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Face and Eye Detection Techniques for Driver Drowsiness Detection

Ankit S. Jayswal[1], Prof. Rachana V. Modi[2]

[1]M.Tech IT, U.V.Patel College of Engineering, Kherva, Gujarat, India
[2]Assistant Professor, Information Technology, U.V.Patel College of Engineering, Kherva, Gujarat, India

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Abstract - *The aim of this study is to save many lives during road accidents because of driver drowsiness. A method for detecting sleepiness in drivers is developed by using a camera that point directly towards the driver's face and capture for the video. Once the video is captured, detect the face and continues monitoring the face region and eyes in order to detect fatigue. Viola jones algorithm, LBP algorithm, Hough Transform algorithm, Golden Ratio concept are explained in this paper. The system able to monitoring eyes and determines whether the eyes are open or closed. In such a case when drowsy is detected, a warning alarm is issued to alert the driver. It can determine a time proportion of eye closure as the proportion of a time interval that the eye is in the closed position.*

Key Words: **Face Detection, Eye Detection, Driver Drowsiness Detection, Techniques of Face and Eye Detection**

1. INTRODUCTION

According to survey, there are lots of road accident occurs by the driver drowsiness in the world. Drowsiness occurs due to poor sleep, variety of drugs, also disgust caused by driving vehicles for long times [1]. The interest in equipping vehicles with driver drowsiness detection system has been motivated by alarming statistics, such as the 2013 World Health Organization report (World Health Organization, 2013) stating that: 1.24 million people die on the road each year; almost 6% of all the accidents are yield by drivers driving in a drowsy condition; and most of the accidents of this type result in casualties. To reduce this problem and to negate these deadly accidents, the driver needs to be constantly under observation [2].

There are different techniques used to detect measure and predict driver drowsiness can be splits into three main sections [3]:

- **Biological signal**

In this type technique measures like brain sign, heart rate and pulse rate. These methods have the optimum unmask ascertainment but they require corporal contact with the mover. They are not effective because of obtrusive [3].

- **Vehicle behavior**

In this type technique measures like pace, flank position and turning angle. These techniques may be implemented non-obtrusively, but they have individual barrier like the vehicle mode, driver skill and driving position. Additionally, it can be expensive because it requires special equipment [3].

- **Face dissection**

After all human face is effective and has a high amount of fluctuation; in computer vision face invention is conceived to the hard problem. In face conversance and facial rate analysis human eyes play a significant role. The most leading and relatively fixed characteristic on the face is the eyes comparatively other facial features. To find the eyes before the finding of other facial characteristics is advantageous. The position of other facial characteristics can be predicted using the eye status [3].

1.1 Face Detection

Face detection is used for decide the face is existing in image or not. This is needed for appropriate face designing and distribution. The way should also take into story the sources of diversities of facial outlook such as observing geometry, brightness, the imaging process and other circumference like Occlusion. Face finder techniques classified on the basis of the image data used to help in finding—color, geometric shape or motion information [4].

1.1.1 Local Binary Pattern(LBP)

The local binary pattern (LBP) algorithm is very efficient to narrate the image structure specialty. High speed computation and rotation invariance are advantages of LBP, they simplify broad usage in the fields of image modification, structure examine, face conversance, image distribution etc. In LBP, each pixel is determined a structure cost, which can be naturally united with purpose for recording thermo graphic and continual video. The primary homogenous LBP structures are used to acknowledge the key points in the target area and then form a mask for joint color-texture feature selection [4].

➢ **Advantages**

- Efficient to describe image structure specialty
- Used in structure dissection, Image Retrievals, face compliance and Image partition
- Find of broach material via Background deduction
- It is an Easy Approach
- Computing simple than Hare like component and rapid
- The most vital properties of LBP components are tolerance against the monotonic illumination changes and enumeration artlessness

➢ **Disadvantages**

- Using larger local sectors raise the mistakes
- It is sparing for non-monotonic illumination variations
- Not precise
- Only used for binary and grey images

1.1.2 Viola Jones Face Detection Algorithm

Paul Viola and Michael Jones is proposed first method The Viola-Jones object detection framework in 2001. To find different types of object classes may be it was trained, it was mainly inspired by the problem of face finder. While this framework acquires high finder rates it is able to processing images immensely. There are three key assistance [4]:

- The preface of a new image explanation called the "Whole Image" that approves the components used by our finder to be calculated very fast.

- An easy and effective classifier that is built by the Adobos' learning algorithm for select a small number of reviler visual components from a very large set of possible components.

- A process for connecting classifier in a "cascade" that approve background region of the image to be fast discarded when spending additional enumeration on promising face-like sectors.

