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DETECTION AND SECURITY SYSTEM FOR DROWSY DRIVER BY USING ARTIFICIAL NEURAL NETWORK TECHNIQUE

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Abstract: In this paper gives ever-increasing number of traffic accidents that are due to a diminished driver's vigilance level has become a problem of serious concern to society. Drivers with a diminished vigilance level suffer from a marked decline in their perception, recognition, and vehicle-control abilities and, therefore, pose a serious danger to their own life and the lives of other people. Statistics show that a leading cause of fatal or injury-causing traffic accidents is due to drivers with a diminished vigilance level. In the trucking industry, 57% of fatal truck accidents are due to driver fatigue. It is the number one cause of heavy truck crashes. Seventy percent of drivers report driving fatigued. In this paper artificial neural network has been used to detect the driver drowsiness level.

Keywords: NHTSA ,image, matlab, object, processing.

1. INTRODUCTION

The ever-increasing number of traffic accidents that are due to a diminished driver's vigilance level has become a problem of serious concern to society. Drivers with a diminished vigilance level suffer from a marked decline in their perception, recognition, and vehicle-control abilities and, therefore, pose a serious danger to their own life and the lives of other people. Statistics show that a leading cause of fatal or injury-causing traffic accidents is due to drivers with a diminished vigilance level. In the trucking industry, 57% of fatal truck accidents are due to driver fatigue. It is the number one cause of heavy truck crashes. Seventy percent of drivers report driving fatigued. The National Highway Traffic Safety Administration (NHTSA) estimates that there are 100 000 crashes that are caused by drowsy drivers and result in more than 1500 fatalities and 71 000 injuries each year. With the ever-growing traffic conditions, this problem will further increase. For this reason, developing systems that actively monitoring a driver's level of vigilance and alerting the driver of any insecure driving conditions is essential for accident prevention. Many efforts have been reported in the literature for developing an active safety systems for reducing the number of automobile accidents due to reduced vigilance.

These techniques can be classified into the following categories.

- Readiness-to-perform and fitness-for-duty technologies:

These technologies attempt to assess the vigilance capacity of an operator before the work is performed. The tests conducted to assess the vigilance level of the operator consist of two groups: performance based or measuring ocular physiology.

- Mathematical models of alertness dynamics joined with ambulatory technologies:

These technologies use mathematical models to predict operator alertness and performance at different times based on interactions of sleep, Circadian, and related temporal antecedents of fatigue.

- Vehicle-based performance technologies:

These technologies detect the behavior of the driver by monitoring the transportation hardware systems under the control of the driver, such as driver's steering wheel movements, acceleration, braking, and gear changing.

- In-vehicle, online, operator-status-monitoring technologies:

The technologies in this category seek to real-time record some biobehavioral dimensions of an operator, such as features of the eyes, face, head, heart, brain activity, reaction time, etc., during driving.

People in fatigue exhibit certain visual behaviors that are easily observable from changes in facial features such as the eyes, head, and face. Visual behaviors that typically reflect a person's level of fatigue include eyelid movement, gaze, head movement, and facial expression. To make use of these visual cues, another increasingly popular and noninvasive approach for monitoring fatigue is to assess a driver's vigilance level through the visual observation of his/her physical conditions using a remote camera and state-of-the-art technologies in computer vision. Techniques that

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use computer vision are aimed at extracting visual characteristics that typically characterize a driver's vigilance level from his/her video images.

In a recent workshop on driver's vigilance sponsored by the Department of Transportation (DOT), it is concluded that computer vision represents the most promising non-invasive technology to monitor driver’s vigilance.

2. LITERATURE SURVEY

Many efforts on developing active real-time image-based fatigue- monitoring systems have been reported in the literature. These efforts are primarily focused on detecting driver fatigue from facial expression or line of sight or eyelid movement or physiological signals.

Singh et al in their paper entitled “Eye tracking based driver fatigue monitoring and warning system”, have proposed a novel system for driver drowsiness detection. The main idea behind this project is to develop a non-intrusive system which can detect fatigue of the driver and issue a timely warning. Since a large number of road accidents occur due to the driver drowsiness. Hence this system will be helpful in preventing many accidents, and consequently save money and reduce personal suffering. This system will monitor the driver's eyes using camera and by developing an algorithm we can detect symptoms of driver fatigue early enough to avoid accident. So this project will be helpful in detecting driver fatigue in advance and will gave warning output inform of sound and seat belt vibration whose frequency will vary between 100 to 300 Hzs. Moreover the warning will be deactivated manually rather than automatically. So for this purpose a deactivation switch will be used to deactivate warning. Moreover if driver felt drowsy there is possibility of sudden acceleration or deacceleration hence we can judge this by Plotting a graph in time domain and when all the three input variables shows a possibility of fatigue at one moment then a Warning signal is given in form of text or red colour circle. This will directly give an indication of drowsiness/fatigue which can be further used as record of driver performance [1].

