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NEW FRAME WORK FOR E-LEARNING BY USING FACIAL EMOTION RECOGNITION AND EYE TRACKING MECHANISM

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Abstract -*India always an important role in the global education. India is always considered as one of the largest network of educational institutions. Although several constraints are been associated with our learning system. In our system, we propose a hybrid architecture system invoking student facial emotion recognition, eye gaze monitoring, head movements identifications based analyzing dynamic student engagement / behavior in classroom and towards a specific course at e- learning platforms[6]. Our proposed architecture uses feature extraction algorithms like Principal Component Analysis (PCA)[13] for facial emotion recognition, Haar Cascade[14] for pupil detection and Local Binary Patterns for recognizing head movements. For machine learning approach and to provide accurate results we propose Open CV. Thus based on the students input weightage is allocated, based on the final score, we do compare with the threshold value. If the students attention value is greater than the threshold value, theory based deliverance is recommended. If the students attention value is lesser than the threshold value, video, smart class, motivational video based deliverance is recommended. For Experimental results are been implemented using Pycharm tool.*

***Key Words*: Learning system, PCA, Haar Cascade, Open CV , Local Binary Pattern, Pycharm**

1.INTRODUCTION

Thus dynamic student behavior analysis is a first step towards an automated teacher feedback tool for measuring student engagement. Our proposed system can be applied in both traditional / e-learning systems. In our system, we propose a hybrid architecture [6] system invoking student facial emotion recognition [10][11], eye gaze monitoring, head movements identifications based analyzing dynamic student engagement / behavior in classroom and towards a specific course at e-learning platforms. Our proposed architecture uses feature extraction algorithms like **Principal Component Analysis (PCA)[12,13]** for facial emotion recognition, **Haar Cascade[14]** for pupil detection and **Local Binary Patterns** for recognizing head movements. For machine learning approach and to provide accurate results we propose **random forest algorithm** based Open CV library. Experimental results are been implemented using Pycharm

1.1 PyCharm

PyCharm is an integrated development environment (IDE) used in computer programming, specifically for the Python language. It is developed by the Czech company JetBrains. It provides code analysis, a graphical debugger, an integrated unit tester, integration with version control systems (VCSes), and supports web development with Django

1.2 Open CV library

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product,

OpenCV makes it easy for businesses to utilize and modify the code.

1.3 Haar Cascade

The appearance of inner eye corner exhibits insignificant variations with eye movements and blinks. Therefore, this paper proposes to use inner eye corners as reference points for gaze tracking. The eye corners can be located easily in the eye ROI. The vectors connecting eye corners and iris centres can be used to calculate gaze position. In this paper, we proposed a method by utilizing a sliding window and haar features, which the detection window starts from the center of the image which already indicates the area of eye to reduce the processing time and errors in eye detection. First, a **cv::Cascade Classifier** is created and the necessary XML file is loaded using the **cv::CascadeClassifier ::load** method. Afterwards, the detection is done using the **cv:: CascadeClassifier ::detect MultiScale** method, which returns boundary rectangles for the detected faces or eyes.

1.4 Principal Component Analysis (PCA)

Principal Component Analysis (PCA) is a statistical technique used for dimension reduction and recognition, & widely used for facial feature extraction and recognition. PCA is known as Eigen space Projection which is based on linearly Projection the image space to a low dimension feature space that is known as Eigen space.Mathematically, a covariance matrix is a p × p matrix, where p represents the dimensions of the data set. Each entry in the matrix represents the covariance of the corresponding variables. Consider a case where we have a 2-Dimensional data set with variables a and b, the covariance matrix is a 2×2 matrix as shown below:

$$\begin{vmatrix} cov(a,a,) & cov(a,b) \end{vmatrix}$$

$$\begin{vmatrix} cov(b,a) & cov(b,b) \end{vmatrix}$$

In the above matrix:

Cov(a, a) represents the covariance of a variable with itself, which is nothing but the variance of the variable 'a'

Cov(a, b) represents the covariance of the variable 'a' with respect to the variable 'b'. And since covariance is commutative, Cov(a, b) = Cov(b, a)

