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Real Time Drowsiness Detection Using Open CV

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Abstract

The project is designed in the prime motive to design a non-invasive model which senses and favors us to figure out the fatigue of an employee. Due to the drowsiness of an employee they're not able to meet the deadlines of the company deals provided to them on time and leads to the rise of cost of company. This system will be implemented to track employee eyes using small camera and algorithm together. By this, we will be able to follow up the indications of drowsy employee and keeps himfromsleeping.Thisprojectcontributesin determiningfatigueofanemployeeinadvance andwillalerthimwithanotificationorbeepalarm. In order to accomplish the desired end product, we make use of an open source library i.e., OpenCV which is a very efficient tool for processing any visual image and there is another package which is made use to recognize the region of interest which in our case are face and eyes. This tool is known as Haar Cascade. The warning will be deactivatedonly afteremployeewakesupandhis/hereyeclose/open state remains constant for more than 6sec.

Keywords:*OpenCV, Haar Cascade, employee.*

1. Introduction

The functioning of drowsiness in a real-time world are in the form of closing of eye,nodding or brain functioning. Hence, we can identify using waves from brain, cardio rate or blinking of an eye. In preliminary stages we could come across various failures experienced by the projects due to unexpected reasons. Drowsiness can also be considered as one of the problems through which companiesfaces failure of the project and loss. The exact and accurate method is not practical because electrodes mustbe attached on employee's body and it may cause them uneasiness and distracting.

The time of a long attachment period of electrodes may lead todamaging of sensors or the electrodes that resultsin inaccurate results.

Another technique is to measure the brainwavesusing complexsystemwhichwillbeattachedonemployee's head. Therefore, this technique is very delicate to handle and makes it difficult. The perfect and most suitable technique is by measuring the physical changes of a person (open/close eyes to detect drowsiness).This process implementation is more likely adaptable to real time situations because it's non-invasive. We use simple camera to continuously monitor employee's face and eyes and if found drowsy, a timely warning is given. Drowsy workers are not productive enough sincethey reactslowlyandmightpossiblyforgetimportanttasks. The impact will be adverse on productivity for a particular company orinstitution.

Additionally, they lack in quickly switch between tasks. Grasping power will be less if a person is drowsy and may listen something else rather what they have really said. By considering all these drawbacks various companies are now in developmental stages to detect drowsiness accurately using the above method and good algorithm with continuous testing and validating. OpenCV- which standsfor"opensourcecomputervision"i.e.,formof library source mostly used for image processing and is also used

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to do all the operations related to images. TheybehaveasamediatorincombiningJava,Python and MATLAB. The Haar Cascade is a process where we train themachine i.e., used for objectidentification in the given frames.

This paper gives the full overview of the different methods to encounter the drowsiness and importance of this problem, face anddrowsiness detection proposed system structure, introduction to OpenCV and Haar Cascade classifiers.

2. Literature Survey

1. Driver drowsiness detection using eye-closeness detection proposed by OrranKhunpisuth, TaweechaiChotchinasari,VarakornKoschakosai and NaritHnoohom.

Year:2016 Conference: IEEE

This paper proposes a model for implementing a real time drowsiness detection system using face recognition.

2. Emotion recognition and drowsiness detection using Python, proposed byAnnmolUppal, ShwethaThyagi, Rishi Kumar and SeemaSharma.

Year:2017 Conference: IEEE

This paper proposes a model for implementing a real time drowsiness detection system using face recognition and also implements emotion recognition.

3. Real time eye blinking detection and tracking using OpenCV proposed by DhavalPimplaskar, MS Nagamode and AtulBorkar.

The aim of this paper is to develop a face andeyerecognition system. This paper only talks about implementation of face and eyes recognition for drowsiness detection.

4. Accident alert system for driving using face recognition, S. Kailasam, M. Kartghiga, R M Priyadarshini and K.Kartheeban.

Year:2017 Conference: IEEE

IEEE International Conference on Intelligent techniques in control, optimization and signal processing.

5. Li Cuimei, Qi Zhiliang, JiaNan and Wu Jianhua. “Human face detection via haar cascade classifier combined with three additionalclassifiers”.

Year:2017

IEEEInternationalConferenceElectricMeasurement and instruments(ICEMI).

This paper proposes a model for detection of face using one of the machine learning processes i.e. Haar Cascade classifier with additional classifiers.

6. “Analysis of real time driver fatigue detection based on eye and yawning” proposed by Narender Kumar and NCBarwar.

This paper proposes a model for implementing a real timedrowsinessdetectionusingeyesandmouthdata.

3. Objectives

In this scenario we are processing a system of ESDS - “Employees sleep detection system” has been designed for detecting employee’s drowsy condition in prior and to give him/her timely warning. Nevertheless, the state of an employee is been identified by the precise, valid and unassertive plan marks of a significant challenge.

The feature of detecting process includes facial movements. Haar cascade is a machine learning process where we train the model by inputting thousands of images which includes positive and negative images. Positive images are nothing but the one we wantsystem to identify.

To develop a system that detects employee drowsinessstateandwarnsthemoftheirstate.

