

Efficient Driver Fatigue Detection and Alerting System

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Abstract- In order to the drowsy driver, this paper contains a new fatigue driving detection algorithm. Experts told that such drivers who do not take usual break, when driving long distance can be feeling sleepy. Most of the severe road accidents are caused by sleepy drivers than drink driving.

In order to avoid accidents fatigue detection method will detect early signs of fatigue in drivers. If driver is falling symptoms of weariness then immediately message is generated that driver is fatigue, then this message will be transferred to the control room in COMMAND navigation system that indicating status of driver. The fatigue is detected in the system by image processing method of comparing the images in video and by using human features we will detect the driver is fatigue or not.

Index Terms- Face detection, Fatigue Detection, Feature Extraction, Eyes location.

I. INTRODUCTION

The drowsiness increases the risk of human-error related accidents. Driver's state of mentality and tiredness is one of the most important reasons of traffic accidents. The overall studies in France, the National Police Administration shows that of insufficient sleep can cause more road accidents than drink driving. The studies also show that 14.9 percent of accidents causing human damage and 20.6 percent of accidents causing death are fatigue related.

Also the growing number of traffic accidents in United States that are due to a decreased driver's awareness level has become a problem of severe worry to society. Drivers with a decreased observation level suffer from a serious danger to their own life and the lives of other people. Statistics show that a most important origin of critical or injury causing traffic accidents is due to drivers with a decreased awareness level.

Sleepiness is defined as, it is inversely proportional to hours slept, and difficulty falling asleep was more with a full-time job. Studies indicate that 8 to 9 hours of extended nocturnal sleep are needed to resolve sleepiness caused by decreased sleep time. Motor vehicle accidents related to fatigue, drowsy driving, and falling asleep at the wheel are particularly common but often underestimated. Sleepiness-related motor vehicle crashes have a fatality rate and injury severity level is more than alcohol related crashes.

In the trucking industry, 57% of fatal truck accidents are due to driver fatigue. It is the principal reason of heavy truck crashes. Seventy percent of American drivers details driving fatigued. The National Highway Traffic Safety Administration (NHTSA) estimates that there are 100 000 crashes that are caused by sleepy drivers and result in more than 1500 fatalities and 71 000 injuries

each year in U.S. With the rising traffic conditions, this problem will further increase.

For this reason alerting the driver of any insecure driving conditions is essential for accident prevention or avoidance. In the last 10 years to avoid many accidents due to driver's fatigue many countries all over the world have begun to pay attention to driver safety problem and to investigate the mental state of driver relating to driver safety. Therefore, how to avoid fatigue driving efficiently can help to prevent many accidents, and save the life of human beings.

Visual delay and mistreatment of emergencies are common faults for high-speed train drivers, heavy rail freight locomotive drivers and car drivers. According to related materials, if the hidden dangers could be warned to drivers several seconds before they become out of control, 90 percent of the traffic accidents could be avoided. Actually, visual delay is the appearance of fatigue, so we should improve the early warning system for fatigue driving. In this way, a large number of traffic accidents will be reduced. It's important to understand the real-time monitoring of drivers and vehicles condition and send out warnings when abnormal cases happen.

This problem will increase day by day. So, there is a requirement of designing detection systems for the driver drowsiness or inattention and can produce some warning alarms to alert the driver and the further people in the vehicle. Driver's behaviors such as visual interruption, false determination on the environment and improper handling of emergencies just the accidents have close connection to crash. This method we'll discuss in this paper, fatigue driving based on image processing.

II. RESEARCH ELABORATIONS

A. First of all driver drowsiness detection has focused on medical science, people reflected on medical science with the help of medical electroencephalograph (EEG), electrocardiograph (ECG) and electromyography (EMG) to detect a driver's EEG waveform, ECG waveform and EMG wave-form. In spitefulness of the truth of medical methodology, it's complicated to detect fatigue. The method we'll discuss in this paper, fatigue driving based on image processing. The research "An Evaluation on Various Vision-based Fatigue Driving Detection Methods" shows fatigue driving results.

