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Automatic Student Attendance Management System Using Facial Recognition

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***Abstract*— In the modern world, education system is advancing day-by-day due to the introduction of concept of "smart classroom". However, the attendance system still remains primitive, where the teacher/lecturer calls the name of students to mark their attendance .This system can be easily manipulated .In order to overcome this issue, biometrics of the students can be involved. The objective of this project is to perform face recognition in order to procure the details i.e., name and usn of the student who attended class and in order to link the attendance to the subject , the professor intended to enter subject details to the database.. This procedure has to be iterated every 15minutes to ensure that the student attends the whole class.**

***Index Terms*— Facial Detection, Recognition,Viola jones Algorithm, MSE, Update Attendance,.**

I. INTRODUCTION

Face detection has been regarded as the most complex and challenging problem in the field of computer vision. Many algorithms and methods have been developed for detection and recognition of face. In face recognition system the first step is face detection. Viola &Jones algorithm is used here to adopt a similar divide and conquer strategy, where different face detectors are trained separately under different view-points or head poses. Feature extractions in general is done by collecting a large set of faces and adopt certain machine learning algorithms to learn a face model to perform classification. Face recognition is the process to detect the faces in the frame and extract feature from the detected faces and compare it with the faces stored in the database. The face which best matches is recognized and the attendance of the recognized person is updated. This image will act as input to the system. For the effective face detection, the image needs to be enhanced by using some image processing techniques like gray scale conversion of image . The image will be passed to perform face detection. Each student's face is cropped and the various features are extracted from them like distance between eyes, nose, outline of face, etc. using these faces as Haar features, the student are recognized and by comparing them with the face database and their attendance is marked. A database of faces needs to be created for the purpose of comparison. By enrolling the students to that database, we can maintain the information of the students like roll number, student's name, and his or her photo for the identification.

II. LITERATURE SURVEY

In [1] this RFID system, the student shows RFID tag which causes to begin the camera and faces are grabbed and recognized so that the student'attendance is marked. The SURF algorithm is then performed to align the extracted and registered faces. Finally, the CW-SSIM is adopted to calculate the similarity of the extracted and registered faces. Each time we need to update the RFID details and involvement of students are needed. System cost is also high.

In [2] A facial recognition system is an application of computer vision which is capable of performing two basic task of identification and verification of person. Local features are extracted by using two techniques Local Binary Pattern (LBP) and Histogram of Oriented Gradients (HOG) whsich are used for recognition of faces. Support Vector Machine (SVM) classifier is used for comparing database stored features with extracted features from captured images of students. Since there are 2 techniques, it takes more time for recognizing the faces. Raspberry camera is costlier.

In [3] This paper proposes another methodology for face detection, they used a conjunction of RGB and YCbCr color space bonds to segment skin pixels in the image. In this paper, they try to recognize faces by feeding region proposals for faces into a Convolutional Neural Network for feature extraction and finally into a SoftMax Classifier for classification. When the background or non-facial regions are skin coloured, they are detected as skin during initial segmentation and finally false positives and even dismissal of true positives.

III. PROPOSED MODEL

The proposed system architecture is as shown in Figure1. The system describe about the algorithms used in the automated attendance system such as Viola &Jones algorithm for face detection and face recognition by MSE.

