"AN APPROACH FOR PREDICTION OF DRIVER FATIGUE"

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ABSTRACT: *An Approach for Prediction of driver-fatigue monitor. It uses remotely located charge-coupled-device cameras equipped with active infrared illuminators to acquire video images of the driver. Various visual cues that typically characterize the level of alertness of a person are extracted in real time and systematically combined to infer the fatigue level of the driver. The visual cues employed characterize eyelid movement, gaze movement, head movement, and facial expression. The eyes are one of the most salient features of the human face, playing a critical role in understanding a person's desires, needs and emotional states. Robust eye detection and tracking is therefore essential not only for human-computer interaction, but also for Attentive user interfaces (like driver assistance systems), since the eyes contain a lot of information about the driver's condition: gaze, attention level, fatigue. Furthermore, due to their unique physical properties (shape, size, reflectivity), the eyes represent very useful cues in more complex tasks, such as face detection and face recognition. A probabilistic model is developed to model human fatigue and to predict fatigue based on the visual cues obtained. The simultaneous use of multiple visual cues and their systematic combination yields a much more robust and accurate fatigue characterization than using a single visual cue. This system was validated under real-life fatigue conditions with human subjects of different ethnic backgrounds, genders, and ages; with/without glasses; and under different illumination conditions. It was found to be reasonably robust, reliable, and accurate in fatigue characterization.*

Keywords – driver-fatigue, eyelid movement, gaze movement, head movement, visual cues . fatigue characterization.

1. INTRODUCTION

Fatigue is a dormant physical condition that can be witnessed right before one falls asleep. Fatigue affects one's reaction time, ability, concentration and general understanding particularly while driving on road adversely. This thing is primarily based on the movement of human eyelid which distinguished level of alertness. Various visual causes that generally characterize the level of alertness of a person are extracted systematically combined to check the fatigue level of the person. A probabilistic model is developed to model human fatigue and to predict fatigue based on the visual causes obtained. The simultaneous use of multiple visual causes and their systematic combination yields a much more robust and accurate fatigue characterization than using a single visual cause.

The system uses a camera that points directly towards the person's face and monitors the person's eyes in formed to detect fatigue. In such a case when fatigue is detected, a warning signal is issued to alert the driver. This system describes how to detect the eyes, and also how to determine if the eyes are open or closed. The system deals with using information obtained for the binary version of the image to find the edges of the face, which narrows the area of where the eyes may exist. Once the face area is found, then eyes are found by computing the horizontal averages in the area. After finding the eyes to monitor the eye movement in the real time capacturing the video in the camera is specific consecutive frame that gives 10 up to the 200 frames. If the eyes are open, it shows eyes in the normal condition mean Fatigue is not predicted. If the eyes are open and close in some consecutive way it shows the possible fatigue detection. If the eyes are continuously close for a while it predicted the fatigue is detected. It gives warning signal given by the system so it alerts to the user to avoid an accident.

Driver operation and vehicle behavior can be implemented by monitoring the steering wheel movement, accelerator or brake patterns, vehicle speed, lateral acceleration, and lateral displacement. These too are non-intrusive ways of detecting drowsiness, but are limited to vehicle type and driver conditions. The final technique for detecting drowsiness is by monitoring the response of the driver. This involves periodically requesting the driver to send a response to the system to indicate alertness. The problem with this technique is that it will eventually become tiresome and annoying to the driver.

2. LITERATURE SURVEY & BACKGROUND

[1] In this paper author developed the fatigue detection techniques based on computer vision. Fatigue is detected from face and facial features of driver. By Hybrid method is used for face and facial feature detection. Which not only increase

the accuracy of the system but also decrease the processing time.

[2]In this paper author proposed, real time machine vision based system is design for the detection of driver fatigue which can be detect the driver fatigue and issue a warning early enough to avoid an accident. Firstly the face is located by machine vision based object detection algorithm and detects eyes and eyebrows.

