Development of a Facial Features Monitoring for Real Time Drowsiness Detection using ANN Algorithm

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Abstract— Traffic management is major issue for this growth. If we are trying to build the smart city we must find solution for that. The additional problem is that the reckless driving which results in hazards effects of human lives. This may lead to unfortunate death. Driving while drowsy is a major cause behind road accidents. Hence the use of such systems that monitor a driver's measure of vigilance and notify the driver in case of drowsiness that can be significant in the prevention of accidents. The drowsiness detection based on EEG signals' spatiotemporal image encoding representations in the form of either recurrence plots or gramian angular fields for deep convolutional neural network (CNN) classification. Results comparing both techniques using a public dataset of 27 subjects show a superior balanced accuracy of up to 75.87% for leave-one-out cross-validation, using both techniques. This project demonstrates the implementation of a driver's drowsiness detection using ANN algorithm. All serious road accidents occur because of the vehicle drivers' drowsiness where they need to take, confirming that drowsiness gives rise to more road accidents than accidents occur through Drink and Drive. Drowsiness Detection System is designed by employing vision-based concepts. The system's mainly pointing towards the driver's face scan and monitoring the driver's eyes to detect drowsiness. The system scans the driver's face then the eyes and then confirms whether the eyes are open or close. The software MATLAB uses the Viola-Jones and Hough transform for the drowsiness detection.

Key words—Drowsiness detection, ANN, image processing, MATLAB.

I. INTRODUCTION

Drowsy driving is the dangerous combination of driving when sleepy. This usually happens when a driver has not slept enough, but it can also happen because of untreated sleep disorders or shift work. Prescription and over-the- counter medications can also cause drowsiness, and alcohol can interact with sleepiness to increase both impairment and drowsiness. No one knows the exactmoment when sleep will come over their body. Falling asleep at the wheel is clearly dangerous, but being sleepy also affects your ability to drive safely, even if you don't fall asleep. In a CDC survey, an estimated 1 in 25 adult drivers (aged 18 years or older) reported having fallen asleep while driving in the previous 30 days. In the same CDC survey, adult drivers who snore or usually sleep 6 or fewer hours per day were more likely to report falling asleep while driving than drivers who do not snore or usually sleep 7 or more hours per day, respectively. Drowsy driving was involved in 91,000 crashes in 2017, resulting in50,000 injuries and nearly 800 deaths. In 2020, there were 633 deaths based on police reports. However, these numbers are underestimated, and over 6,000 fatalcrashes each year may involve a drowsy driver. It is important to monitor the driving person's whether they feel drowsiness or not. This project provides significant to monitor the drowsiness and saves more lives. This project act as one of the advantages significant, efficient to control accidents. The algorithm used here is very easy and efficient.

II. ASSOCIATED LITERATURE

A previous study states that road accidents, having become almost an everyday problem in the present world, cause substantial loss of lives and property and adversely affect the economy. Driving in the state of drowsiness

