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Driver Fatigue Detection Using Image Processing

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***Abstract*—** Nowadays, most of the accidents were related to driver fatigue, drowsiness and driver inattention caused by various distractions inside and outside the vehicle. Falling asleep while driving, is a major cause of road accidents. Car accidents associated with driver fatigue are more likely to be serious, leading to serious injuries and deaths. In this paper a vision-based driver fatigue detection system is proposed in which the system will directly give an indication of drowsiness to prevent accidents. The system tracks human eye and eyelid behavior, looking for the duration of blinks for detecting the drowsiness.

***Keywords*—**Driver Fatigue Detection, Face Detection, Eye Detection, SURF, SVM Classifier, Viola-Jones Face Detection

I. INTRODUCTION

Driving is the controlled operation and movement of a motor vehicle. When you are driving, whether alone or with passengers, driving safely should always be your main concern. Fatigue, drowsiness and sleepiness are often used synonymously in driving state description [1].The major cause of traffic accidents is drowsy driving due to prolonged driving periods and boredom in working conditions. You don't even realize that you are in the process of falling asleep.

Numerous studies have found that fatigued driving can affect driving as much as alcohol. This is due to long drives for hours or when a person does not get an adequate amount of sleep which will affect his or her ability to function.

In order to decrease traffic accidents, many have pay attention towards driving safety problem. In this paper I propose an image processing technique to find the drivers sleepiness. This helps to prevent accidents caused by the driver getting drowsy.

1.1 Problem Statement:

This paper is intended to provide a method to prevent accidents caused by driver fatigue.

1.2 Motivation:

The reason for choosing Driver Fatigue Detection as my platform is because studies have shown that fatigue is one of the leading contributing factors in traffic accidents worldwide [2].

Detection of fatigue involves a sequence of images of a face and the observation of eye movement and blink patterns. This paper is focused on the localization of eyes, which first determines the entire image of the face and then identifies the position of the eyes by an image processing algorithm called Viola-Jones Face Detection Algorithm. Once the position of the eyes is located, the system determines whether the eyes are closed or opened. The eye closure evaluation is employed by SVM Classifier.

The rest of the paper is organized a follows. In section II we briefly review the related driver fatigue detection methods. In section III, we present a vision-based driver fatigue detection system. The results of the system are analyzed in Section IV. Finally the paper is concluded in the last section.

II. RELATED WORK

Several systems were introduced for detecting the driver fatigue. Some of the systems used sensors.

Different algorithms are used to execute the vision-based detection system for obtaining efficient outputs. Eye state estimation by the histogram value [3], neural network technique accustomed realize the variations appeared within the pictures [4], eye-glass removal algorithm is additionally been used for the drivers who are using spectacles [5].

III. METHODOLOGY

The proposed method is composed of two steps: first one is to detect and analyse the face and eye area from the original input image and next is to verify the eye closure features.

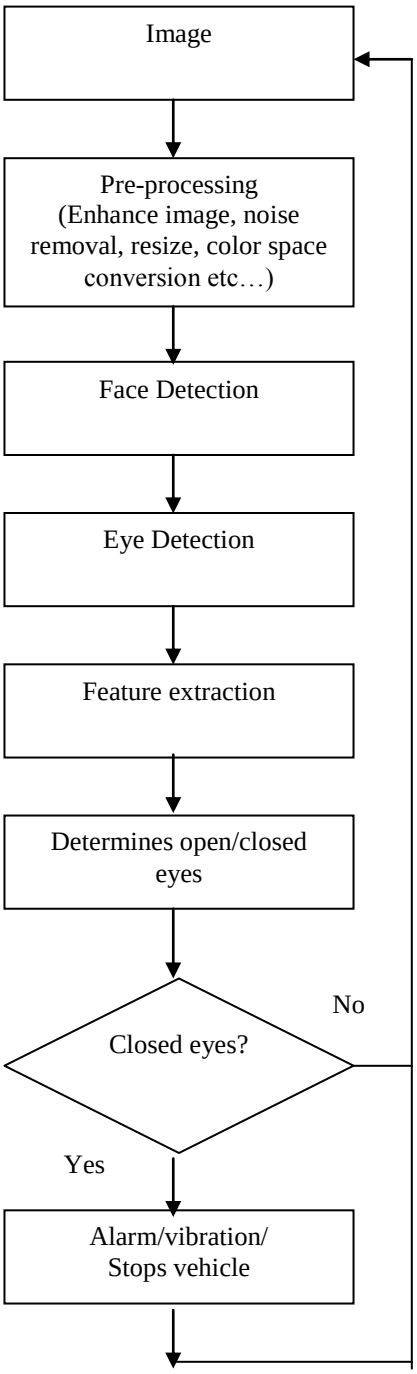

Figure 1. Proposed System Flowchart

The face of the driver is monitored through camera which is fixed in front of the driver. Sequence of frames is extracted from the captured videos and is used as input to the system.

3.1 Preprocessing:
The input image is then preprocessed. Preprocessing is the process of manipulating the image in such a way that the image becomes more suitable for a particular application. It is to improve quality of the image by removing unrelated objects [6]. Some of the preprocessing includes image enhancement, noise removal, resize, color space conversion etc… Here the image is a RGB image and is converted into grayscale image. This is because RGB images use 3 channel of color while grayscale images use just one channel of color which simply reduces complexity. Segmentation is then done for partitioning the extremely contrasted areas and darkness by converting the image into binarisation [7].

3.2 Face and Eye detection:
For detecting face and eyes, Viola-Jones algorithm is used. This algorithm is an Object-class detection algorithm that discovers size and location of objects within an input image [8]. The face is detected from the image and finally the eyes have been filtered from the frame.

3.3 Feature Extraction:
SURF (Speeded-up Robust Features) is an efficient algorithm used as a local feature detector [9]. It provides a unique and robust description of the image feature. SURF represents features of each frame in a vector format along with a label 0 or 1. If the label corresponding to a feature is 0 then it means that the eye is closed. Otherwise if the label is 1 then it means that the eye is opened.

3.4 Classification:
The next step after detecting feature is to pass this feature vector and label to an algorithm called SVM Classifier. SVM Classifier is supervised machine learning algorithms that analyze data used for classification. Given a set of training images, SVM builds a model that assigns new examples of images to one category or the other. New examples are then mapped into the model and predicted to belong to a category (closed or open) [10].

IV. RESULTS AND DISCUSSION

The proposed driver fatigue detection system used a camera to capture driver's images. If drivers close their eyes for longer than expected then the system will generates alerts to awake the driver. If it happens a second time, then generates vibration of a motor positioned in the seat. A third time generally means that the driver should be taken off driving to avoid accidents.

V. CONCLUSION

In this paper I have presented a vision-based driver fatigue detection system using image processing. This system issues timely warning for driver safety. This system also takes advantage of the Viola-Jones, SURF and SVM Classifier algorithms for successful detection of drowsiness of a vehicle driver. The performance is accurate enough to distinguish the open and closed eyes and recognize eye blinking. By

implementing this system we can prevent traffic accidents before they happen.

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