AN PROFICIENT FRAMEWORK TO RECOGNIZE DRIVER BEHAVIOR USING MOUTH AND EYE ANALYSIS

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Abstract— The most basic reason behind fatal road accidents is because of two major factors which are driver's drowsiness and fatigue. The reason behind driver's drowsiness is due to driver's subconscious state caused due to less sleep. To overcome the fatal road accidents, a system need to be developed which is based on driver's drowsiness detection through live video streaming. There are many techniques available for detection of drowsiness such as object recognition, face detection, eye and mouth mapping and skin detection. Many system related to "Driver's Drowsiness Detection" are having performance issues regarding detection of facial expression, so this paper proposes an idea of "Driver's Drowsiness Detection". To identify the drowsy state of the driver a strong and efficient system is incorporated using image processing techniques which are powered by Adaboost Algorithm, YCbcr Color Model and HAAR Features.

Index Terms— Driver's drowsiness, Face detection, YCbcr Color Model, Adaboost Algorithm, Object Recognition, HAAR Features.

INTRODUCTION

The tremendous increase in number of vehicles is due to easier and convenient travelling and transportation. The number of fatal road accidents is increased due to various reasons. Due to various reasons behind road accidents, many peoples looses their lives. So the above issues gives rise to fatal road accidents due to the various causes such as drunk and drive, improper sleep and continuous driving for long time. Thus there is need to identify subconscious state of driver through detection of facial expressions. This paper presents an efficient way to identify drowsy state of the driver by using software and hardware measures. Facial expression of the driver will be monitored through various image processing techniques such as Adaboost Algorithm, YCbcr Color Model and HAAR Features.

YCbcr color model is primarily used to represent digital components. YCbcr is used to represent brightness of the color and difference between two different color signals. In YCbCr, the Y is the brightness (luma), Cb is blue minus luma (B-Y) and Cr is red minus luma (R-Y). YPbPr is one of the analog counterpart of YCbCr which uses three cables for connection, whereas YCbCr uses only a single cable. YCbcr is preferred instead of RGB color model because of RGB uses only red, green and blue colors, it fails to represent an image having higher contrast. The representation of YCbCr separates the luminance and chrominance, so the computing system can encode the image in a way that less bits are allocated for chrominance. The above process is carried out through color subsampling, which encodes chrominance components with lower resolution.

AdaBoost which stands for "Adaptive Boosting", is machine learning meta-algorithm invented by Yoav Freund and Robert Schapire who won the award in 2003 for their work. It can also be used with many other types of learning algorithms for improving the performance. The output of the weak learners is combined in a weighted sum that gives the final output of the boosted classifier. It is adaptive in the case that subsequent weak learners are tweaked. It is sensitive with noisy data and outliers. In various problems it is less susceptible to the overfitting problem than other algorithms. The individual learners can be weak, but as long as the performance of each one is slightly better than random guessing which includes their error rate is smaller than 0.5 for binary classification. It is a type of "Ensemble Learning" in which multiple learners are selected for building a stronger algorithm. It works by choosing a base algorithm and iteratively improving it. Here we assign equal weights for all the training examples and choose a base algorithm. At each stage, we apply the base algorithm to the training set and increase the weights of the incorrect examples. Here we iterate n times, every time applying base learner on the training set with updated weights. Hence getting the final model which is the weighted sum of the n learners.

Once the illuminant in a scene has bounced off a subject which has been captured by the optical or digital components of a camera, then reflected color information is stored using the chroma component of video. *Chroma* is termed as that portion of an analog or digital video signal which carries color information, or in many video applications it can be adjusted regardless of the image luma. In component of YCbcr-encoded video, the chroma is carried in parts of the Cb and Cr color difference channels of the video signal. In recently study for technical literature of colour appearance, the chroma is termed as "colorfulness" of object relative to its brightness of an white object illuminated, which therefore allows that a surface of a given chroma is displaying an increasing "colorfulness" as the level of illumination increases. Early monitoring shows the images by progressive scanning across for each horizontal line of pixels, usually from top to bottom in rapid succession manner. As each of the line was scanned, the values would be sent less frequently for chroma than for luma. The modern display devices won't work this way, the concept of scanlines is still important due to the chroma subsampling types are specified horizontally. Each type is listed as a ratio between the rate at which the luma and chroma values are sent and the lines scanned.