is a major cause behind these accidents. Timely detection of a driver's drowsy condition is very important to avoid these unwanted accidents. This study presents a very cost-effective and robust approach to determine if the driver is drowsy or fatigued by continually analyzing two physiological parameters and eye-blink rate. An effective alert mechanism has also been incorporated in this system. If the threshold values of the drowsiness checking parameters are exceeded, the system detects drowsy or sleepy conditions of the driver and alerts him instantly to regain conscious state. The system uses some basic sensors to monitor the values of the concerned parameters for this purpose. Its implementation is totally non-invasive and posesno threat to eyesight or skin health. It is lightweight and portable, cost effective, user-friendly and can be used during both day and night. Another study proposes EYE gaze tracking is a technique that involves tracking a person's eye gaze using expensive hardware. In this paper a driver monitoring system using eye gaze technique is introduced. If the blink takes more than 2 second drivers drowsiness is detected and the driver is alert by audio and steering vibration warning. Drowsy driving is a prevalent and serious public health issue that deserves attention. Recent studies estimate that around 20% of car crashes havebeen caused by drowsy drivers. Nowadays, one of the main goals in the development of new advanced driver assistance systems is trustworthy drowsiness detection. In this paper, a drowsiness detection method based on changes in the respiratory signal is proposed. The respiratory signal, which has been obtained using an inductive plethysmography belt, has been processed in real time in order to classify the driver's state of alertness as drowsy or awake. The proposed algorithm is based on the analysis of the respiratory rate variability(RRV) in order to detect the fight against falling asleep. Moreover, a method toprovide a quality level of the respiratory signal is also proposed. Both methodshave been combined to reduce false alarms. Due to the changes of measured RRV associated not with drowsiness but body movements. A driving simulatorcabin has been used to perform the validation tests and external observers haverated the drivers' state of alertness in order to evaluate the algorithm performance. It has achieved a specificity of 96.6%, a sensitivity of 90.3%, and Cohen's Kappa agreement score of 0.75 on average across all subjects through a leave-one- subject-out cross-validation. A novel algorithm for driver's state of alertness monitoring through the identification of the fight against falling asleep has been validated. The proposed algorithm may be a valuable vehicle safety system to alert drowsiness while driving. Another paper describes a novel approach for an intelligent driver drowsiness detection system using visual behavior of the driver. The estimation of driver'svigilance is successfully made by combining facial and eye symptoms using fuzzy-logic controllers. Experimental result using fuzzy-logic simulation in Matlab show the performance of the developed approach in term of robustness and reliability. The mission of the specialized requirements of social law in road transport is toensure that the driver's work regime is in line with the specific requirements of the road transport process and also contributes to the improvement of road safety. Currently, the requirements of social legislation in the EU and the AETR contracting states are largely unclear from the driver's position. The aim of the contribution is to verify, on the basis of an analysis of social requirements for drivers in other countries, the hypothesis that regulatory requirements in EU and AETR contracting states are considerably more complicated than in selected other countries. The contribution analyses the impact of the limitations of socialaw in road transport on the work of drivers. It analyses requirements for freight transport drivers in the EU and compares them with requirements in chosen countries(USA, Canada, Australia, and New Zealand) and with requirements imposed on AETR contracting parties. The article also points to the fact that some of the requirements of social legislation in road waste are causing a reduction in road safety.

III. PROPOSED METHODOLOGIES

A. ANN

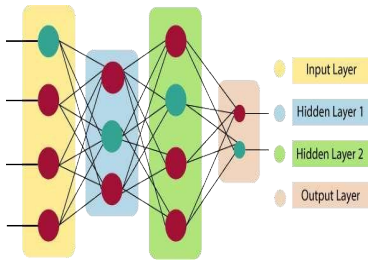


Fig.1AdaptiveNeuro-FuzzyInferenceSystem

Artificial Neural Network can be best represented as a weighted directed graph, where the artificial neurons form the nodes. The association between the neurons outputs and neuron inputs can be viewed as the directed edges with weights. The Artificial NeuralNetwork receives the input signal from the external source in the form of a pattern and image in the or m of a vector. These inputs are then mathematically assigned by the notations x(n) for every n number of inputs. Afterward, each of the inputis multiplied by its corresponding weights (these weights are the details utilized by the artificial neural networks to solve a specific problem). In general terms, these weights normally represent the strength of the interconnection between neurons inside the artificial neural network. All the weighted inputs are summarized inside the computing unit. If the weighted sum is equal to zero, then bias is added to make the outputnon-zero or something else to scale up to the system's response. Bias has the same input, and weight equals to here the total of weighted inputs can be in the range of 0 to positive infinity.

The activation function refers to the set of transfer functions used to achieve thedesired output. There is a different kind of the activation function, but primarilyeither linear or non-linear sets of functions. Some of the commonly used sets ofactivation functions are the Binary, linear, and Tan hyperbolic sigmoidal activation functions.

B. MATLAB FUNCTIONS

MATLAB provides a high-level language and development tools that let you quickly develop and analyse algorithms and applications. The MATLAB language provide native support for the vector and matrix operations that are fundamental to solving engineering and scientific problems, enabling fast development and execution. With the MATLAB language you can write programs and develop algorithms faster than with traditional languages because you do not need toper form low-level administrative tasks such as declaring variables, specifying data types, and allocating memory. In many cases, the support for vector and matrix operations eliminates the need for for-loops. As a result, one line of MATLAB code can often replace several C or C++code. MATLAB provides features of traditional programming languages, including low control, error handling, and object-oriented programming (OOP). You can use fundamental data types or advanced data structures, or you can define custom data type. You can produce immediate results by interactively executing command soneatatime. This approach lets you

quickly explore multiple options and iterate to an optimal solution. You can capture interactive steps as scripts and functions to reuse and automate your work. MATLAB add-on products provide built-in algorithms for signal processing and communications, image and video processing, control systems, and many other domains. By combining these algorithms with your own, you can build complex programs.