Previous research shows that principal cause for different road accidents is the variety of speed of eye moving, external lighting obstruction and realistic lighting conditions. In the realistic lighting condition the eye motion is highly nonlinear. In references, Qiang Ji et al. made many changes facial fatigue detection over existing techniques. However, these techniques need infrared (IR) eye detector, or clear pupils and stable illumination. Later they used Kalman filtering for eye-tracking

method, it is a linear system estimation algorithm. In fatigue detection eye motion has the highly nonlinear so standard Kalman filter is no longer favorable. To solve these problems ZHANGs used a nonlinear unscented Kalman filter for fatigue detection but it require IR-sensitive camera.

B. Main reasons of driving drowsiness

Four main factors of driver weariness: sleep, work, time of day, and physical. Most of the work is done successfully in day rather than in midnight. Sometimes by consuming caffeine or other stimulants people continue to keep on awake. Daily insufficient sleep increases and lastly the body fall downs and the person falls asleep. Time of day factor matters on body. Human brain much tries to think in day.

Between the hours of 2 AM and 6 AM, the brain tells the body it should be asleep. The final factor is a person's physical condition. People sometimes are on medications that create drowsiness or have physical ailments that cause these issues. Being physically unhealthy, by being either weak or fat will cause fatigue. Additionally, being psychologically worried will cause the body to get fatigued.

III. FACE DETECTION

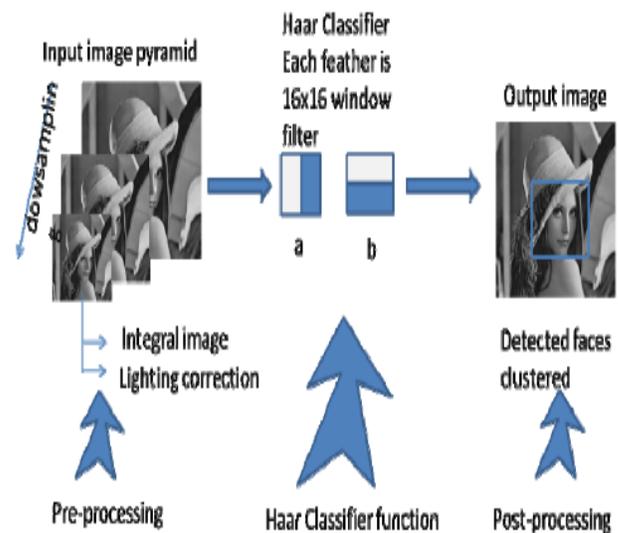
A. Algorithm for Face detection

Face detection and tracking are important in many computer vision applications including activity recognition. Face detection done through an image or video. There are various methods for face detection, artificial neural network method, template matching method, Viola and Jones algorithm, AdaBoost face detection algorithm. Therein, skin color detection method is useful when it appears to multi-face detection and tracking. Systems based on color can recognize human faces from different visual angles, but this method adapts to color image and cannot be used in night mode. Template matching method mainly identifies human faces by the geometrical relationship within face structure. As for illumination and pose variation and covered partial human faces, this method shows its drawbacks. AdaBoost algorithm is adaptable to light variation, anti-shake and can localize human faces with all-weather conditions.

B. Using Modified AdaBoost Algorithm

Viola and Jones came up with the cascade of the Haar classifiers, which increases the computational. We modified Viola and Jones algorithm based on characteristics of FPGA. First, we used 16 classifiers as parallel computing tool. Each stage has 16 integer multiple of the number of classifiers. Also, the output passing rate of Bayesian training algorithm is modified to insure the overall detection rate and false alarm rate remain un-changed after modified the number of classifiers. The eventually trained Haar classifier contains 40 stages, 2192 classifiers and 4680 features.

