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FANNC Based Advanced Attendance Management System

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ABSTRACT: In this paper, an efficient technique for taking attendance in a classroom is introduced. The proposed system can overcome the difficulties of traditional methods i.e.; roll call method and manual signing method. The system comprises face detection, face recognition and attendance marking system. The face detection is carried out by Viola Jones algorithm, which is an efficient feature selection method. The face recognition is done by KL Transform along with FANNC (Fast Adaptive Neural Network Classifier). FANNC enables better verification of each student. The result from the experiment shows that the detection and recognition is carried with an efficiency of 72.2% and 69.4% respectively.

KEYWORDS: Attendance; Face Detection; Face Recognition; FANNC; Attendance Storage.

I. INTRODUCTION

As per tradition, student's attendance is taken manually by using attendance sheet given by the faculty members in class. Moreover, it is very difficult to verify each student's attendance in a large classroom environment which leads to consumption of time. Also faculty can be cheated by the student which leads to proxy attendance. Therefore, a fully automated attendance management system is essential.

Face recognition technology is gradually evolving to a universal biometric solution since it requires virtually zero effort from the user end while compared with other biometric options. Thus the proposed system manages the manual attendance issues and malpractices can be reduced to an extent by making use of biometrics. Here we propose a system in which biometrics is added along with the attendance management system.

II. LITERATURE SURVEY

The current traditions of taking attendance are to take a roll call or signing the attendance sheet which is done manually. This system is prone to several malpractices and distracts the student from listening to lecture. To calculate the overall attendance using the marked hardcopy takes a manual effort to compare, calculate and track the attendance of the student. Thus, the system is computationally slower.

A conference paper on Real Time Human Face Detection and Tracking was proposed by J. Chatrath et al. Their paper describes a technique of real time profile detection and recognition. Results showed that up to 50 human faces could be detected and tracked by this system. Processing of data and time consumption is comparatively less in such systems.

In our proposed system, real time face images of the students are captured using live Webcam. This image will consist of all students present in the class for that particular lecture. Later on, Face detection and Recognition is performed. Then, the calculated features are compared with the stored features. If features match in comparison phase, then attendance for particular student is registered in the database. At the end of each year/month attendance report will be generated. This makes the proposed system speedier than the current system.

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III.SYSTEM DESIGN

A. REAL TIME ATTENDANCE

The flowchart of the real time attendance system is shown in Fig: 1. The system initialize count as zero, where count is the number of periods in a day in which attendance should be taken. Then capture real time face images of the students using live Webcam. As the next step, face detection is carried out to determine whether there are any faces in the image using Viola Jones algorithm. Along with detection of faces count gets incremented by one. If the face is present, then it returns the features of each face. Then, the extracted features of captured image are compared with the stored features using FANNNC classifier. If features match, then attendance updating is carried out. The process is carried out in a day for eight hours; thus count is with a maximum value of eight. The system restarts the same procedure in the next day with the addition of old information.