[3] In this paper author, developed the detect the driver fatigue based on the eye tracking which comes under an active safety system using ordinary color web camera to initialize the face detection and eye location and eye tracking.

[4] In this paper author present the driver's fatigue approach for real-time detection of driver fatigue. The system consists of a sensors directly pointed towards the driver's face. The input to the system is a continuous stream of signals from the sensors.

[5] In this paper author, developed a real-time driver fatigue detection system based on eye tracking and dynamic template matching. Using two new matching functions, the edge map overlapping (EMO) and the edge pixel count (EPC), to enhance matching accuracy.

[6] In this paper author is to developed artificial neural network has been used to detect the driver drowsiness level. 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.

[7] In this paper author proposed the Eye tracking systems have many potential applications such as learning emotion monitoring and driver fatigue detection systems etc...So, how to use an eye tracking system to implement an eye mouse to provide computer access for people with severe factors. The eye mouse allows people with severe disabilities to use their eye movements to be manipulated by computers. It requires only one low-cost Web camera and a personal computer and five stage algorithm is developed to estimate the directions of eye movements and then use the direction information to manipulate the computer. Several experiments were conducted to test the performance of the eye tracking system.

[8] In this paper author proposed the system for skin, face, eyes detection which together can be used for detecting human presence in video. This system is build so that it can applied to both real-time data although with lower detection rate and static data i.e. .images and video for in processing with higher detection rate.

[9] In this paper author proposed the face recognition techniques (FRT) presented in face the issue and rarely state the assumptions they make on their initialization; many simply skip the feature extraction step, and assume perfect localization by relying upon manual annotations of the facial feature positions.

2. PROPOSED METHODOLOGY AND PROPOSED ARCHITECTRE

In this section discuss the proposed methodology in this proposed work is to detect closed eyes simultaneously to observed and alert the driver on fatigue detection. This is done with the help of mounting a camera in front of the driver and continuously captured its real time video using skin detection, eye detection and Hough Transform algorithm.

The conventional fatigue detectors are most efficient and successful only on frontal images of faces. The system can barely cope with 45° face rotation. The detection area is both around the vertical and horizontal axis. Another shortcoming with these processes was that they were perceptive to lighting conditions. For a few cases the designed system detected multiple recognition of the same face, due to overlapping sub-windows.

In this proposed design take test cases up to 200 frames. This system describes a method to track the eyes and detect whether the eyes are closed or open. The next item to be considered in image acquisition is the video camera. To demonstrate the project we have used the simple Laptop camera. To create the video frames used Computer Vision System Toolbox.

The camera uses the function vision.CascadeObjectDetector creates a System object, detector that detects objects using the Viola-Jones algorithm. The Classification Model property controls the type of object to detect. By default, the detector is configured to detect faces. Computer Vision System Toolbox provides algorithms, functions, and apps for the design and simulation of computer vision and video processing systems. Using this tool box the system can perform object detection and tracking, feature detection and extraction, feature matching, stereo vision, camera calibration, and motion detection tasks. The system toolbox also provides tools for video processing, including video file I/O, video display, object annotation, drawing graphics, and compositing. Algorithms are available as MATLAB functions, System objects, and Simulink blocks.

The MATLAB script is supposed to do the following:

Step 1. It captures the video and opens a facial view where the user has to point his face properly in front of the camera.

Step2. The MATLAB script detects the face and displays the image and lets the user place a bounding box around the face.

Step 3. Afterwards one the eye, mouth portions of the frame are recognized, it rescales the eye, mouth portions to 24*24 pixels.

The camera uses Viola-Jones algorithm to scan a sub-window capable of detecting faces across a given input frame. The standard image processing approach would be to rescale the input image to different sizes and then run the fixed size detector through these frames.

