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A PATH FOR HORIZING YOUR INNOVATIVE WORK

EFFICIENT FATIGUE DETECTION USING EFFECTIVE FACE TRACKING ALGORITHM

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Abstract: Drivers who do not take expected breaks when driving long distances run a major danger of becoming sleepy state which they often fail to recognize early enough according to the experts Driver concentration is one of the main causes of traffic accidents. Studies show that around one quarter of all serious motorway accidents is responsible for sleepy drivers in need of a rest, denotation that drowsiness causes more road accidents than drink-driving. If a warning is emitted, that driver is fatigue indicates nearby service areas in the COMAND navigation system. Driver fatigue is one of the important factors that cause traffic accidents, and the increasing number of accidents due to lessened driver's acuteness and diligence level has become a problem of serious concern. Therefore, how to avoid this problem has become a topic of discussion.

Keywords: Face detection, Fatigue Detection, Feature Extraction, Eyes location.

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INTRODUCTION

In the todays day to day life there is increase of vehicle owners for the transportation, so that traffic accidents happen more commonly in recent times. Thus more importance should be put on the preventive measures. Current statistics approximate that per annum 1,200 deaths and 76,000 injuries can be attributed to fatigue related crashes. Of all the reasons of traffic accidents, factors related to drivers fatigue themselves occupy a higher percentage. 20% of UK road accidents caused by fatigue, and the figure are closer to 40% in Australia. Research on Driver Fatigue Detection System, which aims to ensure the safety of operations and reduce traffic accidents caused by artificial factors related to drivers, has been a research focus in the area of transportation protection.

In order to avoid or reduce the traffic accidents, warnings to a fatigue driver should be accurate and prompt. Driver Fatigue is often caused by four main factors: sleep, work, time of day, and physical. Often people try to do much in a day and they lose precious sleep due to this. Time of day factors can often affect the body.

So, there is a need of designing some systems that can detect the drowsiness or inattention of the driver and can generate some warning alarms to alert the driver and the other people in the vehicle. It is a challenging issue to develop a driver fatigue detection system.

2. LITERATURE REVIEW

In references Qiang Ji et al. has made considerable improvements of facial fatigue detection over existing techniques. However, their methods need infrared (IR) eye detector, or bright pupils and steady illumination. Their eye-tracking method that used Kalman filtering is a linear system estimation algorithm. The standard Kalman filter is no longer optimal in realistic driving environments because the eye motion is highly nonlinear.

To tackle some of those problems, in reference[1], ZHANGs have also proposed a new real-time eye tracking based on a nonlinear unscented Kalman filter for diver fatigue detection.

But these proposed systems/detectors works on IR image which is a problem.

To tackle this problem we have proposed a system that can be used without IR illuminator that illuminates a person’s face and use an IR-sensitive camera to acquire an image.

3. IMPLEMENTATION

The system is composed of five parts, that is, image capture, face detection, feature extraction, and eye detection, eye state. After that fatigue is evaluated.

3.1. Image Capture:

Capturing the video: - The development of the system to capture the video by camera and saving the video properly in database. The camera provides 30 frames per second at VGA mode. Original images are usually converted to gray scale images to be easily used in classifiers.

3.2. Face Detection: In every given frame the face is detected using a specified algorithm. Face detection is a computer technology that determines the locations and sizes of human faces in arbitrary (digital) images. It detects facial features. That is, the content of a given part of an image is transformed into features, after which a classifier trained on example faces decides whether that particular region of the image is a face, or not. If the result of face detection comes positive then the algorithm proceeds to the next, otherwise the flow of algorithm goes back to the image capture stage.

3.2. Feature Detection: Feature detection is carried out by using SURF feature extraction algorithm. It is performed by segmenting the face that has been detected.

Figure 1 is the detection process of AdaBoost algorithm, Viola and Jones came up with the cascade of the Haar classifiers, which enhances the computational speed without sacrifices its detection rate. In this paper, we modified classifiers, which enhances the computational speed without sacrifices its detection rate. In this paper, we modified Viola and Jones algorithm according to the characteristics of FPGA. First, we used 16 classifiers as parallel computing tool.

