Review of Fatigue Systems and Implementation of Face Components Segregation

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ABSTRACT
This paper present different perspectives of modeling the fatigue in any working individual. Mood detection and fatigue detection is based on lot of parameter like facial expression , voice tone known as speech synthesis, eye movements and gestures etc. This paper highlights the most expressive way of humans to display emotions and fatigue that is through facial expressions. This paper proposes fatigue detection and show the implementation face component segregation.

Keywords
Mood detection, fatigue detection, Facial expressions matching, Movements of eye

General Terms
Pattern Matching, Face segregation, Face Recognition.

1. INTRODUCTION
Humans are able to convey their emotional state by facial expressions. The emotional intelligence is the ability to manage and use one's emotions in positive and constructive ways. When it comes to satisfaction and success at work, emotional intelligence matters just as much as intellectual ability. It is harder and difficult to manage work accuracy than ever to cope with stress in the workplace. Regardless of occupation, seniority, or salary level, we're spending more and more of our work days feeling frazzled and out of control, instead of alert and relaxed. Emotional intelligence is about communicating with others in ways that draw people to you, overcome differences, repair wounded feelings, and defuse tension and stress. It includes lot of parameter such as nonverbal cues or signals, moment-to-moment emotions influence, while some stress is a normal part of the workplace, excessive stress can interfere with the productivity and reduce your physical and emotional health. Finding ways to manage workplace stress is not about making huge changes to every aspect of your work life or rethinking career ambitions. Rather, stress management requires focus on the one thing that's always within your control. Facial expressions are also used as paralinguistic cues to regulate our conversation. So to show mood and stress of a person various methodologies are available. As there is lot of key factor such as tone of voice, posture, gesture etc. This paper describes most expressive way humans display emotions is through facial expressions.[13] So Facial expressions are the primary source of information for mood and fatigue detection. As virtual environments may be used for a plethora of pedagogical purposes such as virtual schools Worldwide, more effective methods for Human Computer Interface are being developed which rely on higher level image analysis techniques which has its wide applications in automatic interactive tutoring, multimedia and virtual environments. For the computer to interact with humans, it needs to have the ability to understand the emotional state of the person. The fatigue directly affect human performance in term of accuracy and reaction time and it has been claimed as primary cause of many major accidents so fatigue measurement also be a basic part. For resolving the absence of mutual sympathy in interactions between humans and machines is one of the most important issues in human-computer interaction, many researches about the emotional communication between the human and the machine have been reported. In this paper lot of perspectives of modeling the mood as well as fatigue in any individual it may be the student, learner, employee of software industry or other organization where work based on facial expression, either it may be student or employee of software industry or industrialist.

2. SURVEY OF PREVIOUS WORK
In the past decade, many countries have begun to pay great attention to the driver safety problem. Researchers are working on the detection of driver's fatigue level using various techniques, such as physiological detection [1][2][3], driver behavior monitoring [4], vehicle running status analysis [5] and vision- based detection [6][7][8][9][14]. However, among those techniques, vi- sion-based driver fatigue detection method is a natural, non-intrusive and convenient technique to monitor driver's vigilance. When driver fatigue occurs, visual behaviors can be easily observed from changes in their facial features especially from their eyes. It is indicated that the change regularity of eye states have high relativity with the driver's mental states [11]. Eyes express the most direct reaction when driver is drowsy or inattention and eye blinking is always used as the basis for driver fatigue detection by researchers. Zheng pei calculated the ratio of eye closing during a period of time. The ratio can reflect driver's vigilance level [16]. Wenhui Dong proposed a method to de-tect the distance of eyelid, then judged the driver's status by this kind of information [11]. Nikolaos P used front view and side view images to precisely locate eyes [10].Edge detection and gray-level projection methods were also applied for the eyes location by Wen Bing Horng [7]. Zutao Zhang located the face by using Haar algorithm and proposed an eye tracking method based on Unscented Kalman Filter [8]. Abdelfattah Fawky presented a combination of algorithms, namely wavelets transformation and edge detection and YCrCb transform in the eye detection [9]. Qiang Ji depended on IR illumination to locate eyes [10]. Eyes always contains two kinds of information: size of opening and duration of the different states. By analyzing the change rules of eyes in fatigue, we propose an efficient approach for driver fatigue detection.

2.1 CAUSES OF FATIGUE

1. The length of time spends at work & in work related duties.

2. Type & duration of a work task & environment in which it is performed.

3. Individual factor such as not enough sleep: less sleep can negatively affect your concentration and health.

4. Features of the work & workplace.

5. Features of an employee or workers life outside work.

6. Circadian system [15].

As fatigue becomes a problem and important issue in the process industry increases risk on site because fatigue employee are less able to respond effectively to changing circumstances. Fatigue can lead to incidents because employees or workers are not alert. As fatigue and mood are totally a part of emotional cognition which directly affects the performance, work accuracy and time constraints and also deal with psychology of human being and it has been proved as primary cause for many major situations because of lack of alertness and tiredness. [14]

3. VISUAL FATIGUE MANAGEMENT SYSTEM

This method used a new objective visual fatigue measurement system by using a high resolution camera and an infrared illuminator. As fatigue evaluation method use both approaches subjective approach and objective approach. As subjective approach use observer views so there may be less accuracy so used objective approach based on eye movement such as eye region and size, pupil accommodation speed, blink frequency, and eye closed duration means pupil detection methodology [4] which model under different stages such as

1. Image Browsing

2. Gaze Movement

3. Cropping Eye Region

4. Circular edge detection

5. Component Labelling

6. Eye Separation

3.1 FLOW OF IMPLEMENTED PHASE

a. Take input image from a standard data set.

b. Convert the picture into appropriate size for further processing.

c. Perform steps to segregate the components of face.

d. Remove the skin colour.

e. Convert the image in binary format.

f. Dissect the image.

g. Compare the components on the standard parameters for fatigue.