Ming et al in their paper entitled “An EEG-based method for detecting drowsy driving state”, have researched the characteristic of EEG signal in drowsy driving. A method based on power spectrum analysis and FastICA algorithm was proposed to determining the fatigue degree. In a driving simulation system, the EEG signals of subjects were captured by instrument NT-9200 in two states, one state was sober, and the other was drowsy. The multi channel signals were analyzed with FastICA algorithm, to remove ocular electric, myoelectric and power frequency interferences. Power spectral densities were calculated after FFT, and the fatigue index F was gotten finally. Experimental results show that the method presented in this paper can be used to determine the drowsiness degree of EEG signal effectually [2].

Picot et al in their paper entitled “Drowsiness detection based on visual signs: blinking analysis based on high frame rate video”, have presented an algorithm for drivers’ drowsiness detection based on visual signs that can be extracted from the analysis of a high frame rate video. A study of different visual features on a consistent database is proposed to evaluate their relevancy to detect drowsiness by data-mining. Then, an algorithm that merges the most relevant blinking features (duration, percentage of eye closure, frequency of the blinks and amplitude-velocity ratio) using fuzzy logic is proposed. This algorithm has been tested on a huge dataset representing 60 hours of driving from 20 different drivers. The main advantage of this algorithm is that it is independent from the driver and it does not need to be tuned. Moreover, it provides good results with more than 80 % of good detections of drowsy states [3].

3. PROBLEM FORMULATION AND METHODOLOGY

1. All From the literature survey it is evident that a lot of work is being done in the field of driver drowsiness detection systems
2. All the existing techniques for sensing have used physiological or image processing techniques
3. No one has so far worked in the area optimizing the driver drowsiness detection system using ANN.
4. Thus there is a need for carrying out investigations in the field of optimization of driver drowsiness detection using ANN.

4. RESULTS

Following graph (figure 1) plots the percentage accuracy achieved when 1 neuron was used to construct the artificial neural network

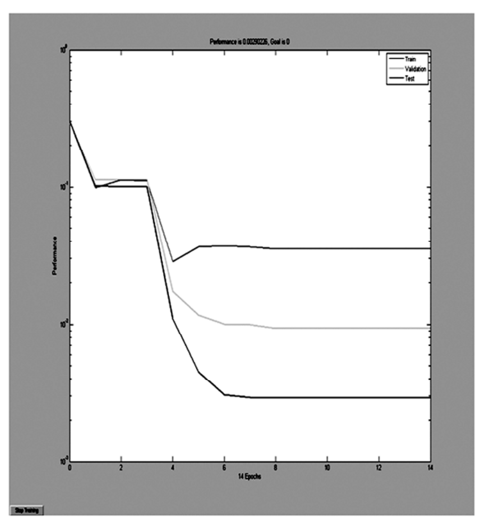

Figure 1: Percentage Accuracy Plot When 1 Neuron Used

It can be seen from the graph that ANN characteristics were TRAINLM-calcjx, Epoch 0/100, MSE 0.299914/0, Gradient 0.252154/1e-010 TRAINLM-calcjx, Epoch 14/ 100, MSE 0.00290226/0, Gradient 3.29611e-008/1e-010 TRAINLM, Validation stop.

Total testing samples: 113

$$cm = \begin{matrix} 70 & 4 \\ 0 & 39 \end{matrix}$$

$$cm\_p = \begin{matrix} 61.9469 & 43.5398 \\ 0 & 34.5133 \end{matrix}$$

Percentage Correct Driver drowsiness Detection: 96.460177%

Percentage Incorrect Driver drowsiness Detection: 3.539823%

Following graph (figure 2) plots the percentage accuracy achieved when 2 neurons were used to construct the artificial neural network

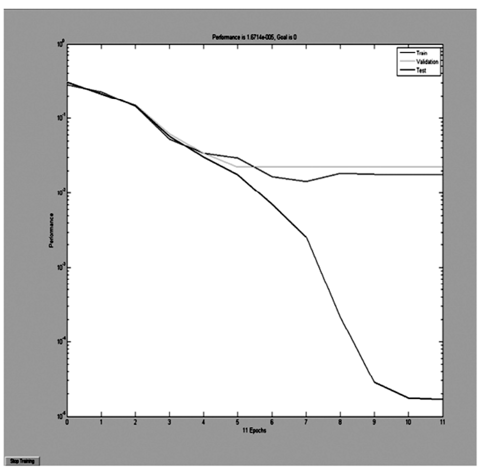

Figure 2: Percentage Accuracy Plot when 2 Neurons Used

It can be seen from the graph that ANN characteristics were TRAINLM-calcjx, Epoch 0/100, MSE 0.304977/0, Gradient 0.301833/1e-010 TRAINLM-calcjx, Epoch 11/ 100, MSE 1.6714e-005/0, Gradient 0.000339815/1e-010

TRAINLM, Validation stop.