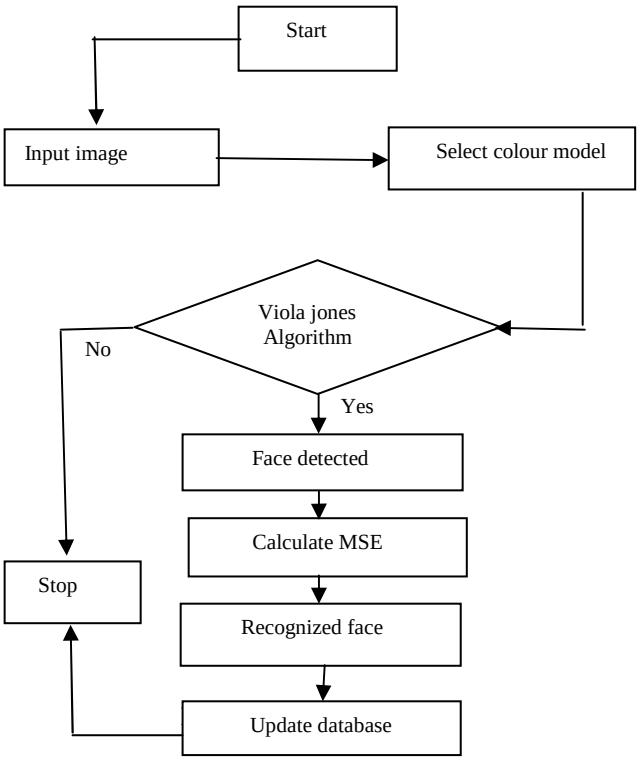

Figure1: Data flow diagram

A. Pre-processing:

A color image has three channels(Red,Green,Blue components).One important task in image processing application is color space conversion. Real time image and videos are stored in RGB color space, because it is based on sensitivity of color detection cells in the human visual system. Conversion of RGB to YCbCr color space is often in order to take advantage of the lower resolution capability of the human visual system for color with respect to luminosity. Thus RGB to YCbCr color conversion is widely used in image and video processing.We prefer YCbCr in feature extraction .In situations where, color description places integral role the HSV color model is preferred over RGB model. HSV model describe color similarity to how human eye tells to perceive color.

Disadvantage of RGB – even if there is a small fluctuation in light the algorithm fails. Hence converting RGB to Grayscale is important, also Grayscale works on edges of the image. Grayscale take average of(R+G+B)/3 =8 bits .Therefore preferring Grayscale has more advantage

B. Face Detection:

Face detection is achieved using viola jones face detection algorithm. Viola and jones algorithm has four stages : Harr Feature Selection, Creating an Internal Image, Ada-boost Training, and Cascading Classifiers .Harr Feature Selection: All human faces share some similar properties. These evenness may be matched using Haar Features. A few properties are familiar to human faces:

1. The eye region is darker than the upper-cheeks. 2. The nose bridge region is brighter than the eyes. 3. Configuration of properties forming matchable facial features.4. position and area: eyes, mouth, bridge of nose .5. Value: oriented gradients of pixel intensities. The four features matched by this algorithm are then sought in the image of a face are given in below images

Rectangle features: Value = Σ (pixels in black area) - Σ(pixels in white area) Three types: two-, three-, four rectangles. Viola & Jones used two- rectangle features. For example: the difference in brightness between the white &black rectangles over a specific area. Each feature is related to a special location in the sub-window

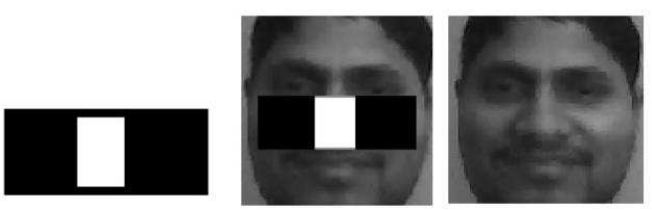

Fig 2: Haar Feature that looks similar to the bridge of the nose is applied onto the face.

Fig 3: Haar Feature that looks similar to the eye region which is darker than the upper cheeks is applied onto a face.