Thresholding is a simplest method for image segmentation. From a grayscale image, this particular thresholding can be useful for creating the binary images. The simple thresholding method is to replace each pixel in an image with a black pixel if and only if the image intensity is less than of some fixed constant T, or a white pixel for the image intensity if it is greater than that constant T. Many color images can be thresholded. One approach is to assign separate threshold for each of the RGB components for an image and then combine it with AND operation. This process reflects a way of how the camera works and how the data storage is done for computer, Although it does not correlate with the way that how the people recognize colour. Hence, both the HSL and HSV colour models are used oftenly; here note that hue is a circular quantity it also requires the circular thresholding. CMYK color model can also be used. Adaptive thresholding is also a form of

thresholding which takes into account of spatial variations in illumination. A technique for real-time adaptive thresholding can be developed using the integral image of the input. Global Thresholding is a method in which the histogram of the input image intensity should reveal atlest two peaks, respectively to the signals from the background and of the object. Global thresholding is as good technique as the degree for intensity separation between the two peaks in the image which is an unsophisicated segmentation choice.

Haar features are termed as the digital image features which are used in object recognition purpose. They got this name due to their intuitive similarity of Haar wavelets and which are used in the first real-time face detection. The Haar wavelet is defined as a sequence of rescaled "square-shaped" functions which forms a wavelet family or basis together. Wavelet analysis is similar process to Fourier analysis in which it allows a target function over an interval of an orthonormal basis in terms of representation. Recently, working with only image intensities which are RGB pixel values at each and every pixel of image which makes the task of feature calculation expensive. In a publication which discusses working with alternate feature set which is based on Haar wavelets instead of using the usual image intensities. Viola and Jones both adapted the idea of using Haar wavelets and developed Haar features. A Haar feature considers adjacent rectangular regions at a very specific location in a detection window, which sums up the pixel intensities in each region and then it calculates the difference between these sums. This particular difference is then used for categorizing the subsections of a particular image. For example, let us consider we have an image database of human faces. A common observation is that among all faces the region of the eyes is darker than the region of the cheeks. Hence, a common haar feature is used for face detection is a set of two adjacent rectangles that lie above the eye and the cheek region. This position of the rectangles is defined which is relative to a detection window that acts like a bounding box to the target object.

LITERATURE SURVEY

[1]This paper narrates a method which provides a monitoring system for drowsiness detection based on eye behaviour. For implementing this monitoring system various techniques are used namely Monitoring Physiological Characteristics, Electroencephalogram (EEG), Electrooculography (EOG), eye tracking and Non-intrusive image based method. Here, a small camera has been equipped by system which focuses straight towards the face of driver and then checks the driver's eyes with a specific end goal for fatigue recognition. If the eyes of driver is close for five successive frames, then the proposed system assumes the driver is nodding off and then a signal of warning has been issued. In this method a camera based drowsiness measures leads to an appreciated contribution. EEG is defined as a technique which is used for measuring the electrical action created by the nerve cells of the human brain, which is basically the cortical movement. The term Electrooculography (EOG) is a strategy which is utilized for measurement of the potential distinction between the front and back of the eye ball. Throughout the observation, this framework has the capacity to suddenly identify any eye confining error which may have happened and if there arise such an occurrence of this kind of error, then the system has capacity to recover and accurately locate the person eyes. Couple of areas for future scope is that it can be used to design the alarm system (an ergonomic design) so that, it can effectively work and warn the driver when drowsy condition is occured. For the alarm circuit design, a prototype of alarm that is connecting with an image processing device (Computer prototype) using a serial (RS-232) could be used for implementation. Such system will have one limitation that it does not work for dark skinned which can be corrected by using adaptive light source.

[2]This paper proposes a method in which the driver drowsiness is detected with the help of IR active illuminators and related hardware/software implementation to acquire the drowsy-related visual cues and detected the driver fatigue. The fatigue is modularized on low-cost DSP platform. The recordings and 3G transmission signal which has driver fatigue and real time in/out video steaming for detection. The system has been installed in Automotive Research and Testing Center (ARTC, Taiwan).

[3]This paper explains the idea in which detection is done considering both physiological and physical signs. Physiological factors include core body temperature (thermal) and pulse rate. Both of these parameters will decrease during the drowsiness. These parameters are monitored by using somatic sensors. Physical cues including yawning, drooping eyelids, closed eyes and increased blink duration will alert the driver for detection. The disadvantage is that, the consideration of several parameters will slow the calculation if the system has minimum specification.