PROPOSED MODEL

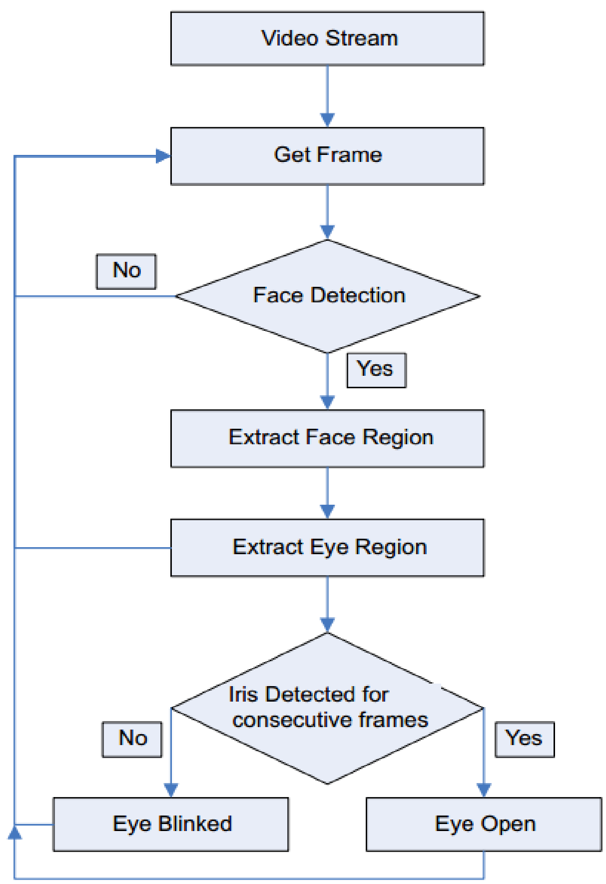

Figure 1: Proposed model

3. RESULT ANALYSIS

The system was tested on 15 people and was successful with 12 people, resulting in 80% accuracy. Figure below shows an example of the step-by-step result of finding the face, eyes and process to detect the fatigue level of the person using eyelid movement.

I. Input video from camera for processing under the MATLAB when the eyes of the person are opened.

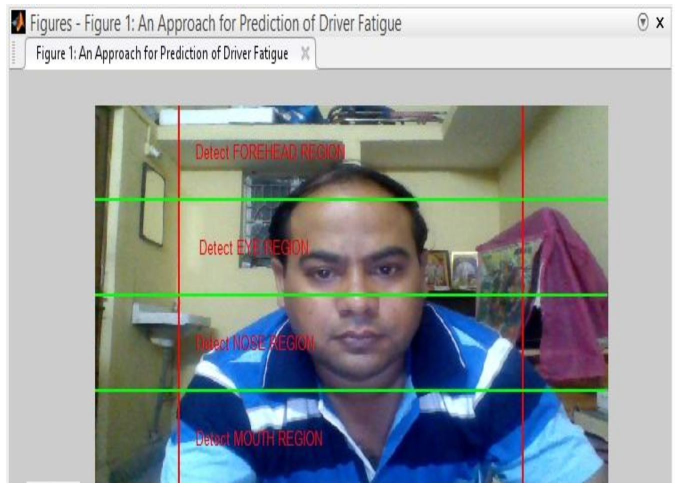

Figure 2: Figure shows the GUI implementation of the process when the eyes of the person are open and the eye area are slice.

