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Smart Exam Proctoring System

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Abstract: As the world is shifting towards digitalization, mostof the exams and assessments are being conducted online. These exams must be proctored. Several students are accessing thetest at the same time. It is very difficult to manually look if a student is committing malpractice. This project aims to use face detection and recognition for proctoring exams. Face detectionis the process of detecting faces in a video or image while facerecognition is identifying or verifying a face from images orvideos. There are several research studies done on the detectionand recognition of faces owing to the requirement for securityfor economic transactions, authorization, national safety andsecurity, and other important factors. Exam proctoring platforms should be capable of detecting cheating and malpractices like face is not on the screen, gaze estimation, mobile phone detection,multiple face detection, etc. This project uses face identificationusing HAAR Cascades Algorithm and face recognition using theLocal Binary Pattern Histogram algorithm. This system can beused in the future in corporate offices, schools, and universities.

Index Terms: Face Detection, Face Recognition, Proctoring, LBPH algorithm

I. INTRODUCTION

Most of the schools and universities are now shifting towards conducting exams online as it is a tedious taskto conduct the exams offline and evaluate the students. Itrequires manual work. However, conducting the exams online is not a simple task. As several students are accessing thetest at the same time, it is difficult to keep a watch on everyone. And the ways students commit malpractices can't benoticed manually. So, this project aims to eliminate maximumpossibilities that a candidate may use to cheat in exams. This includes impersonation, use of external devices, tab switching, face spoofing, etc. The objective of this platform is to proctor exams and prevent any student misconduct. There are numerous approaches to achieve it. This project is mainly focusing on continual webcam proctoring. The goal is to provide a regulated environment for exam proctoring using face detection and facial recognition algorithms. There are several researches done on face detection and face recognition can be executed. This model uses Haar Cascades algorithm forface detection and Local Binary Pattern Histogram algorithm for face recognition. These are Machine Learning algorithms widely used and easier to execute. Although, several other models are studied before deciding the final system architec- ture.

II. LITERATURE REVIEW

In [1], the availability of annotated datasets and computa- tions has led to an impressive improvement in the performanceof CNNs, but domain adaptation and dataset bias are a problem, and training CNNs is very time-consuming. Sun, W.
[4] proposed a method called Fully Convolutional Network with Domain Adaptation and Lossless Size Adaptation (FCN- DA-LSA). An embedded domain adaptation layer is embeddedin the lossless size adaptation preprocessor, followed by apixel-level FCN classifier. In this method, the domain mustbe known in advance. In [10], extensive experiments are con- ducted on four popular face recognition benchmarks, includingAFW, PASCAL face, FDDB and WIDER FACE, showingthat the method is comparable, but a large dataset certainly affects the performance. Wu, W. [9] proposed a multiscale face detector (DSFD) based on Faster R-CNN.In [8], twotypical structures called Centralised Attention Feature (CAF) and Distributed Attention Feature (DAF) are proposed for face recognition, which are in-place and end-to-end train- able.Recognition of small faces using this proposed methodis inefficient.Liang J [7] designed and implemented a method for face recognition from low-light images. Low-light images are challenging due to the limited number of photons and the inevitable noise, and to make the task even more difficult, theyare often spatially unevenly distributed. Liang J [7] proposeda novel recurrent exposure generation module (REG) and coupled it seamlessly with a multiple exposure detection mod-ule (MED) module, thus greatly improving face recognition performance by effectively suppressing uneven illumination and noise problems. Nevertheless, the proposed model shows lower performance because S3FD has much fewer parame- ters and consequently much lower model capacity comparedto DSFD and PyramidBox, resulting in insufficient guiding effects for the generation modules.11],The proposed model uses a dual-vision face detection method for preprocessing anduses 3WPCA (Three Level Wavelet Decomposition - PrincipalComponent Analysis) as the feature extraction ComponentAnalysis) as the model for feature extraction.

In dual-vision face recognition, we use the half-join method to combine half of the left image and half of the right image into one image, which can then be extracted using 3WPCA. The use of stereo vision cameras is not yet very cost effective for academia.

III. METHODOLOGY

A. Face Detection using Haar Cascades

Face Detection is a popular subject with much research and studies and has a wide range of applications. Face detectionis used in biometrics, video surveillance, human computer interface and image database management. It is also used in emotional inference, photography, marketing, lipreading, etc. Although face detection is extensively used, it is a tedioustask. Therefore a proper and efficient approach needs to be used for face detection. Haar Cascades is an object detection algorithm that can be used for detecting faces in image orreal time videos. It uses the cascading window, and computes features in every window and classifies whether it could be anobject. The algorithm can be explained in four stages:

1) *Calculating Haar Features:* In a recognition window, a haar feature is practically the result of calculations on adjacent rectangular sections. To calculate the difference between the sums, the pixel intensities in each region must first be added.
2) *Creating Integral Images:* Essentially, integral images speed up the calculation of these haar features. Sub- rectangles and array references are constructed for each ofthese rectangles, rather than performing the computation for each pixel. The Haar features are then calculatedbased on these.
3) *Using Adaboost:* Essentially, Adaboost selects the best features and trains the classifiers to use them. The algo- rithm can recognise objects by using a ”strong classifier” consisting of the combination of several ”weak classi- fiers”
4) *Implementing Cascading Classifiers:* The cascade clas- sifier consists of several stages, each formed by a group of weak learners. From the mean of the predictions ofall weak learners, a highly accurate classifier can be created by boosting during the training of the weak learners, which either decides on the following regionor signals that an object has been identified based on this prediction (positive) (negative). The stages are createdso that negative samples can be discarded as quickly as possible, since the majority of the windows contain nothing of interest.