[4]This paper introduces an idea of driver's drowsiness detection system that has been developed using video processing which analyses eye blinking for counting eye closure duration and head alignment estimation for detecting driver's drowsiness state. A supervised method using WNC is proposed for the accurate detection. Certain facial expressions are introduced in the system other than blinks and head movements, in order to obtain a reliable drowsiness detection. The main disadvantage is that system can give alert when driver moves his head for long time while having conversation.

[5]This paper narrates a method that automatic driver's drowsiness with the help of a system can be implemented with an automatic device called Advanced Driver Assistance System (ADAS). The main goal of this system is to reduce fatality of death rates and traffic accidents. Security of vehicles can also be taken care of, as far as death rates are concerned. This ease of security is maintained by the Advanced Driver Assistance System (ADAS). This system is totally based on artificial intelligence. The algorithm proposed for face recognizing technique, detecting eye movements are accurate under outdoor light and external environmental changes. Disadvantage of the proposed technique was that the proposed algorithm didn't had any solution for distraction of the driver called driver's distraction identification system.

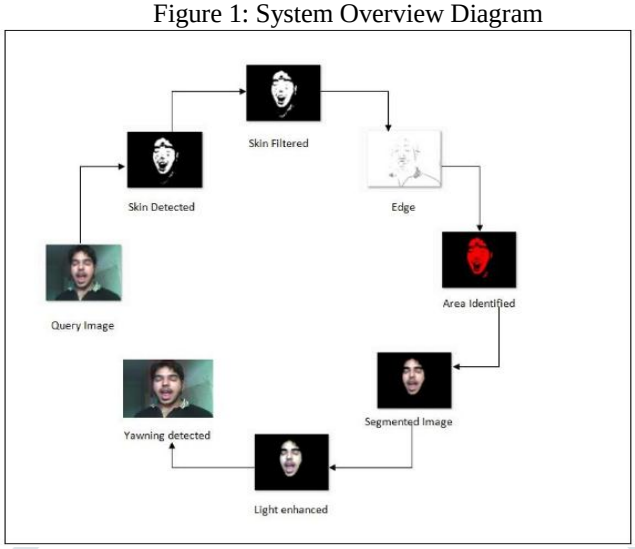
[6]This paper proposed a method in which the driver drowsiness detection system using eye movements and alerting the driver with the help of buzzer. It is based on real -time application. Data about the eyes movements were obtained through image processing algorithms. Image processing offers an unharmful approach to detect drowsiness without any external effect of environment or light interference. An algorithm was designed for facial recognition and movement. With this algorithm, it was stated that a good amount of blinking on an eye was obtained. The proposed algorithm was able to detect the eyes at low and high light interference irrespective of any gender, but for optimal detection the camera had to be positioned as front as possible. The disadvantage of the proposed algorithm was that the camera or the monitor capturing screen had to be positioned to the exact front side of the driver to detect drowsiness. Screen kept aside at least 45 degree would fail to capture driver's facial recognition and will lead to inaccurate result.

[7]This paper explains the idea that stated the combination of eye and yawning methods called the fusion technique. behavioural characteristics of the driver are observed with accuracy and hence creating an awareness threat alert to the driver. Both yawn and eye detection technique schemes are system vigorous, while the algorithms are user-friendly and can be applied for other applications too. Disadvantage of this proposed system that it is time consuming and combination may lead to inaccurate results. System capturing the behavioral characteristics of the driver and then observed seems too late to notify the driver's drowsiness. A negative impact of built in

systems can be driver use such systems to stay awake throughout the journey and drive for longer periods rather than taking a break midway and have a nap; i.e. risk approach by depending too much on the system.

PROPOSED SYSTEM

Figure 1: System Overview Diagram



The proposed System is been detailed as below and Complete Algorithmic procedure is been described below.