➢ **Advantages**

- In real time to detect face this algorithm is the most appreciated algorithm.
- The main advantage of this way is unambitious detection speed while relatively high detection accuracy.
- This algorithm gives proper face detection.
- This technique is a specifically successful technique as it has a very low false positive rate.

➢ **Disadvantages**

- Extremely long performing time
- Finite faces
- False to detect black faces

1.2 Eye Pair Detection

After face detection next step is to detect eye pair detection. Golden ratio concept is used here to find the eye pair because eye pair is always located in the upper area of the face. Golden ration detect only one eye and after that use face symmetry to detect other eye. First detect left eye because the point at golden ratio of height and width and by symmetry the right eye location is calculated. By this eye pair is detected successfully [5].

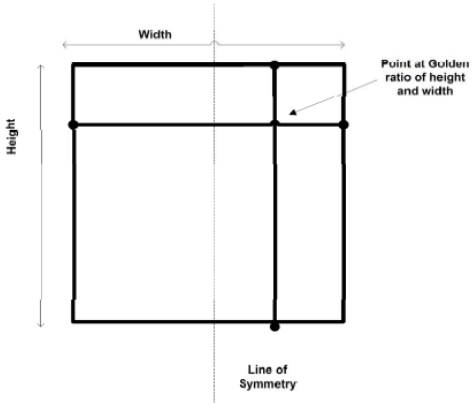

Fig-1 Eye pair detection using golden ratio concept

1.3 Hough Transform detection of human eye

Hough Transform is a technology for extraction of image feature, but also a way of connects some of the pixels near the pixel edge region. We know that human pupil is round, so in the image Hough Transform discover for equivalent area and encircle the area. Three parts Eye detection and location, feature extraction and eye recognition has own role. These three parts are independent with each other. First of all collect video should convert colored image into gray scale image before it detected.

After that convert image into binary image. This method is based on feature extraction to detect human eye. To find the equivalent circular area we need to get edge detection of the image. We can get the circle center and radius in the output a circle of equivalent area [21].

Hough Transformation can be applied to detect the image space resolution curve, the general form of analytic representation of the curve parameters are [21]:

$x^2 + y^2 + 2ax + 2by + c = 0$

In the image we can take at random 3 mark, they are $E(X_1, Y_1)$, $F(X_2, Y_2)$, $G(X_3, Y_3)$, shown in Fig-2. The line segment EF and GF midpoint coordinates is (X_4, Y_4) and (X_5, Y_5), so

$$X_4 = (x_1 + x_2)/2$$

$$Y_4 = (y_1 + y_2)/2$$

$$X_5 = (x_3 + x_4)/2$$

$$Y_5 = (y_3 + y_4)/2$$

The normal equation of EF and GF is

$$\frac{y_2 - y_1}{x_2 - x_1} \cdot \frac{y - y_4}{x - x_4} = -1$$

$$\frac{y_3 - y_2}{x_3 - x_2} \cdot \frac{y - y_5}{x - x_5} = -1$$

Obtained the circle center(x_0, y_0) by solving the equation, the circle radius R is

$$R = \left(\sum \left[(x_i - x_0)^2 + (y_i - y_0)^2 \right]^{1/2} \right) / n$$

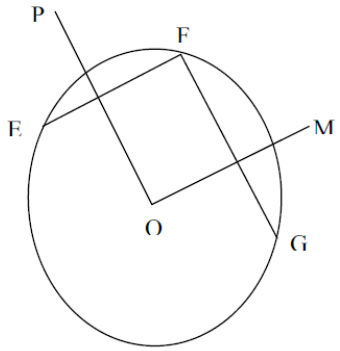

Fig-2 Point calculate round equation

1.4 Eye Blink Detection

Electrooculogram (EOG) and using a camera, these two are common methods to detect eye blink detection.

For the dissection of eye blink Electrooculogram (EOG) is the more dependable method rather than camera. EOG gives more information about the eye blink. But using of EOG is not confortable to the user, because in this method at least three electrodes need to be placed on the head. In other method camera is more appropriate rather than EOG. In particular asthenic people used of camera are best method [5].

CONCLUSIONS

There are lots of road accident occurs by the driver drowsiness in the world. Many researchers research new methods to prevent this road accident by driver drowsiness. In this system, first we will detect the face. Face detection is very important because of varying background. It is very complicated to detect direct eye detection in varying background. Eye template is creating from the video frame for eye tracking. After this we will focus on eye blink duration if eye duration is reached at the standard duration time then blow the alarm and aware to the driver from accident.

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BIOGRAPHIES

Ankit S. Jayswal
M.Tech IT, U.V.Patel College of Engineering, Kherva, Gujarat, India.

Prof. Rachana V. Modi
Assistant Professor, Information Technology, U.V.Patel College of Engineering, Kherva, Gujarat, India.