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Smart Exam Proctoring System

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Abstract: *As the world is shifting towards digitalization, most of the exams and assessments are being conducted online. These exams must be proctored. Several students are accessing the test 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 detection is the process of detecting faces in a video or image while face recognition is identifying or verifying a face from images or videos. There are several research studies done on the detection and recognition of faces owing to the requirement for security for economic transactions, authorization, national safety and security, 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 identification using HAAR Cascades Algorithm and face recognition using the Local Binary Pattern Histogram algorithm. This system can be used 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 task to conduct the exams offline and evaluate the students. It requires manual work. However, conducting the exams online is not a simple task. As several students are accessing the test at the same time, it is difficult to keep a watch on everyone. And the ways students commit malpractices can't be noticed manually. So, this project aims to eliminate maximum possibilities 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 for face 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 architecture.

II. LITERATURE REVIEW

In [1], the availability of annotated datasets and computations has led to an impressive improvement in the performance of 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-DALSA). An embedded domain adaptation layer is embedded in the lossless size adaptation preprocessor, followed by a pixel-level FCN classifier. In this method, the domain must be known in advance. In [10], extensive experiments are conducted on four popular face recognition benchmarks, including AFW, PASCAL face, FDDB and WIDER FACE, showing that 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], two typical structures called Centralised Attention Feature (CAF) and Distributed Attention Feature (DAF) are proposed for face recognition, which are in-place and end-to-end trainable. Recognition of small faces using this proposed method is 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, they are often spatially unevenly distributed. Liang J [7] proposed a novel recurrent exposure generation module (REG) and coupled it seamlessly with a multiple exposure detection module (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 parameters and consequently much lower model capacity compared to 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 and uses 3WPCA (Three Level Wavelet Decomposition - Principal Component Analysis) as the feature extraction Component Analysis) 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 detection is 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 tedious task. 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 or real time videos. It uses the cascading window, and computes features in every window and classifies whether it could be an object. 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 of these rectangles, rather than performing the computation for each pixel. The Haar features are then calculated based on these.
- 3) *Using Adaboost:* Essentially, Adaboost selects the best features and trains the classifiers to use them. The algorithm can recognise objects by using a "strong classifier" consisting of the combination of several "weak classifiers"
- 4) *Implementing Cascading Classifiers:* The cascade classifier consists of several stages, each formed by a group of weak learners. From the mean of the predictions of all weak learners, a highly accurate classifier can be created by boosting during the training of the weak learners, which either decides on the following region or signals that an object has been identified based on this prediction (positive) (negative). The stages are created so 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. Although it sounds like a simple task, it is a complex process for a computer, as many features and variables need to be identified and extracted. Light intensity, image or video quality, face direction, face size, gaze are some of the factors affecting effective face recognition.

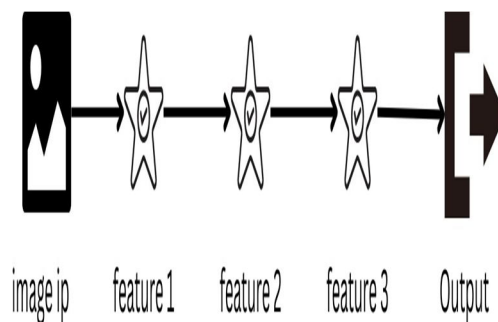


Fig. 1. Haar Cascade Algorithm

The LBPH algorithm works by recognizing 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. These are 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. The basic 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 characteristics of the original image is then produced by combining each histogram. For a picture from the training data set, each person created a histogram.

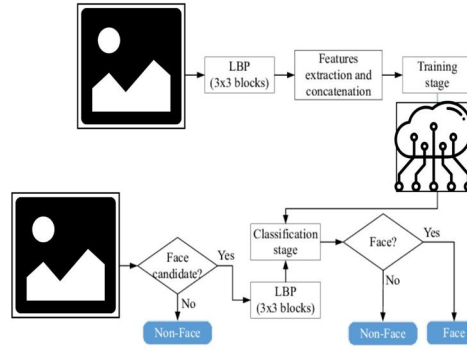


Fig. 2. Local Binary Pattern Histogram Algorithm

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

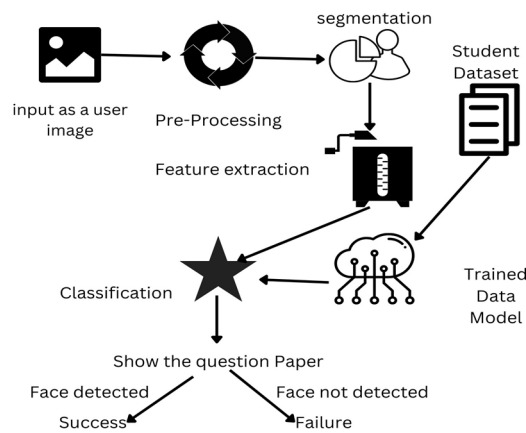


Fig. 3. System Architecture

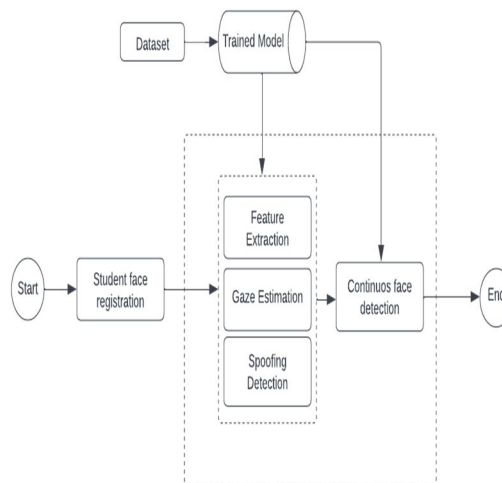


Fig. 4. DFD Level 1

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