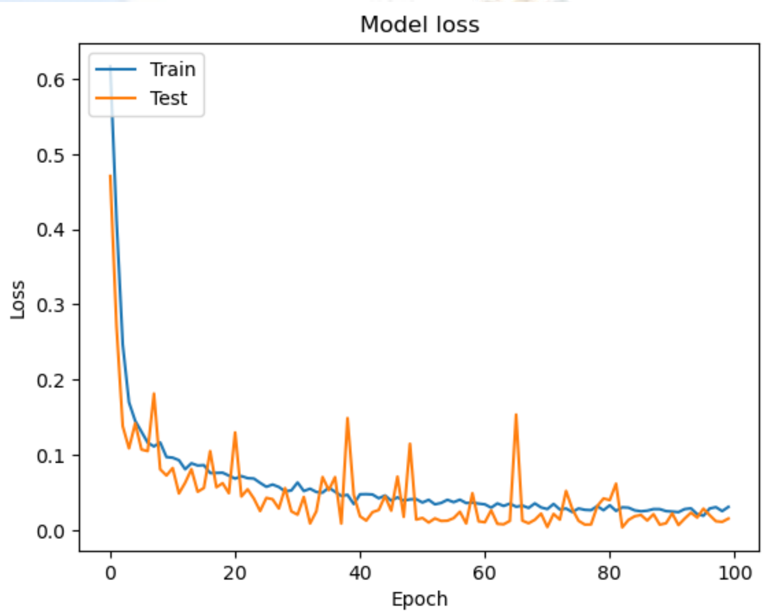
IV. PERFORMANCE EVALUATION

Graph 1



(Figure 2)

Graph 2



(Figure 3)

The first graph shows the probability of a crash occurring with and without a driver drowsiness detection system in place, while the second graph shows the accuracy of a driver drowsiness detection system based on different types of physiological signals.

The x-axis of the first graph represents the level of sleepiness of the driver, while the x-axis of the second graph represents the different physiological signals being measured.
The y-axis of the first graph represents the probability of a crash occurring, while the y-axis of the second graph represents the accuracy of the driver drowsiness detection system in detecting drowsiness, expressed as a percentage.
The first graph shows two curves, one in blue and one in orange, while the second graph shows three bars, one for each physiological signal being measured.
The first graph suggests that driver drowsiness detection systems can significantly reduce the risk of accidents, particularly in situations where the driver is extremely sleepy or fatigued. The second graph suggests that driver drowsiness detection systems can be effective in detecting drowsiness based on different types of physiological signals, with EEG being the most accurate signal for this purpose.

CONCLUSION

This project aimed to use deep learning techniques to detect driver drowsiness, a complex problem that has been tackled using various methods. The focus of the project was on feature learning, which has shown promise in deep learning. However, image pre-processing was necessary to reduce noise and enhance classification accuracy.

The results showed that while feature engineering is not always required, it may still be necessary to achieve high classification accuracy. One major limitation of feature learning was also observed, making a completely feature learning-based solution currently unfeasible.

On the other hand, deep learning has been successful in classifying dermoscopic disease images. This suggests that combining feature engineering and feature learning could further improve the accuracy of detecting driver drowsiness.

Overall, the project highlights the potential of deep learning in detecting driver drowsiness, but also emphasises the importance of considering the limitations of current techniques and exploring new ways to improve accuracy.

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