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Drowsiness Recognition and Alerting System for Vehicle Driver

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Abstract **- Drowsiness of drivers is one of the main causes of road accidents. Thus countermeasure systems is required to prevent sleepiness related accidents. In this paper, a method for detecting driver's drowsiness and subsequently alerting is proposed based on eye shape measurement. The Local Successive Mean Quantization Transform (SMQT) features and split up snow classifier algorithm is used detect driver's face and shape measurement algorithm is used to find the eye blink. Different criterions such as duration of eyelid closure, number of groups of continuous blinks and frequency of eye blink are used to find drowsiness of the driver. Experimental results show that this new algorithm achieves a satisfied performance for drowsiness detection**

Keywords - Face Detection, Eye Region Extraction, Eye Blink Detection, Drowsiness Detection

1. INTRODUCTION

Safe driving is a major concern of societies all over the world. Thousands of people are killed, or seriously injured due to drivers falling asleep at the wheels each year. Recent studies show that driver drowsiness accounts for up to 20% of serious or fatal accidents on motorways and monotonous roads, which impairs the drivers' judgment and their ability of controlling vehicles. Therefore, it is essential to develop a safety system for drowsiness-related road accident prevention. This paper is organized as follows: in section 2 the related work about the detection of driver fatigue is presented. Section 3 describes the proposed method. Experimental results are shown on section 4 and finally section 5 presents the conclusion and future studies.

2. RELATED WORK

Some research works have been performed in order to automatically detect driver's fatigue state. These works for driver's fatigue detection can be approximately divided into two categories: one uses some physiological characteristics, and another use some facial image features. The former detects the change of driver's physiological characteristics such as brain waves, heart rate and pulse rate. In spite the detection accuracy is good, but some special devices must be attached on driver's body. It is intrusive and causing annoyance to the driver. People in fatigue show some visual behavior easily observable from changes in their facial features like eyes, head and face. The later detects eyelid movement, head movement, and yawning based on some image features. As eye state provides significant information, such visual behavior can be measured and driver's state of attentiveness can be predicted. Tabriz presented a method to estimate the open or close state of eye by the number of pixels in pupil Mai Suzuki proposed to use the open or close degree of eyelid and blinks time for drowsiness detection. Zhang adopted a vertical projection technique to locate the position of eyes and judged open or close state of eye based on gray image feature Zhu used Kalman filter to track the eyes an obtain the parameters of the blink duration which are used to judge the fatigue of the driver, Danghui Liu finds the difference between current frames and previous frame. Vidyagouri Hemadri proposed to detect drowsiness of driver by combining eyelid movement and yawing . However, all these algorithms used high definition and high quality images. In fact, low definition and low quality images are usually captured by a simple camera.

In this paper we are finding the eye blink based on shape measurement which can also give good result for low quality camera.

3. PROPOSED SYSTEM

In this paper new method to detect the drowsiness based on eye shape measurements is proposed. The proposed algorithm consists of four different phases such as face detection, eye region extraction and eye blink detection, drowsiness detection.

3.1 FACE DETECTION

Local SMQT Features and split up snow classifier detection and face tracking algorithm is applied for face detection and tracking. This algorithm is more efficient for tracking than the Haar Cascade Classifier when working with multiple image frames, and it can track different types of facial views, not only the front view. The size and angle of the face location are adjusted each time when it shifts. X is a pixel and D(x) be set of $|D(x)|=D$ pixels from a local area in an image. D(x) can be vector or matrix SMQT transformation of the local area

SMQT: D(x) M(x). M(x) is new set of values. Model of the image can be described as

$I(x) = gE(x) R(x) + b$
I(x) = Intensity image
R(x)= Reflectance
E(x)= illuminance
G= Gain factor and b=bias term

Reflectance feature should be extracted since it contains object structure. Assume E(x) is partially smooth. Illuminance is considered to be constant in the chosen local area E(x)=E, Vx € D SMQT on the local area will yield illumination and camera–insensitive features. Entire local patterns which consist of the same structure will result the similar SMQT feature for certain specified level. Number of possible patterns using local SMQT features will be D.

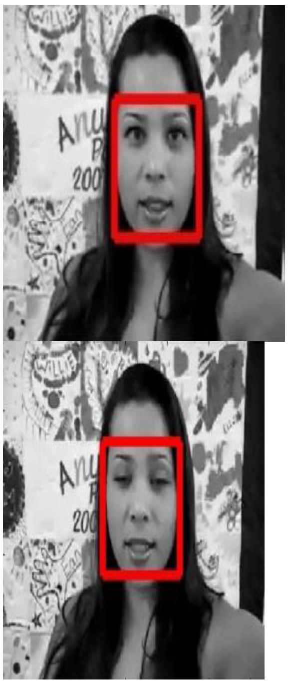

Figure 1: Face detection

3.2 EYE-REGION EXTRACTION

Once we detected human face, next step is to find the eye region from the human face. As we know that eyes are present top position of the face. We simply extract the top half part from the human face. Where we will find the eyes and discard the lips and other region of the face. This will help to speed up the process. Fig2. Shows result of eye region extraction from face.