Integral image:.An image representation is called the integral image evaluates rectangular features in *constant* time, which gives them a considerable speed advantage over more sophisticated alternative features. Because each feature's rectangular area is always adjacent to at least one other rectangle, it follows that any two rectangle feature can be computed in six array references, any three-rectangle feature in eight, and any four rectangle feature in nine. The integral image at location (x, y), is the sum of the pixels above and to the left of (x, y), inclusive .Adaboost Training: The speed with which features may be evaluated does not adequately compensate for their number, however. For example, in a standard 24x24 pixel sub-window, there are a total of M = 162,336 possible features, and it would be prohibitively expensive to evaluate them all when testing an image. Thus, the object detection framework employs a variant of the learning algorithm Adaboost to both select the best features and to train classifiers that use them. This algorithm constructs a “strong” classifier as a linear classifier rejects the sub-window under inspection, no further processing is performed and continue on searching the next sub-window. The cascade therefore has the form of a degenerate tree. In the case of faces, the first classifier in the cascade – called the attentional operator – uses only two features to achieve a false negative rate of approximately 0% and a false positive rate of 40%. The effect of this single classifier is to reduce by roughly half the number of times the entire cascade is evaluated. In cascading, each stage consists of a strong classifier. So all the features are grouped into several stages where each stage has certain number of features combination of weighted simple “weak” classifiers. Cascade architecture**:**

On average only 0.01% of all sub windows are positive (faces).Equal computation time is spent on all sub-windows must spend most time only on potentially positive sub-windows. A simple 2-feature classifier can achieve almost 100% detection rate with 50% FP rate. That classifier can act as a 1st layer of a series to filter out most negative windows 2nd layer with 10 features can tackle "harder" negative-windows which survived the 1st layer, and so on. A cascade of gradually more complex classifiers achieves even better detection rates. The evaluation of the strong classifiers generated by the learning process can be done quickly, but it isn't fast enough to run in real-time. For this reason, the strong classifiers are arranged in a cascade in order of complexity, where each successive classifier is trained only on those selected samples which pass through the preceding classifiers. If at any stage in the cascade a classifier rejects the sub-window under inspection, no further processing is performed and continue on searching the next sub-window. The cascade therefore has the form of a degenerate tree. In the case of faces, the first classifier in the cascade – called the attentional operator – uses only two features to achieve a false negative rate of approximately 0% and a false positive rate of 40%. The effect of this single classifier is to reduce by roughly half the number of times the entire cascade is evaluated. In cascading, each stage consists of a strong classifier. So all the features are grouped into several stages where each stage has certain number of features.

C. *Face Recognition:*

Mean Square Error (MSE) is used for face recognition. Images will be in the form of training set in the Database. Images in the database are considered as reference images and the captured image in class is considered as live image. The live image of particular person from the captured image will be compared with reference images. Then the face will be detected from live and reference images by Viola jones algorithm. The face detected from live image is (a,b) pixels and face detected from the reference image will be (p,q) pixels. To calculate MSE both live and reference image pixels should be same , if not both images will be automatically converted into the same size. Now we add up the pixels and find MSE by using MSE= $\mu D2 - \mu R2$ .if MSE>threshold , student will identified and there name will be displayed.

In the same way professor face will be detected and recognized.

D. *Update Database:*

The professor face with the subject name will be stored in the database From the previous stage, face is recognized and persons name is identified. Now, extract the USN from the database and updates the attendance in system database with respect to each subject deatils.

IV. RESULTS

By training the face recognition system with pictures of people with different angles below results are obtained, in which as the number of trained images increases (5,10, 15) accuracy rate or confidence level also increased

Fig 4: Test image 1

Fig 5: Test image 2

TABLE 1: CONFIDENCE LEVELS WHEN SYSTEM IS TRAINED WITH DIFFERENT SET OF IMAGES

names	After training with 5 pictures	After training with 10 pictures	After training with 15 pictures
Person 1	0.56120	0.75462	0.8418
Person 2	0.53766	0.65499	0.73244
Person 3	0.65499	0.75643	0.81594
Person 4	0.65422	0.76381	0.85859
Person 5	0.5289	0.64235	0.70636