OutputsInput video from camera for processing under the MATLAB

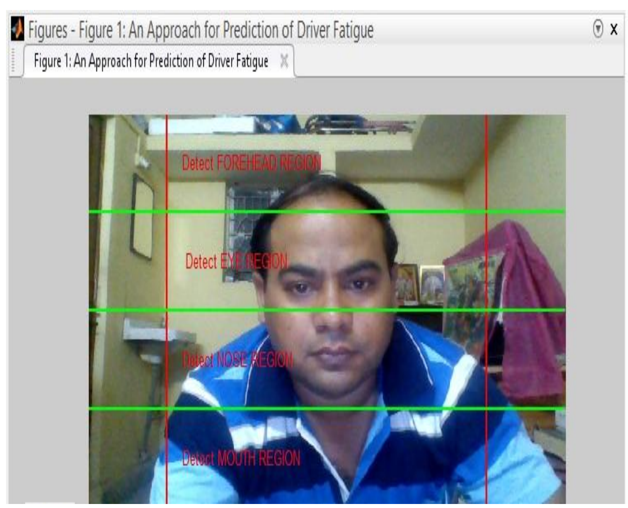

Figure 3: Figure shows the Person place their face in front of the camera as per location of Head Portion,Eye Region,Nose Region and Mouth region for processing the operation

ii) Input frames captured from camera for processing when the eyes of the person are opened and closed

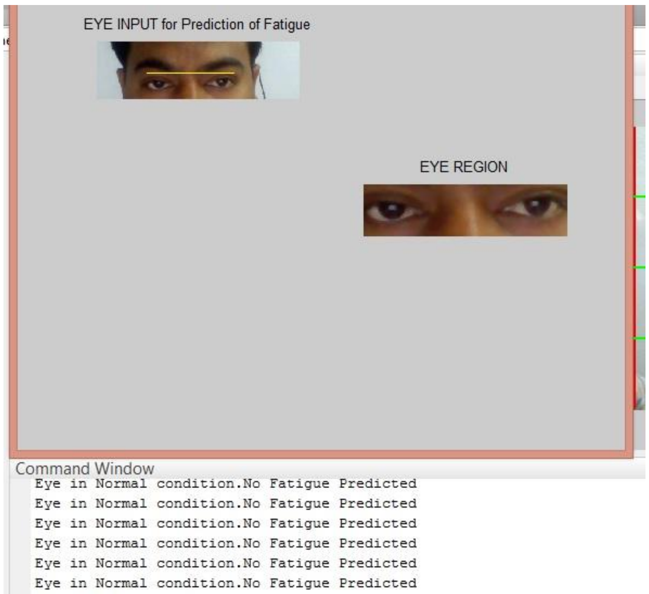

Figure 4: Figure shows eyes of the Person in Noormal Condition.so No Fatigue Predicted

iii) Recognition if the eyes of the person are open or closed

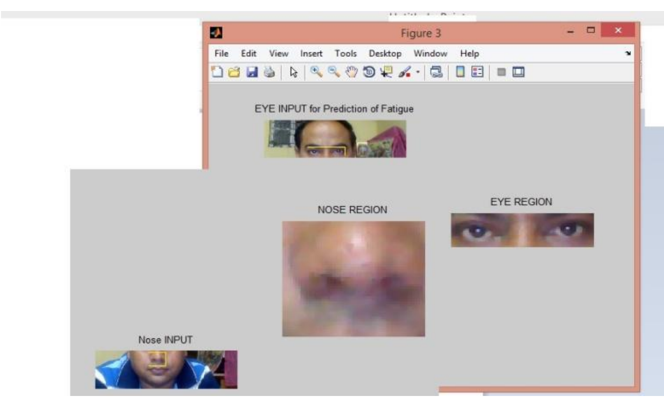

Figure 5: Recognitising if the eyes of the person are open or closed

Figure 5: Fatigue Detection process initiated when the eyes of the person are open and the eye area are sliced means it shows the possibale Fatigue Detection.

iv) Recognition if the eyes of the person are open or closed.

