Detection Drowsniess Driver Among Computer Vision Approach

Radhika Puttewar
UG research scholar
Department of Computational science
SRTM _University ,Nanded.
Maharashtra . 431601

Dr.S. B. Thorat
Professor ,Shri Sharda Bhavan Education Society's Institute of Technology & Management, VIP Road,Nanded.
Maharashtra,431601.

Abstract

Various investigations show that driver's drowsiness is one of the main causes of road accidents. The development of technologies for preventing drowsiness at the time is a major challenge in the field of accident avoidance. The advance in computing technology has provided the means for building intelligent vehicle systems. The purpose of this study is to detect the drowsiness in drivers to prevent the accidents and to improve the safety on the highways. A system aiming at detecting driver drowsiness or fatigue on the basis of video analysis is presented. Real time face detection is implemented to locate driver's face region. A method of detecting drowsiness in drivers is developed by using a MATLAB with laptop camera those points directly towards the driver's face and capture for the video. As a detection method, the system uses image processing technology to analyze images of the driver's face taken with a laptop camera. The captured video is done; it is converted into number of frames of images and monitoring of the face region and eyes and mouth in order to detect drowsiness. The system is able to monitoring eyes and mouth and determines whether the eyes are in an open or close and also mouth open or close shows signs of drowsiness. This detection system provides a noncontact technique for judging various level of alertness and facilitates early detection of a decline in alertness during driving.

Keywords: *MATLAB, SVM algorithm, Image processing, Laptop camera, drowsiness detection.*

1. Introduction.

Over the last few years, advanced robots embedded with lots of sensors and functions are centre of attraction and attention of researchers all around the world. This paper describes the application and functionality of a Robot that can be used in case of disaster management to rescue human life. The robot is designed in such a way that it can be used by any organisation for various purpose. This robot works as, searching for living Human beings and collects data from the atmosphere. The team of rescue members can wirelessly receive the data in real time and perform their job accordingly. By the help of this robot rescue team can get information that the area is safe or not before entering to that particular location.Over the last few years, advanced robots embedded with lots of sensors and functions are centre of attraction and attention of researchers all around the world. This paper describes the application and functionality of a Robot that can be used in case of disaster management to rescue human life. The robot is designed in such a way that it can be used by any organisation for various purpose. This robot works as, searching for living human beings and collects data from the atmosphere. The team of rescue members can wirelessly receive the data in real time and perform their job accordingly. By the help of this robot rescue team can get information that the area is safe or not before entering to that particular location.Over the last few years, advanced robots embedded with lots of sensors and functions are centre of attraction and attention of researchers all around the world. This paper describes the application and functionality of a Robot that can be used in case of disaster management to rescue human life. The robot isdesigned in such a way that it can be used by any organisation for various purposes. This robot works as, searching for living human beings and collects data from the atmosphere. The team of rescue members can wirelessly receive the data in real time and perform their job accordingly. By the help of this robot rescue team can get information that the area is safe or not before entering to that particular location.

Vehicle oriented system:

Drowsiness is detected by analyzing the driver's behaving using information measured by sensors located in the vehicle, such as its position on the road, steering wheel movements, pressure on the driving pedals or the variability of the vehicle's

speed. The main disadvantages of this approach are that driving behavior may be very different from driver to driver. This makes it difficult to construct a "correct driving" model that can be used to detect variations in driving behavior. This model has to be learnt for each driver .

Driver oriented system:

There are two types of driver oriented system which are named as-

(a) Instructive monitoring system based on biological indicators

Drowsiness is detected using physiological information. It is measured by sensors located on or around the driver. The physiological information is eye activity, cerebral activity,Yawns, facial expressions, or gaze direction. These systems are more reliable because physiological drowsiness signs are known and are similar to one driver or another driver. There is one drawback with placements of sensors on the driver's body. They may not bother driver while driving. Another drawback is that measurements may be difficult because the driver is constantly moving. This system is bulky to implement .

(b) Non- instructive monitoring system based on face analysis

The human face is dynamic and has a high degree of variability. Face detection is considered to be a difficult problem in computer vision research. As one of the most important features of the human face, human eyes play an important role in face recognition and facial expression analysis. In actuality, the eyes can be considered salient and relatively stable feature on the face in comparison with other fac ial features. Therefore, when detecting facial features, it is advantageous to detect eyes before the detection of other facial features. The position of other facial features can be estimated using the eye position. In addition, the size, the location and the image-plane rotation of face in the image can be normalized by only the position of both eyes .

2. Literature Survey

Zheng Gangtie et. al., (2009) had performed the drowsiness prediction by employing Support Vector Machine(SVM) by means of eyelid related parameters extracted from EOG data which were collected in driving simulator provided by EU project Senstion. The dataset was firstly divided into three incremental drowsiness levels. To identify how the parameters were associated with drivers' sleepy condition by a paired t-test. A SVM drowsiness detection model was constructed with the help of all the features. Using this method, it was found that the drowsiness detection accuracy was quite high especially when the subjects are very sleepy .

Amna Rahman in 2015, has proposed a method to detect the drowsiness by using Eye state detection with Eye blinking strategy. In this method first, the image is converted to gray scale and the corners are detected using Harris corner detection algorithm which will detect the corner at both side and at down curve of eye lid. After tracing the points then it will make a straight line between the upper two points and locates the mid-point by calculation of the line, and it connects the mid-point with the lower point. Now for each image it will perform the same procedure and it calculates the distance 'd' from the mid-point to the lower point to determine the eye state. Finally, the decision for the eye state is made based on distance 'd' calculated. If the distance is zero or is close to zero, the eye state is classified as "closed" otherwise the eye state is identified as "open". They have also invoked intervals or time to know that the person is feeling drowsy or not. This is done by the average blink duration of a person is 100-400 milliseconds (i.e. 0.1-0.4 of a second).