4. FACE LOCALIZATION

When working in an industry, the worker's eyes' position and change constantly. To search and locate the worker's eyes directly in the whole image will not be easy. Moreover, the back- ground is usually complex and unpredictable especially when the worker is working with machines. So the first step we detect face in order to reduce the range of eye detection, besides, the procedure will improve the veracity and speed of eyes location and reduce the interference of background. For purpose of reducing the blindness of face searching, we calculate inter-frame differences to decide whether there is a moving object. When some object is detected and in the local area there contains skin color information in YCbCr color space, we believe there is a person before the camera. Although people of different races distinguish in skin color, the distribution of human skin color in YCbCr color space can be approximated by a planar Gaussian distribution [12]. Specifically, face area can be segmented from a image by skin color information. To improve the accuracy of detection, in this paper, we use a mixed skin model based on YCbCr and HSI color Space. Because in the HSI color space hue is independent of brightness, the brightness factor can be excluded from colors. This mixed skin model is more suitable for distinguishing skin and non-skin colors no matter the face is under light or shadowed.

The three components (Cb, Cr and H) have different abilities to represent various skin colors and they can be complemented by each other. By using this method, it is easy to separate face region from the origin image, as is shown in fig below. By performing vertical and horizontal projections on skin pixels, the right, left, top and bottom boundaries of the face can be confirmed if the projection values exceed some threshold which has been set based on experience, as is shown in Fig. 2(c). Usually the normal position of the eyes will be in the upper half part of the face region, as is shown in Fig. 2(d), further- more, the area is sufficient for us to detect eyes later.

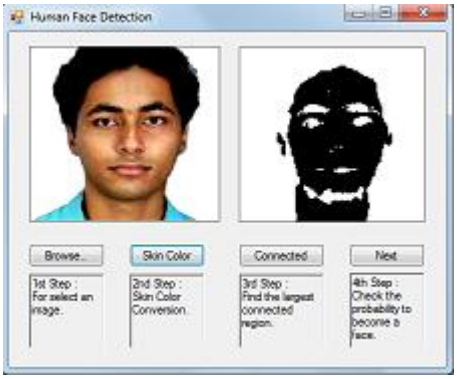

Fig.1: Removal of skin color

The above snapshot shows the initial step of the fatigue system. Image is browsed from the standard data set that is stored on the machine, then the skin colour is removed from the original image and the binary image is procured from the process.

This image is further more divided into different section as per the component list on which we are going to calculate our fatigue result.

5. GAZE MOVEMENT

According to the thermodynamic principle, for a closed system the minimum of Helmholtz free energy f (E) is used to describe the equilibrium state instead of maximum entropy. It

is easy to see that the larger the free energy gap between different particles the smaller the probability that they can reach the same level. When the free energy gap is same the higher temperature the larger the probability it will. By considering the diversity to the nearby pixels and the similarity to the eye pixels sufficiently, the specific region of the eyes can be obtained. After this step, projection method is used again to detect the eyes' precise boundaries. The method has been adopted frequently in the eye detection so we needn't describe the de- tails. Our method starts from both sides, left and right, to find eyes, therefore we can detect the eyes separately.

(a) Left eye (b) Right eye

Fig. 2: Eyes detected

Then we segment the eyes from the image and use them to generate an eye template, by this means we obtain a rather stable eye template for the status analyzing and reduce the influence of light reflections. The eye template is generated as follows.

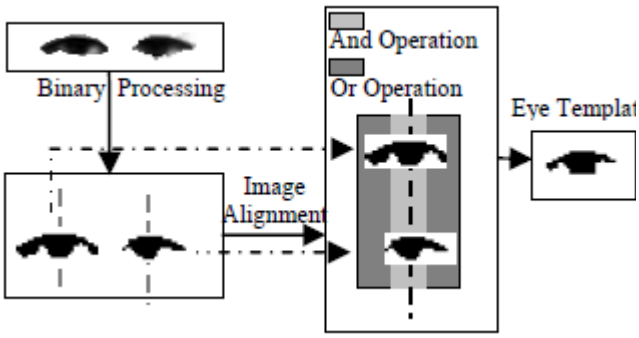

Fig. 3: Eye template generation process

Also the two eyes' positions are re- corded, the eyes can be detected in the next frame based on these positions. The searching area expanding 6 pixels in four directions from the eyes' centers in the current frame. If the distance between two eyes detected in the next frame changes greatly, the eye tracking is regarded as failure. Then the face detection and eyes location procedures will be restarted.

Fig.4: Segregation of face components

In this example the image is segregated into different section that our required in our fatigue system to process the image and take out a result.

Finally each component is separately processed as it was done in facial expression.

The output of this is then calculated and then an analysis is done with the standard formats and angles and then output is displayed.

6. CONCLUSION

In this paper we will be aiming at evolving a strong system that will not be dependent on hardware as the hardware interventions make the system vulnerable to crash as they are more prone to damage and not working well. This paper will make a standalone application to detect fatigue on different parameters that will allow us to find fatigue level of workers by use of our software.

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