Total testing samples: 113

$$cm = \begin{matrix} 76 & 3 \\ 1 & 33 \end{matrix}$$

$$cm\_p = \begin{matrix} 67.2566 & 2.6549 \\ 0.8850 & 29.2035 \end{matrix}$$

Percentage Correct Driver drowsiness Detection: 96.460177%

Percentage Incorrect Driver drowsiness Detection : 3.539823

Following graph (figure 3) plots the percentage accuracy achieved when 3 neurons were used to construct the artificial neural network.

It can be seen from the graph that ANN characteristics were TRAINLM-calcjx, Epoch 0/100, MSE 0.259294/0, Gradient 0.204606/1e-010 TRAINLM-calcjx, Epoch 10/ 100, MSE 0.00290391/0, Gradient 0.0018924/1e-010

TRAINLM, Validation stop.

Total testing samples: 113

$$cm = \begin{matrix} 72 & 1 \\ 0 & 40 \end{matrix}$$

$$cm\_p = \begin{matrix} 63.7168 & 0.8850 \\ 0 & 35.3982 \end{matrix}$$

Percentage Correct Driver drowsiness Detection: 99.115044%

Percentage Incorrect Driver drowsiness Detection: 0.884956%

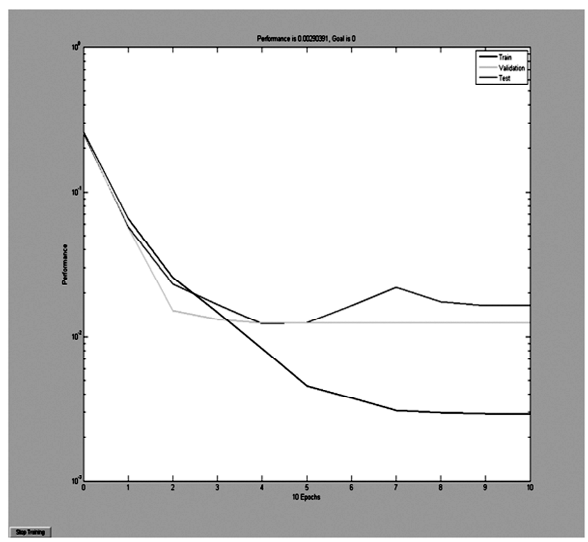

Figure 3: Percentage Accuracy Plot when 3 Neurons Used

Following graph (figure 4) plots the percentage accuracy achieved by varying number of neurons used to construct the artificial neural network

It is evident that maximum 3 neurons are required to give the best result.

Thus it can be concluded from this work that ANN with 3 neurons is ideally suitable for predicting driver drowsiness. And it can achieve 98 % accuracy.

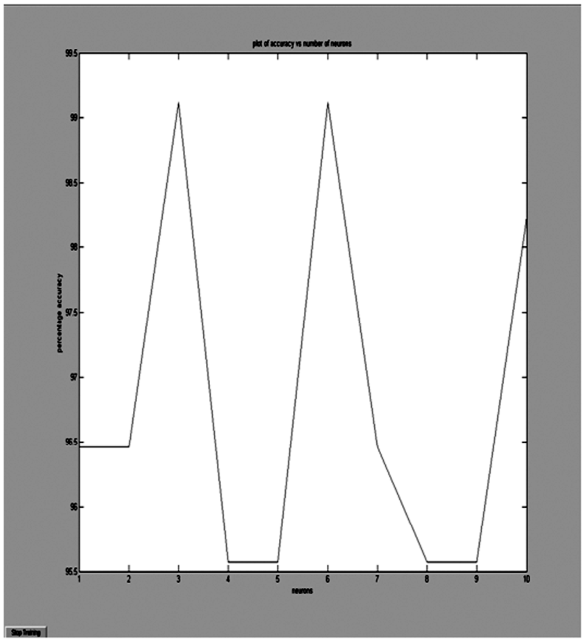

Figure 4: Percentage Accuracy Plot When Various Neurons Used

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