3. Objective:

The project focuses on these objectives, which are:

- To suggest ways to detect fatigue and drowsiness while driving.
- To study on eyes and mouth from the video images of participants in the experiment of driving simulation conducted by Matlab,Svm Algoritham that can be used as an indicator of fatigue and drowsiness.
- To investigate the physical changes of fatigue and drowsiness.
- To develop a system that use eyes closure and yawning as a way to detect fatigue and drowsiness.

4 Related works:

The Image Processing Toolbox (IPT) provides a comprehensive set of functions for image manipulation, analysis, digital imaging, computer vision, and digital image processing. The IPT

capabilities include image file I/O, color space transformations, linear filtering, mathematical morphology, texture analysis, pattern recognition, image statistics and others.

The IPT contains a full reference manual with mathematical descriptions of various algorithms and over 100 code examples of the function usages. The use of the O-Matrix interactive programming environment coupled with the performance of the multithreaded and hardware optimized IPT functions enable rapid and convenient code development. The IPT is designed to aid engineers and scientists in a wide range of areas such as medical imaging, microscopy, industrial inspection and measurement, surveillance and biometrics. The IPT is also a valuable tool for learning image processing disciplines. The key capabilities are described below:

Performance

The Image Processing Toolbox excels at the processing of large image data sets and performance-demanding image processing, digital imaging, computer vision and digital image processing applications. Solutions that can take hours to run in Matlab, IDL, and even hand-coded implementations can often be run in minutes with IPT. See the IPT Benchmarks page for details.

Color Transformation

The provided functions allow you to convert between standard color spaces such as RGB, YUV, HSV, NTSC as well as device-independent spaces such as CIE XYZ, CIE Lab, CIE Luv and others. Transformation can be applied directly to 8bit or floating point data.

Geometric Transformation

Spatial coordinate transformations of gray and color images can be performed. You can use predefined transformation such as resizing, rotation, affine and perspective transformations, or define the coordinate transformation yourself. All operations support various interpolation methods.

Linear Filters and Image Transforms

Pre-defined filters such as Gaussian smoothing, high-pass, Sobel derivative and many others can be applied. You can also define linear filters of your own. FFT (part of O-Matrix), Discrete Cosine Transform, Radon transform and reconstruction by back-projection can be used.

Mathematical Morphology

Morphological operations on binary and gray level images can be used. Standard operations such as erosion, dilation, opening and closing as well as more advanced operations such as skeleton, morphological reconstruction, distance transform, connected components labeling and others are available.

Image Enhancement

A collection of functions allow you to: apply noise reduction filters, such as median and adaptive (Wiener) filter; generate synthetic noise; and apply histogram equalization. Motion blurred and out-of-focus images can be improved using various de-convolution methods.

Image Analysis

These tools allow you to extract information from images. You can: compute the pixel level histogram and co-occurrence matrix; analyze local properties and textures using non-linear filters such as standard deviation filter and entropy filter; use Hough transform for line detection; use normalized cross correlation and sum of square differences for image registration.

Drowsiness detection:

Drowsiness detection using face detection system Drowsiness can be detected by using face area detection [5], [6] and [14]. The methods to detect drowsiness within face area are vary due to drowsiness sign are more visible and clear to be detected at face area. From the face area, we can detect the eyes location. From eyes detection, author in [5] stated 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 [5]. Figure 4 is an example of the image taken for detecting eyelid movement.

Yawning Detection Method

According to drowsiness of a person can be observed by looking at their face and behavior. The author propose a method where drowsiness can be detected by mouth positioning and the images were process by using cascade of classifier that has been proposed by Viola-Jones for faces. The images were compared with the set of images data for mouth and yawning. Some people will close their mouth by their hand while yawning. It is an obstacle to get

good images if a person is closing their mouth while yawning but yawning is definitely a sign of a person having drowsiness and fatigue. Figure 5 are the examples of yawning detection method used in the research.

Examples of Person in Normal and Yawning **Condition**

After gone through the research papers and the existing methods, this project proposed that eyes and yawning detection method will be used. Eye blink duration gives the data that the longer the person's close their eyes, the drowsier it will be considered. It is because when a person is in drowsy state; its eyes will be closed longer than the normal eye blink. Other than that, yawning is one of the symptoms of drowsiness where it is a normal human response when yawning is the sign that they feel drowsy or fatigue.

5. Conclusion

Previously, the author focuses on developing the algorithm or command to detect drowsiness. The developments of the algorithm takes time due to the authors only have basic skill in using MATLAB. The author learns about the MATLAB commands by developing the algorithm only with the help from Computer Vision Toolbox System that is already built-in in MATLAB software and also by trial and error of the shared file from the MathWorks. MathWorks is where all the high skills of MATLAB users from all over the world share their works on algorithms.

Other than that, during the Final Year Project I, investigating the drowsiness signs and collecting the data from the video of the experiments have been the main job scope. It will be used as parameters to develop the simulation system in detecting drowsiness. Until now, one of this semester's project objectives has been achieved which is to study the video images of participants in the experiment of driving simulation conducted by MIROS. Several techniques to develop the simulation system have been discovered. There are also other objectives that this project needs to achieve.

For the progress of Final Year Project II, the author started developing the algorithm to detect the drowsiness. Few techniques have been implemented in this project which has been found through the previous researches. Further adjustment of the algorithm and the techniques need to be done in order to meet the requirement of this project and to finish it within the given time frame.

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