- Skin Detection : Using YCBCR model
- Skin Area Filtering : Recursion pixel filtering & Edge notation
- Face Identification : Face area identification ,Face region separation, Face light correction , Eye mapping, Mouth Mapping
- Yawning Detection: counting Mouth Pixel, Eye pixel counting, Threshold pixel measurement, Yawning Alert

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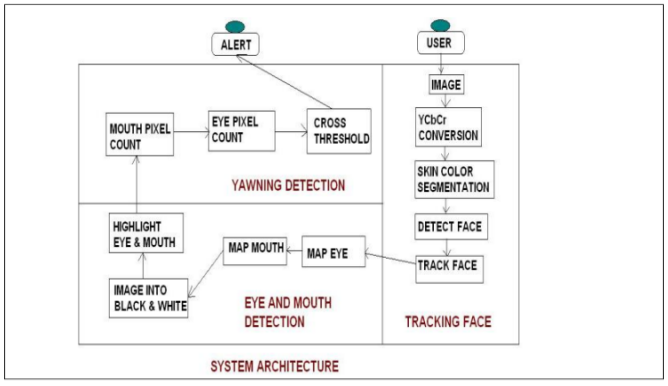
- Algorithmic procedure
- _____
- Input –Image
- Output- Face Detection
- Step 0: Start
- Step 1: Buffered image Initiated to read Image
- Step 2: YcBcR method initialized to skin extraction
- Step 3: Recursion pixels filtering for Skin Filtering
- Step 4: Edge Creation with pixel differencing
- Step 5: Area Segmentation
- Step 6: Light enhancement
- Step 7: Eye and mouth mapping using Cb and Cr
- Step 8: raster adjustment for face
- Step 9: Feature presence conformation
- Step 10: counting mouth and eye pixel
- Step 11: Threshold checking
- Step 12: Alert of Yawing
- Step 13:stop



Precision is been defined as fractional value number of relevant yawning alerts elevated to total number of irrelevant and relevant yawning alerts detected. It is usually expressed as a percentage.
Q = no. of relevant yawning alerts
R= n of irrelevant yawning alerts
Precision = (Q/ (Q+ R))*100.

In has been detect that tendency of average precision for raised yawning alerts are higher compared with existing systems

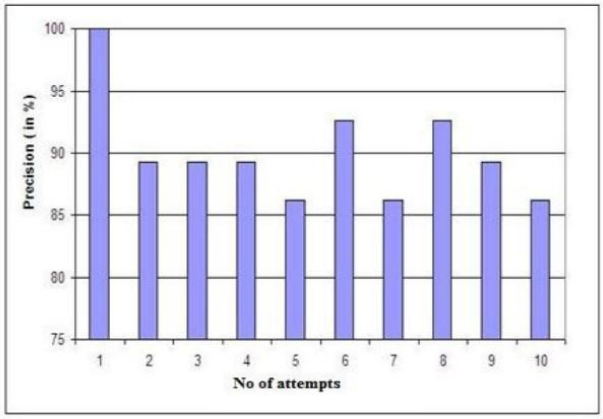


Figure 3: Average precision of the proposed approach

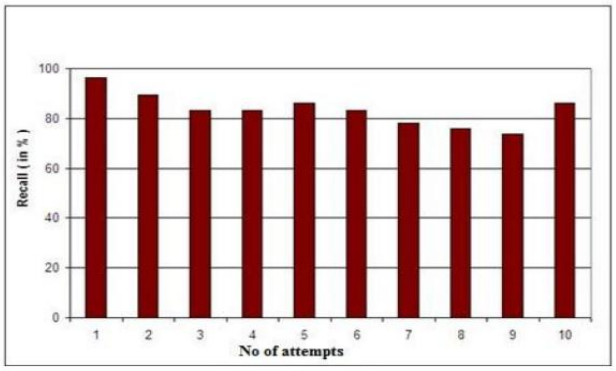
Recall is ratio of no of relevant yawning alerts are raised to total number of relevant yawning alerts identified. It is usually expressed as a percentage.

E = no of relevant yawning alerts raised .

F = no of relevant yawning alerts not raise.

Recall = (E/ (E+ F))*100

Observed recall is better as comparative to existing systems.



Average Recall of the proposed approach

CONCLUSION

Presented article proposed another strategy for discovery of driver sleepiness, by checking the yawing stages. Here in our proposed demonstrate we effectively refined the errand of catching a picture from the web cam and store it in given particular way. The proposed strategy plainly over performs SVM strategy which demonstrates that the framework is more productive in yawning identification. The proposed framework plans thought in breakdown model to assess yawning pictures by utilizing Adaboost calculation. Moreover, we have disregarded confounded calculations with a specific end goal to accomplish genuine execution of the framework. On the center some portion of the model application effectively recognizes the eye furthermore, mouth highlights so that the sluggishness of a man can be viably distinguished.

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