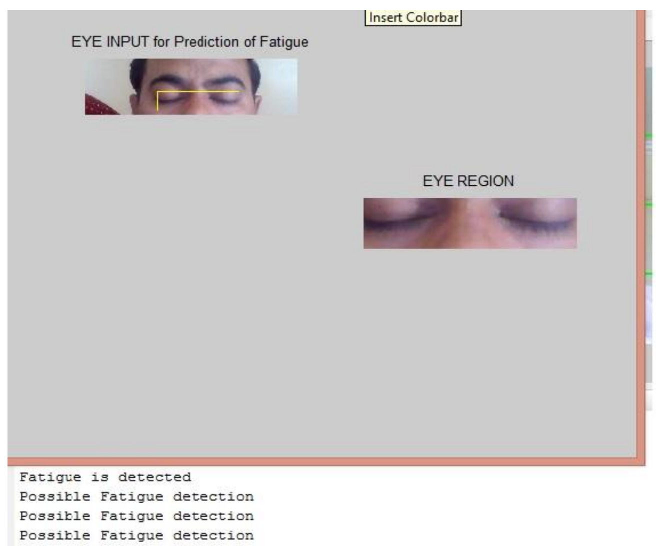

Figure 6 : Recognitising if the eyes of the person are close then shows the Fatigue is detected

4. COMPARISON WITH OTHER TECHNIQUES

The simplest method for driver fatigue detection is based on applying a threshold on each extracted symptom. In the systems presented driver drowsiness was detected by applying a constant threshold on PERCLOS. In the first stage was driver face identification and then an appropriate threshold was chosen for the system based on physical and psychological characteristics of the identified driver. Here, the list down a few techniques and make a comparison of them.

4.1 METHODS BASED ON THRESHOLD

In this system the fatigue detection was carried with 5 different persons under the age group 30 to 35 years. For a total of 200 frames, they had opened their eyes for 100 frames and closed their eyes for 100 frames and monitoring their results is discussed in the table below.

For Open Eye

No. of Person	Total Frames	Eyes Open	Eyes Open Detected	Correct Detection Rate
Person 1	200	94	94	100%
Person 2	200	92	92	100%
Person 3	200	91	91	100%
Person 4	200	85	85	100%
Person 5	200	86	86	100%

Table 1: Open eye detection Rate

For Closed Eye

No. of Person	Total Frames	Eyes Close	Eyes Close Detected	Correct Detection Rate
Person 1	200	91	91	100%
Person 2	200	83	83	100%
Person 3	200	88	88	100%
Person 4	200	92	92	100%
Person 5	200	85	85	100%

Table 2: Closed eye detection Rate

5. CONCLUSION

A noninvasive system to locate the eyes and face monitor fatigue when it occurred. The detectors have been tested different faces and eyes under the same lighting situations and have obtain the result very well considering the amount of parameter adjustment done during the testing. The monitoring the fatigue if the eyes are opened or closed in several continuative way then warning signal is issued. The system is able to automatically detect eyes localizing error that might have occurred so in case of this type of error then system is able to recover and properly localize the eyes. The following conclusions were made:

- Image processing achieves highly accurate and reliable detection of fatigue.
- Image processing offers a non-invasive approach to detecting fatigue without the annoyance and interference.
- A fatigue detection system developed around the principle of image processing judges the driver's alertness level on the basis of continuous eye closures.

6. LIMITATIONS

With 60% accuracy, it is observed that there are limitations to the system.

- The most significant limitation is that it will not work with people who have very dark skin. This is apparent since the core of the algorithm behind the system is based on binarization. For dark skinned people binarization doesn't work.
- Any reflective objects behind the person. The more uniform the background is, the more robust the system becomes. For testing, rapid head movement was not allowed. This may be acceptable, since it can be equivalent to simulating a tired person. For small head movements, the system rarely loses track of the eyes. When the head is turned too much sideways there were some false alarms.

7. FUTURE WORK

The system does not work in dark skinned individuals. This can be corrected by having an adaptive light source. The adaptive light source would measure the amount of light being reflected back. If little light is being reflected, the intensity of the light is increased. Darker skinned individual need much more light, so that when the binary image is constructed, the face is white, and the background is black.

Another big improvement would be to include other salient features in the human face (i.e. the nose or the mouth). This could introduce new geometrical constraints, but it might provide much better accuracy overall. In the long run, properly adjusting the parameters, and using a parallel implementation, this method could actually provide good results for real-time fatigue detection schemes.

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