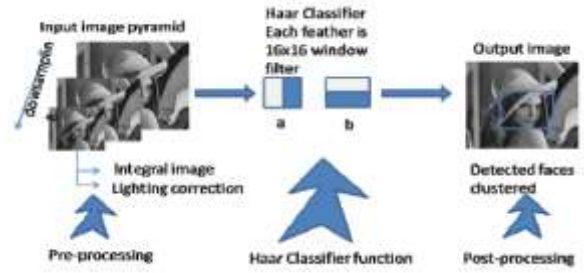

Fig 1 Fatigue Detection using surf feature extraction algorithm

3.4. Face Eye Localization and Eye State Recognition: Eye detection is important of eye tracking – without it, there's no way to identify the eye itself. In this stage the eyes are detected in the specified region by the feature detection.

In this paper, we focus on train drivers. After obtaining a large number of drivers eyes pictures, we formed a general eye pattern for train drivers. Therefore, after detection human faces, sensitive eye areas are obtained through general eye pattern, then time difference method is applied to video image sequence and obtain eye difference image

We use PRECLOS as the criteria for fatigue judging. The PERCLOS means (PERcent of the Time Eyelids are CLOSed). PRECLOS is recognized as the most effective vision-based fatigue evaluation method. It's also the standard measurement of fatigue driving recommended by the U.S. Highway Traffic Safety Administration. PRECLOS is the time ratio of eye slowly close in a certain period of time rather than rapid eye blinking. Person whose eyelids are closed at least 80% time within one minute is defined as sleeping. Eye position, open eye pattern and closed eye pattern of a detected person are obtained by frame differential accumulation figure. Then use closed and open eye pattern to determine whether this person is fatigue or not.

4. RESULT & DISCUSSION

The system was tested under the environment of Pentium 4 with 512 MB RAM. The format of input video Is 320 240 true color. After starting the system, it took less than 40 milliseconds for initial face location and eye detection. Once the eye templates were found, eye tracking could achieve more than 30 frames per second. Recall that in this system, if the driver closes his/her eyes over 5 consecutive frames, then the driver is regarded as dozing off.

Table 1 lists the results of eye tracking from three test videos. The first four videos were captured under different illumination conditions with different people and backgrounds. Tracking Failure is the count of eye tracking failure. Correct Rate of eye tracking is which is the ratio of (Total Frames – Tracking Failure) to Total Frames .

From Table 1, we can see that the correct rate of eye tracking is higher than 98.3% in the first four videos, and it still can reach 80.0% in the very strict environment of video 5. The average correct rate achieves 96.0% in the proposed system on these test videos.

Table 2 shows the result of driver fatigue detection on the three test videos. The field Close Eyes represents the number eye closing and then opening of the driver in the video. Real Dozing is the number of dozing off determined by humans. Generate Warning is the number of fatigue detection that generates a warning alarm.

Table 1: Result of Eye Tracking

	Video 1	Video 2	Video 3	Total
Total Frames	1470	1680	2280	5430
Tracking Failure	5	8	21	34
Correct Rate	99.7%	99.2	98.1	99.0

False Positive is the number of wrongly generated warning alarms. False Negative is the number of not detected fatigue. Correct Warning is the number of correctly detected fatigue, which is equal to (Generate Warning – False Positive – False Negative).

Table 2: Result of Fatigue Detection

	Video 1	Video 2	Video 3	Total
Closed Eyes	18	36	34	88
Real Dozing	3	7	6	16
Generate Warning	20	42	39	101
False Positive	0	0	0	0
False Negative	0	0	3	3
Correct Warning	20	42	39	101
Correct Rate	100%	100%	100%	100%
Precision Rate	100%	98.4%	85.6%	94.6%

As can be seen from Table 2, the system could correctly detect all fatigue states in all the test videos. In spite of this kind of interference and illumination changes, the average precision rate for fatigue detection for all videos could still achieve 89.3% in the proposed system.

5. CONCLUSION

The theory suggests that different environments lead to different mechanisms of the movements. The driver's eye movements and mechanism is different from the usual in the vehicle running form, due to the highly concentration.

In the process of observation, the driver's eye movements seem as a regular random motion. Most of the time the driver's eye movements are aimed to the lights in front of the monitor, as well as part of the nonlinear mutations movement of the instrumentation in the actual driving environment.

Secondly, As a result of the effective combination of hardware acceleration and algorithm, the average rate of the detection and identification is close to 30 frames / second, compared with the condition with no hardware acceleration, the real-time detection has been greatly improved.

Thirdly, it has a high recognition rate of the human faces in this algorithm. In addition, this algorithm also improves the face recognition accuracy of different genders and ages, to solve the problem of the low identification caused by the wrinkles and other facial features in the past.

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