B. Face Recognition using Local Binary Pattern Histogram

Face recognition has wide-range of applications. Althoughit sounds like a simple task, it is a complex process for a computer, as many features and variables need to be identifiedand extracted. Light intensity, image or video quality, face direction, face size, gaze are some of the factors affecting effective face recognition.

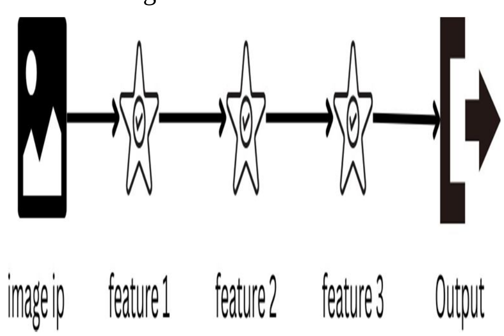

Fig. 1. Haar Cascade Algorithm

The LBPH algorithm works byrecognizing a person’s face based on their local binary pattern histogram. Both the front and the side faces of a person can be recognized by its performance.Matrix formats consist of rows and columns, which represent all images.Images are composed of pixels.Pixels are the building blocks of an image.Theseare all small squares.It is possible to form the complete image by putting them side by side.The smallest possible amount of information can be found in a single pixel.Each image has pixels with values ranging from 0 to 255. Thebasic colours red, green, and blue are represented by the three values R, G, and B. A single pixel has three channels, one channel for each of the three basic colors, because the combination of these three colours will produce all the colours in the image. With the aid of the Grid parameters X and Y, the picture acquired in Step is split into several grids.This picture is in grayscale, and each grid’s histogram is meant to reflect the intensity of each pixel’s occurrences. A new histogram that accurately captures the characteristicsof the original image is then produced by combining each histogram. For a picture from the training data set, each person created a histogram.

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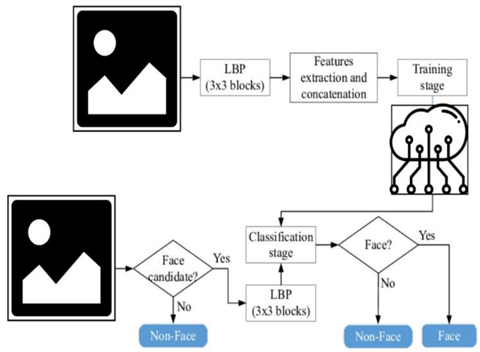

Fig. 2. Local Binary Pattern Histogram Algorithm

To determine which image best represents the input image's histogram, two histograms are compared. This output contains the image's ID or name. The computed distance is also returned by this algorithm along with a confidence measurement. The confidence and threshold automatically estimate how accurately the system recognised the image. A confidence value below the specified threshold indicates the accuracy.

C. Figures and Tables

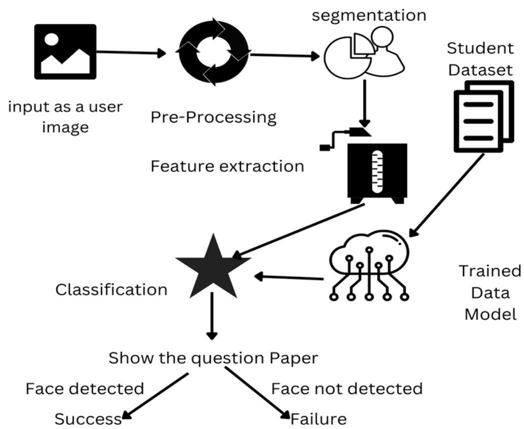

Fig. 3. System Architecture

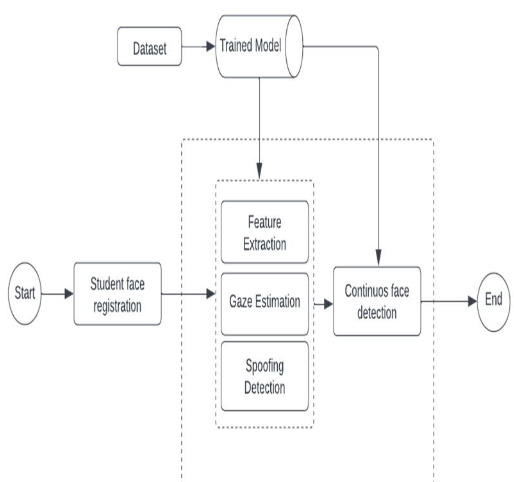

Fig. 4. DFD Level 1

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