Fig.1 Face Detection flow based on Haar Classifiers



Fatigue Detection using surf feature extraction algorithm

C. Implementation on FPGA

Only the region of the picture through all of the stages is considered as human face region, and each stage contains 16 integer multiple of the number of classifiers, paper. We designed to simultaneously process the computing of 16 classifiers, and could obtain a speed 16 times faster than the traditional computing process. Because each stage declines regions that don't contain face area, declined regions cannot enter the next stage. The pass rate of the first stage in this design is 20%, while traditional pass rate is 50%. Because most of the computation is centralized on the first stage, as long as image region is blocked by the first stage, then there is no need to initialize parameters for the second stage. Thus time wasted on initialization will be cut off.

IV. PROPOSED SYSTEM

Image input:

We click images from camera which is situated in front of driver. Then we extract one by one Images. We will compare these images with previous images.

Surf feature detection algorithm :

First of all we detect the feature from eyes is useful for finding and tracking of face. It decides whether eyes are closed or opened.

After extracting the feature points in image we track the face and eye movements if eyelids are 80% closed then the driver drowsiness detected.

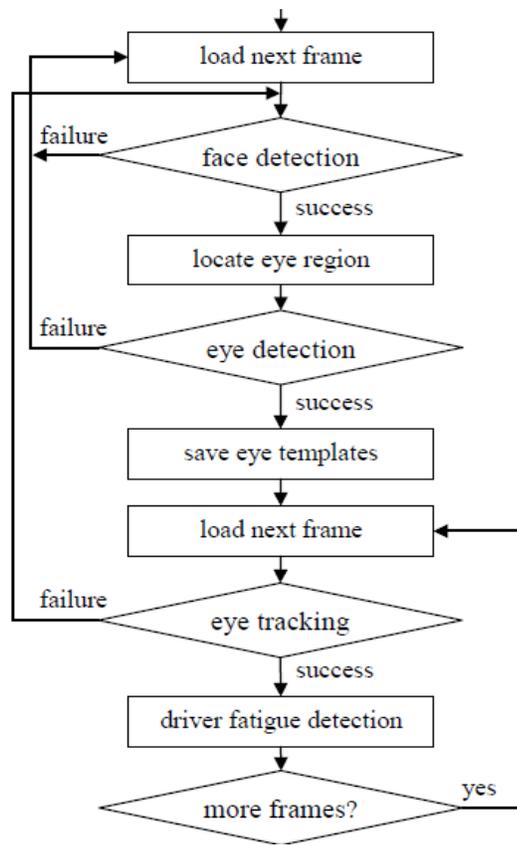


Fig 2.Flow Diagram

D. Eye state recognition

We apply PRECLOS, it is the criteria to judge the fatigue. PRECLOS is identifies as the most helpful vision-based fatigue evaluation method. The U.S. Highway Traffic Safety Administration suggested that it is typical method for measurement of fatigue while driving. PRECLOS is the time fraction of eye slowly close in a certain period of time relatively than rapid eye blinking. Person whose eyelids are shut down at least 80% in one minute is described as sleeping .

When Eye localization completed then Eye state identification should be performed. By using frame differential accumulation figure Eye position, open eye pattern and closed eye pattern of person are obtained. Then use closed and open eye pattern to determine whether this person is fatigue or not. This is the template matching algorithm, where $P_{m,n}(i,j)$ denotes the pixel value of eye coordinates i, j . $T(i,j)$ denotes the pixel value of pattern coordinates i,j . $S(m,n)$ denotes the correlation value between detected eye image and pattern image, $0 \leq S(m,n) \leq 1$. Threshold th is set. If $S(m,n) \geq th$, detected eye image and pattern image are considered match each other.

V. CONCLUSION

As explained overall the paper, many technologies exist for detection fatigue in driver. This system also tried to overcome

the shortcomings of earlier developed fatigue detection system. In this technique the fatigue will be detected immediately and also shows current status of driver. It provides new enhancement in technology. The system can be very useful an efficient to avoid accident and can save people life. It can make the world a much better and safe place to live.

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