Specific Objectives

1 Theabilitytopreciselyidentifyanimagefromtheface.

2 Theabilitytodetecttheregionofinterestinthis case the area of interest are theeyes.

3 The accuracy of division of the conditions respectiveofthestateofeyesareopenorclosed.

4 The employee is provided with a warning if drowsiness is detected.

4. Methodology

OpenCV

OpenCV stands for “Open Source Computer Vision”. It's an Open Source BSD licensed library which includes hundreds of advanced Computer Vision algorithms that are optimized to use hardware acceleration.

OpenCV is used for image processing, image manipulating. It can also be used to for machine learning processes.

Python has its own packages and libraries with which a particular code can be run.

Here, we are using NumPy, TensorFlow anddlib for working on python.

Algorithm

1. Image sequence input tocamera.
2. Facedetection.
3. Locatingeyes.
4. Eye state recognition using Eye Aspect Ratiomethod.
5. If eyes are closed and continues to be closed for predefine threshold, Drowsiness state isdetected.
6. Else normalstate.
7. Repeat theprocess.

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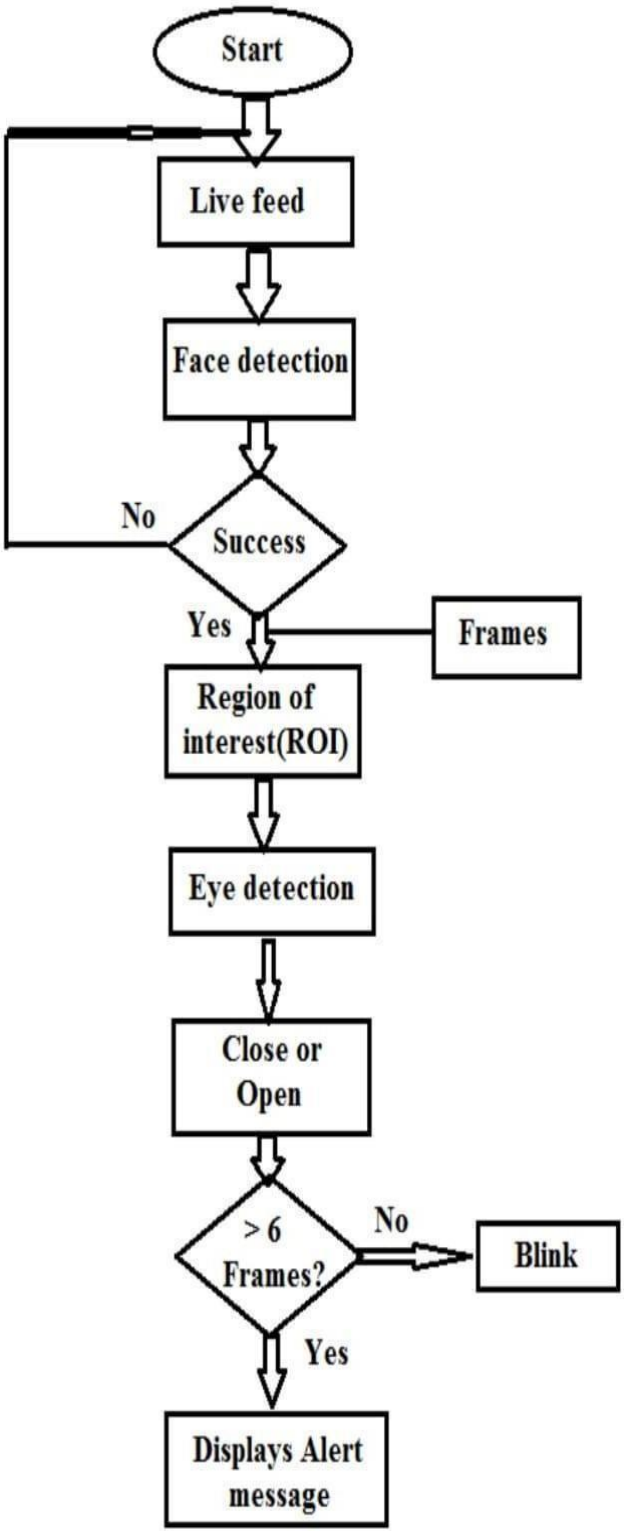
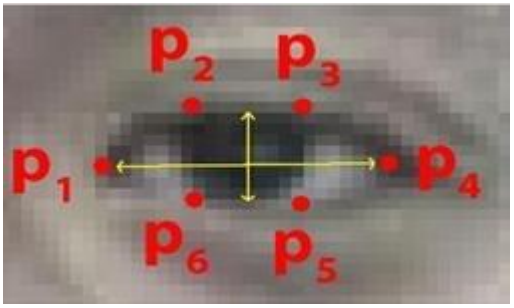


Figure 1: Flowchart for drowsiness detection system

Eye Blink Detection

1. The input is given to the system which includes region of interest (ROI) which cites the object of interest i.e.eyesandface.HereHaarcascadecomes intopicture.
2. Facial Landmark can be applied to confined important regions i.e. eyes, nose, ears andmouth.
3. Both the eyes are expressed by (x, y) coordinates whicharesix innumbers,startsfromtheleft edge of the eye and then clockwise bygone the region of interest.