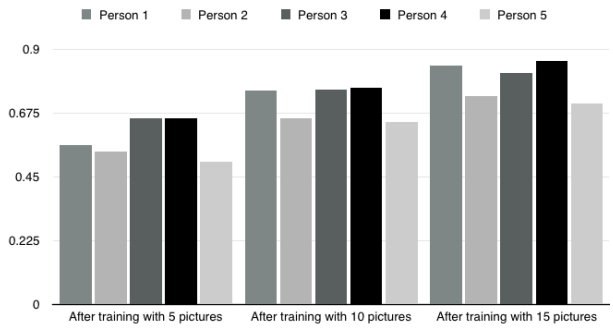

Fig 6: Result graph 1

Fig7: Test image Person 1

Fig 8: Test image Person 2

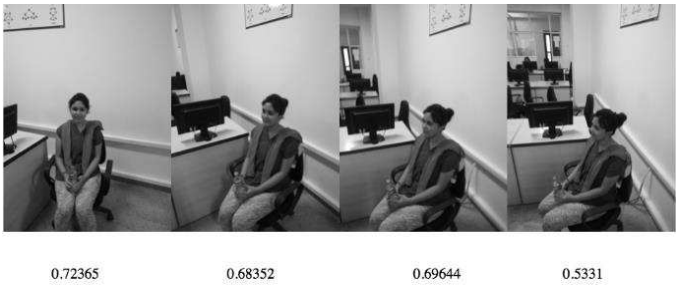

Fig 9: Test image Person 3

Fig 10: Test image Person 4

Fig 11: Test image Person 5

TABLE 2: CONFIDENCE LEVELS WHEN THE FACES ARE DIFFERENT ANGLE

Names	0°	30°	60°	90°
Person 1	0.72329	0.78278	0.6596	0
Person 2	0.78199	0.70743	0.5102	0
Person 3	0.72365	0.68352	0.69644	0.5331
Person 4	0.82436	0.82332	0.6778	0.5102
Person 5	0.74136	0.73276	0.5310	0

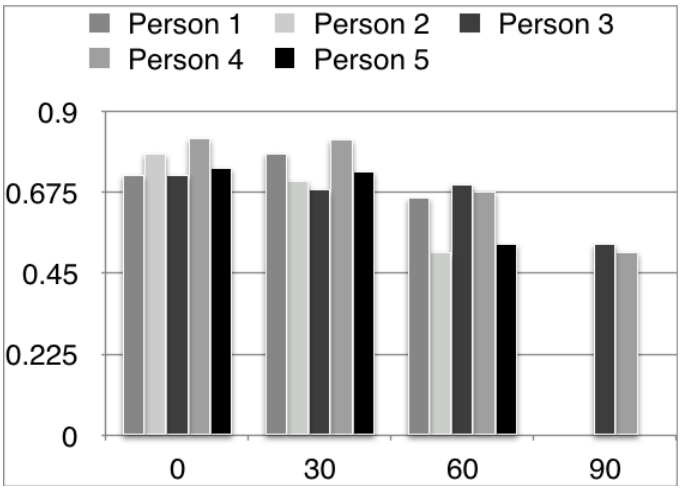

Fig 12: Results graph 2

The above results conclude that , as the number of training images increases the confidence level and the accuracy of the system also increases. System is also tested for different face angles and it can recognize faces up to 60deg.It is noticed that when the system is tested with an image contain six students, system recognized five of the students giving efficiency of 70%.

V. CONCLUSION:

In this work, we have presented a novel approach to face detection and face recognition of particular students in the class room. The outcome that we obtained was stupendously good. When we practically demonstrated on real time, we were able to recognize 70% of the student's face even though student face wasn't aligned with the camera. This infers that, this system was able to recognize the face of a student even when angle of alignment is different with respect to camera. This Automated system had an upper hand when compared to traditional systems which are currently in use. This system reduces man power and consumes less time to track the student's face in the classroom and safeguard the data in a highly secured way. This system is having high efficiency rate and is faster and provides ease of access for the user. In order to yield better result in our project, we adopted the use of viola & Jones algorithm for face detection and MSE for face Recognition.

VI. FUTURE ENHANCEMENT:

The future work is to eventually improve the recognition rate of algorithms when there are unintentional changes in a person looks like tonsuring head, using scarf, beard. The system developed only recognizes face up to 45 degrees angle variations which has to be improved further. In environments which have low variations, adaptation could bring very significant improvements to face recognition.

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