IV. PROPOSED MODEL FUNCTIONS

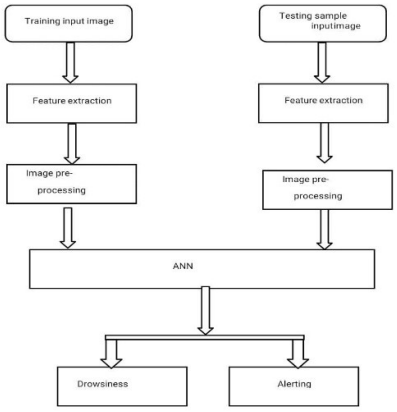


Fig. 2. Proposed system block diagram

Drowsiness can be detected by using face area detection. The methods to detect drowsiness within face area are vary due to drowsiness sign are morevisible and clear to be detected at face area. From the face area, we can detect the eyes location. From eyes detection, author instated that there are four types of eyelid movement that

can be used for drowsiness detection. They are complete open, complete close, and in the middle where the eyes are from open to close and vice versa. Figure 4 is an example of the image taken for detecting eyelid movement. a) Open eye b) Close eye c) ProcessedcloseeyeFig3.2ExamplesofEyelid Movement. The algorithm processes the images captured in grey-scale method; where the colour from the images is then transformed into black and white Working with black and white images is easier because only two parameters have to be measured. The author then performs the edge detection to detect the edges of eyes so that the value of eyelid area can be calculated. The problem occurring with this method is that the size area of eye might vary from one person to another. Someone may have small eyes and looks like it is sleepy but some are not. Other than that, if the person is wearing glasses, there is obstacle to detect eye region.

IV. IMPLEMENTATION AND OUTPUT EVALUATION

1)Training stage:

In the training stage, the dataset (MRL eye) containing the images of classes (open, close) eyes, and yawning will be pre-processed by resizing, converting to grayscale etc. As the better prediction is occurred when we have a greater number of samples so to occupy more number of samples, we will be doing data augmentation, by using image data generator we will be generating more samples that contains (rotated, flipped, inverted etc.) samples of the original image so while training the machine learns better. Moving further we are using a

pre trained model (sequential) that contains pre trained parameters that can be directly used in our model in order to use that wewill be importing the model and after adding layers that is needed for our classification, we will be fitting the model. After training the model will be saved to the trained image folder. This will be further used for image processing.

2)Detection of Eyes:

At first, the image is captured and saved to a folder dataset. From that folder ofimages, the face ofthe driver is detected and then the eyes are detected.

3) Yawning Detection:

The mouth is represented by eight landmark points. At any point of time when a person opens his/her mouth to yawn, the distance between the upper and lower landmark point increases. The proportion between the upper and lower lip distance to the level distance between the corners of the lips. That's how the yawning is detected.

4)Tracking stage:

After detecting stage there will be tracking stage where the core region of drowsiness (eyes, mouth) will be tracked by using two parameters - MAR (Mouth Aspect Ratio), EAR (Ear Aspect Ratio) for tracking whether the person is closing eyes than a particular ratio as well as the personis opening mouth than a particular ratio in order to detect the drowsiness. Then we used our model to detect the statusof the eye with an accuracy of 98%.

5) Alert stage:

In this final stage, If yawning or fatigue is detected then the system will be alertness to stop driving. In this stage instead of giving a small alert the alarm will be continuously beeping until the driver stops the car instead of giving a small alert the alarm will be continuously beeping until the driver stops the car