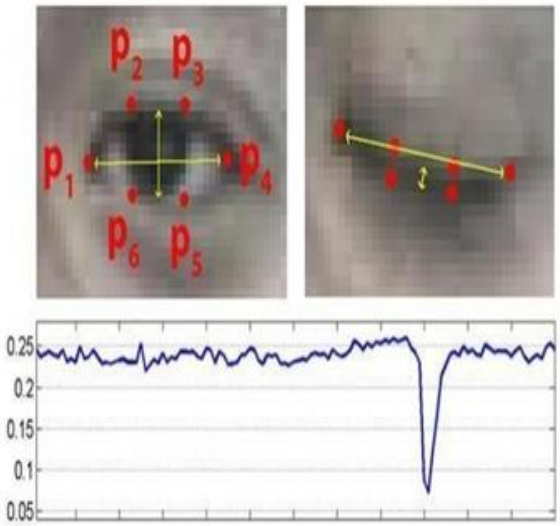


4. We've the comparison equationfrom which we can conclude the drowsy state is called the **EAR.**

$$\mathrm{EAR} = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

Here p1,…p5, p6 are 2 dimensional landmarks on face. EAR defines EYE ASPECT RATIO.

5. The numerator has the values of the landmarks of vertical part of an eye, which has 2 sub-divisions i.e. (p2 and p3) and (p6 and p5). The denominator has the values of the horizontal part i.e. (p1 and p2).
6. The ratio (EAR) will be almost constant when the eyesareopen, but will dramaticallyfallsto zero when he/sheblinks.
7. In the below image we have eyes which are fully open - the EAR here will always be greater than zero and constant for a time.
8. However, when an employee blinks (bottom – right) EARdecreases extremely, nearingzero.



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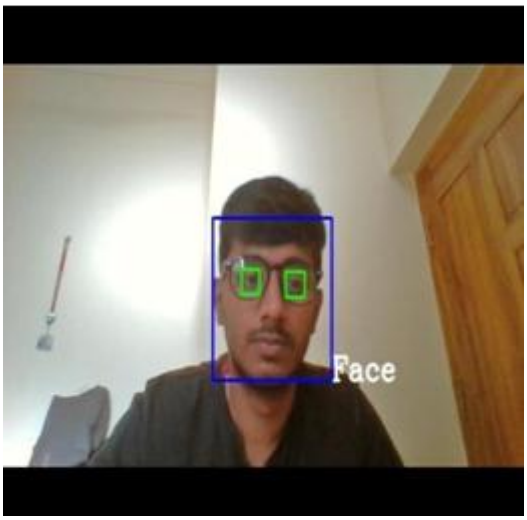
Eye State Determination State

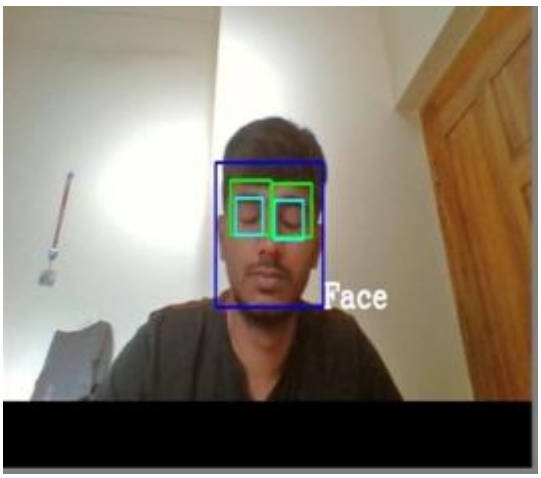
Finally, the state of an eye can be detected using EAR ratio value.

If EAR value>0, its open state. If EAR value=0, its closed state.

5. Result

Drowsiness Detection: The last leap of theproposed systemis to detect the drowsy state of an employee. EAR value would be constant over timeduringopenstateofaneyeanddecreases dramatically to zero when eyes are in closed state/blinking state. Normal person takes 0.1 sectoopenhis/hereyesafterclosingforevery blinking. If a person is drowsy his/her EAR will be zero and constant. So, we will give warningintheformofalarmwhenEARvalue becomes zero and remains zero for more than 6seconds.





6. Applications

Since drowsiness detection allows us to detect the state of an eye of a particular person, it can be used in various fields like,

- Used in detective, ward and securitycabins.
- At Nuclear power plant where operators require continuousmonitoring.
- InAutomobilestodetectdriver's drowsiness.
- Inclassroomswherestudentsfeeldrowsyand inattentive during theclass.
- Military applications where continuous monitoring of a soldier isrequired.

7. Conclusions

Areal-time,non-intrusiveandrepeatedmonitoring system for drowsiness detection isdeveloped.

Drowsiness is a serious challenge for companies where employees don't reach the deadline due to fatigue and results in loss of money and time for companies.

Drowsy driving is a serious threat to drivers and traffic participants and also applicable for various fields.

By this we can reduce accidents and loss for companies due to fatigue and to alert them about.

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