2. Unit Testing or Component Testing

In computer programming, **unit testing** is a software testing method by which individual units of source code, sets of one or more computer program modules together with associated control data, usage procedures, and operating procedures are tested to determine if they are fit for use

Table -1 Unit Testing or Component Testing

Test case no	Description	Pre-conditions	Pass/Fail	Expected results
PD_001	Place your pupil in front of cam	Cam analysing	Pass	Successfully analysed.
PD_002	Analyse the pupil.	User pupil	Pass	Successfully imported.
PD_003	Analyse the pupil movement	Motion of pupil	pass	Analysed successfully
PD_004	Movement of pupil are analysed	Movement of pupil	Pass	Successful
PD_004a	Pupil projection	Human Eye	Fail	Update of projection failed
PD_005	Recording of pupil motion	User pupil movement recorder	Pass	Imaging successful
PD_006	Perfection of pupil	Perfect projection	Pass	Projection successful
PD_007	Analysing of motion	Analysing the motion	Pass	Analysed successfully
PD_008	Display of pupil movements	Pupil movement	pass	Successfully displayed

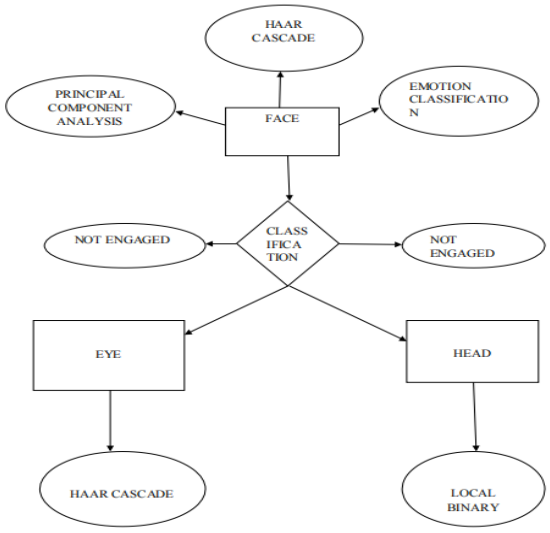

Fig 1. Entity Relationship diagram

3. RESULTS

3.1 Face Detection

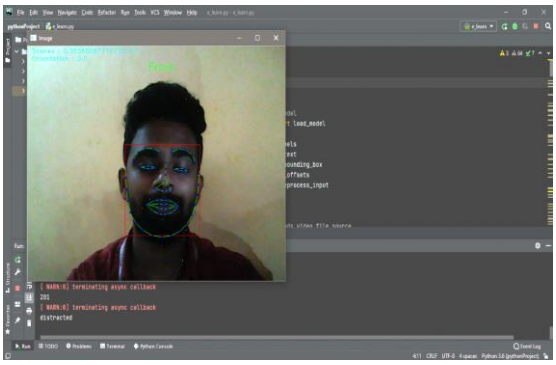

Fig 2. Face at front

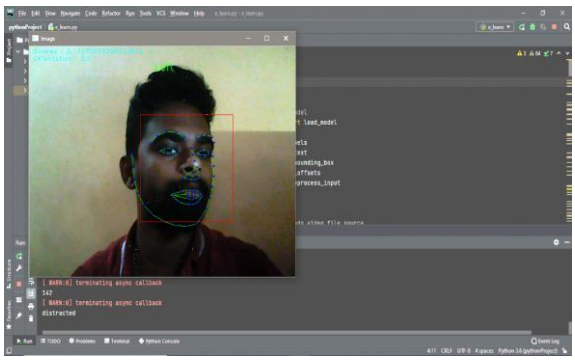

Fig 3. Face at left

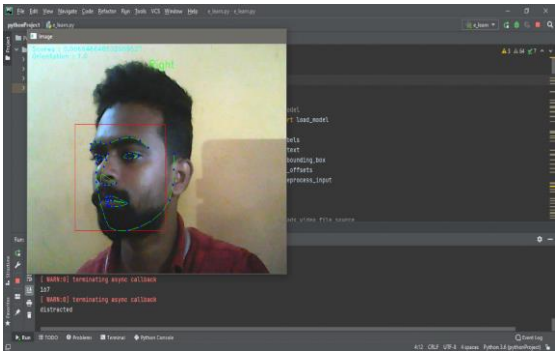

Fig 4. Face at right

3.2 Emotion Detection

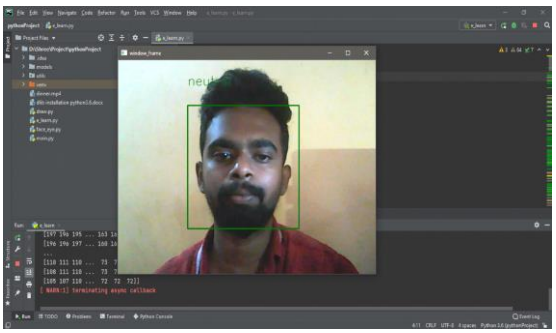

Fig 5. Neutral emotion

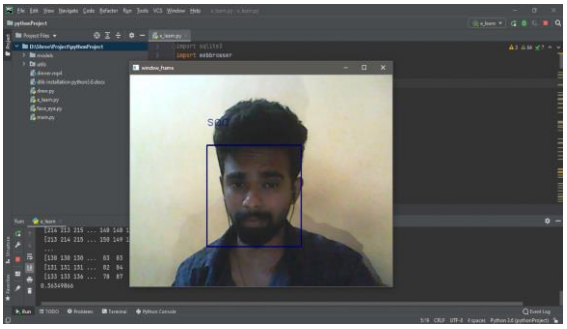

Fig 6.Sad emotion

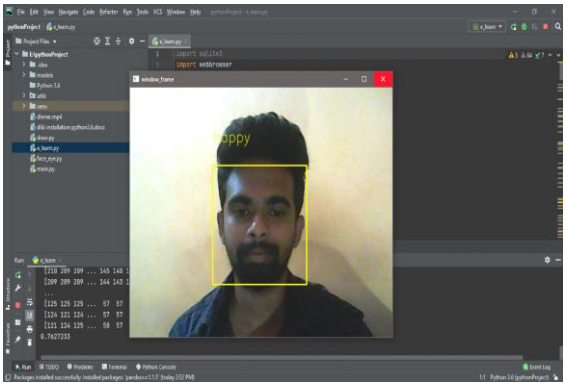

Fig 7. Happy emotion

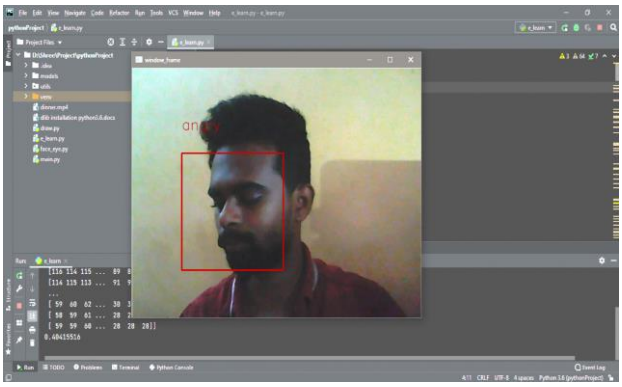

Fig 8. Angry emotion

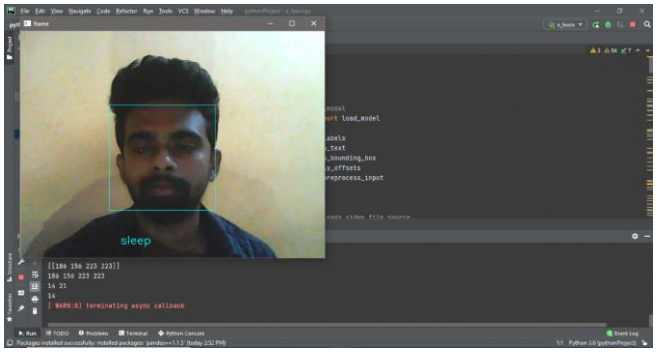

Fig 9. Sleep emotion

4. CONCLUSION

The hybrid biometric based learner analysis does appear to be a promising new tool for evaluating learners' behaviour dynamically. This technology can provide many benefits to e-learning, such as facilitating adaptive and personalized learning. Thus through this proposed system, the tutor can change the deliverance by dynamically analyzing the learner attention level. This would bring a revolution in the education sector.

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