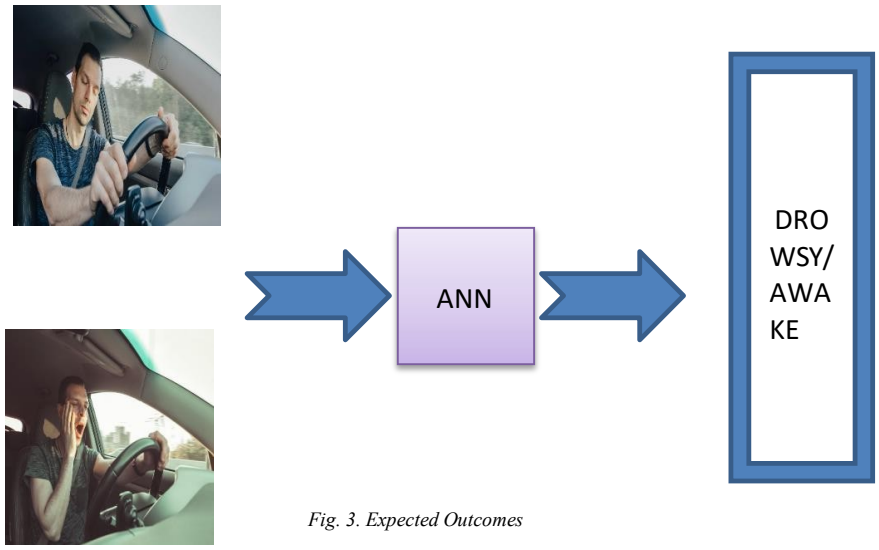


Fig. 3. Expected Outcomes

Fig. 4. Depiction of the phenomenon

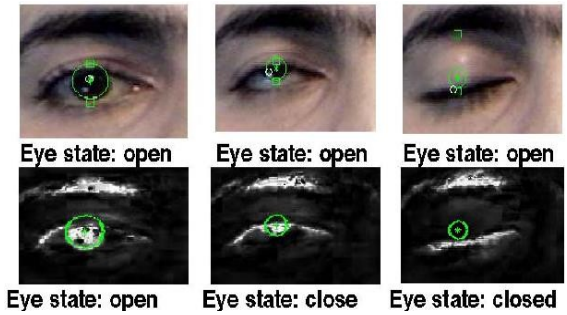
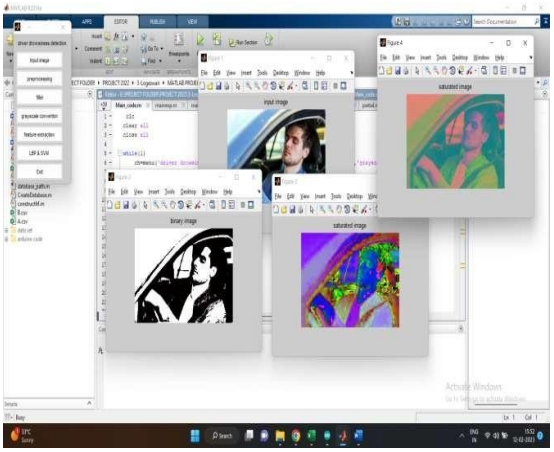


Fig. 5. Eye state Analysis



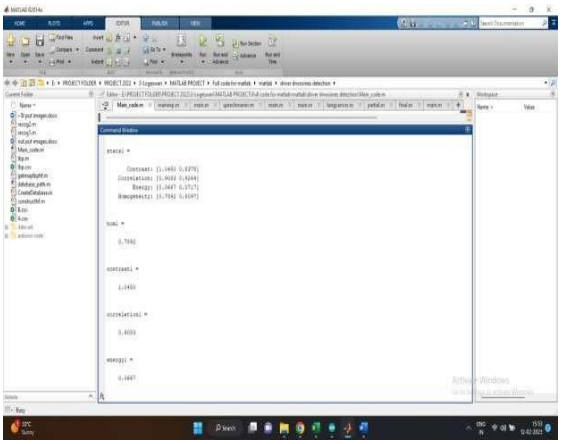


Fig. 5. Converted Gray Scale images *Fig. 6. Extracted Feature*

VI. CONCLUSION

Driver safety is paramount when designing IT'S to prevent significant losses in both cost wise and smart living. There are various reasons for road accidents, but about 70% of accidents are caused by fatigue or disturbance of the driver. Driver disturbances are caused by a number of factors such as critical health, yawning, head rotation, disturbances. This leads to road accidents. That can be solved with the help of this proposed method. In this project, various computer-aided methods designed to detect driver interference in order to automatically alert the driver before damaging the health of the driver and others. For future work we suggest work on designing a driver-based visual sensor system for driver safety. We plant of further work on the project by adding a sensor to track the heart rate to prevent accidents caused due to sudden heart attacks to drivers.

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