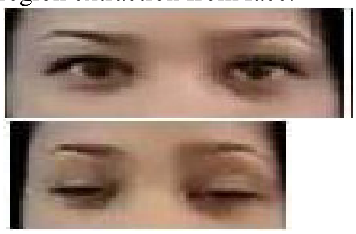

Figure 2: Eye region extraction

3.3 BLINK DETECTION

We propose an ESD (Eyelid's State Detecting) value, which is a measurement used to classify the state of eyelid, open or close. The value can be computed by using the algorithm the objective of the algorithm is to find the minimum threshold, which brings the binary image having at least one black pixel We then threshold the image with the threshold value (begin with 0). If there in black pixel found increase the threshold value at least one white pixel appears. If there is no black pixel increase threshold value and follow the same sequence until get black pixel. Fig 3. Show the binary image of eye region with minimum threshold value

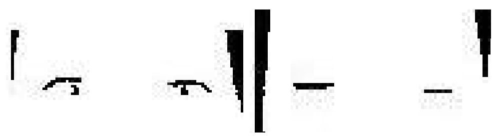

Figure 3: Binary converted image

Then apply the Sobel edge detection method to find the edge of the image. Once we find the binary image dilate the image and remove the boarder. Then again find the boarder of the dilated image. Fig 4. Shows the dilated image with boarder removed.

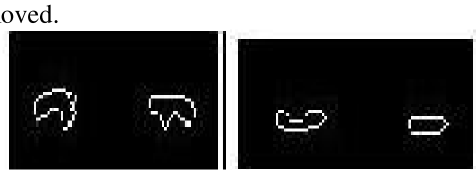

Figure 4: Dilated image

Divide image in vertically in to exact two part. Then take the first half part of the image and find the maximum axis length and minimum axis length. If first part is not found then go to second part of the image and find the maximum axis length and minimum axis length of the image as shown in the Fig. 5

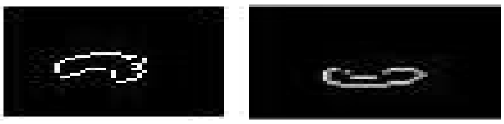

Figure 5: Major Axis length and Minor Axis length

Once we get the major axis length and minor axis length find the average of the major axis length and minor axis length.

Major Axis Length

Minor Axis Length

Once we get the average from the above equation set the threshold to check whether eye is open or closed.

3.4 DROWSINESS DETECTION

Normally, the eye blinks 10 times per minute, the interval is about two to six seconds, the duration of each blink is about 0.15 to 0.25 seconds, and the number of groups of continuous blinks is not more than two times. Therefore, three criterions are proposed to judge drowsiness. The first criterion is the duration of eyelid closure. It is used as distinctive characteristic to judge whether a driver is drowsy or not. It is computed by counting the number of eye closed frames. If the number of related frames is larger than a threshold drowsiness is reported. The second criterion is the number of groups of continuous blinks. It is another characteristic to judge whether a driver is drowsy or not. The number of groups of continuous blink can be computed by the eyelid open and eyelid close. When driver lies in normal condition, the number of groups of continuous blinks is not more than two times, otherwise he may be drowsy. The third criterion is the frequency of eye blink. It is also used to judge whether a driver is drowsy or not. When a driver is drowsy, the frequency of his blink becomes slower. Numbers of eyelid open and close are counted continuously to check the drowsiness of the driver.

4. EXPERIMENTAL RESULT

All these algorithms are implemented in MATLAB 7.11and these programs are tested in Windows XP 32bit operating system with Intel i3 processors and 3 GB of RAM. This algorithm is tested with different types of video images. Videos are converted in to sequence of frames for the purpose of testing. Table.1 shows the result of 25 videos and Table 2. Shows the result obtained using different criterion.

Table 1: Result of 25 videos

Actual Drowsiness in videos	33
Correct Drowsiness Detected	29
False Drowsiness Detected	03
Percentage of correct detection	87%

Table 2: Different criterion

Sl. No	Criterion used to find drowsiness	Number of Drowsiness detected	Correct Drowsiness detected
1	1 Duration of eyelid closure	13	13
2	Number of groups of continuous blinks.	11	10
3	frequency of eye blink	8	6

5. CONCLUSION

New drowsiness detection algorithm is introduced in this paper. Local Successive Mean Quantization Transform (SMQT) features and split up snow classifier algorithm is implemented to detect human face. Then eye region is extracted from the detected face. Eye blink detected using shape measurement and three different criteria used to find the drowsiness of the driver. Experimental results show that this new algorithm achieves a satisfied performance for drowsiness detection the algorithm can be extended to work under various adverse cases such as person wearing spectacles and under different illumination conditions.

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