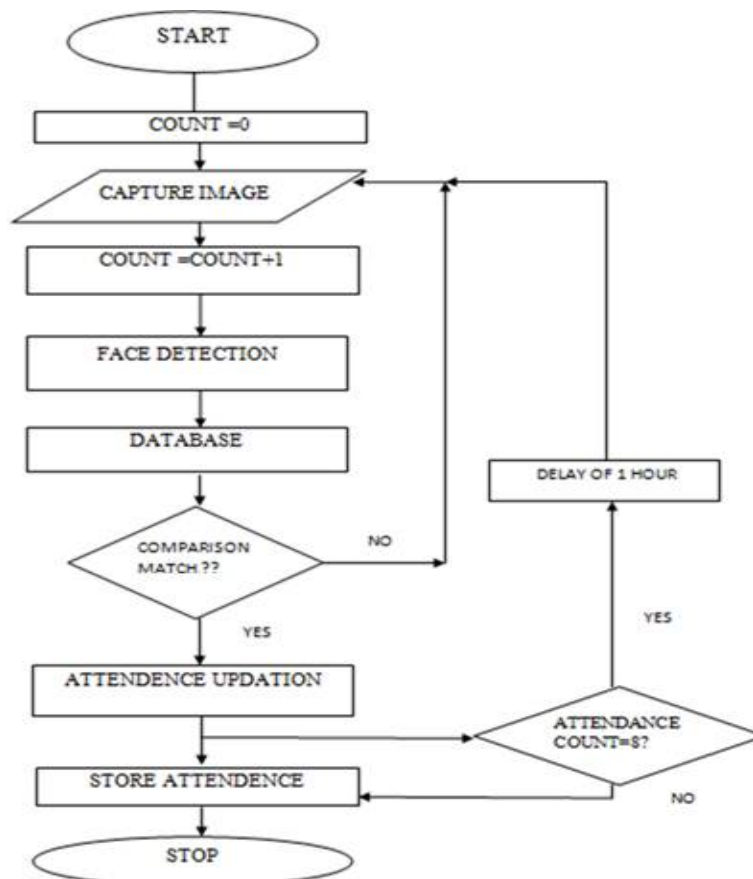


Fig 1.Flowchart of Real Time Attendance system

B. DATABASE CREATION

Databases are designed to satisfy the specific needs of the algorithm under development. In the face recognition process the input image is compared with the database. Real time face recognition requires a database having large amount of faces with different illumination, poses and expression for better performance. The flowchart in Fig 2 shows creation of a database which holds the name & ID number of the students in an institution. Various folders are used to store the images of each student with different poses, illumination and expressions.

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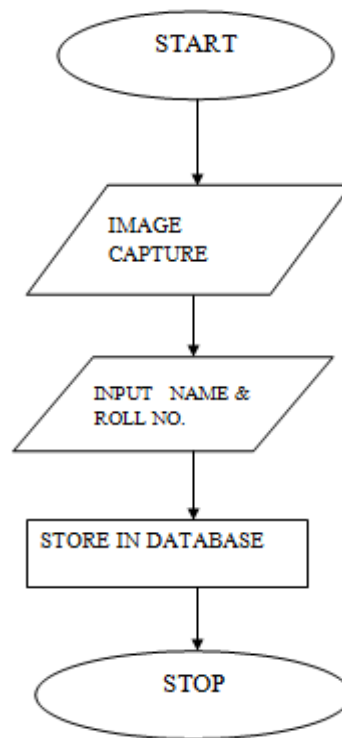


Fig 2.Database Creation

IV.SUBSYSTEMS

A. FACE DETECTION SYSTEM

Face detection is the initial step to the entire facial analysis algorithm. It determines the presence and location of a face in a video sequence, by distinguishing face from background present in the scene. Simple face detection is carried out in three steps: a) Detection of faces b) Identification of facial regions c) Tracking of faces. In this system, Viola Jones Algorithm and a trained classification model is used to detect faces from the video sequence.

There are three key ingredients involved in Viola Jones algorithm. The first is the introduction of a new image called the - integral image, which allows the features used by the detector to be computed very quickly. The integral image at location (x, y) , is the sum of the pixels above and to the left of (x, y) as shown in Fig 3.

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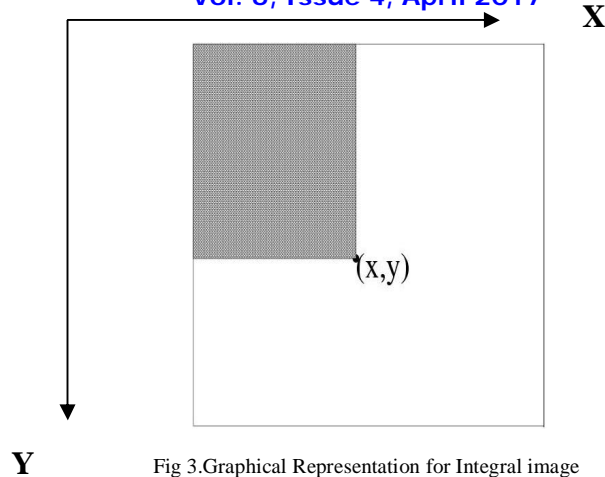


Fig 3. Graphical Representation for Integral image

formal definition:

$$ii(x, y) = \sum_{x' \leq x, y' \leq y} i(x', y')$$

----- (eq:1)

Recursive definition:

$$s(x, y) = s(x, y - 1) + i(x, y)$$

----- (eq:2)

$$ii(x, y) = ii(x - 1, y) + s(x, y)$$

----- (eq:3)

The second step uses easy and efficient classifier which is built using the AdaBoost learning algorithm, to select a small number of critical visual features from a very large set of potential features. The third step is a process for combining classifiers, which allows background regions of the image to be quickly discarded.

B. FACE RECOGNITION SYSTEM

Face recognition phase shown in Fig 4 compares the features from the detected images obtained from real-time camera with that of the images stored in the database. Then, find out the best match and recognize the person. In our system, KL Transform along with FANNC is used for face recognition. The KL Transform algorithm tracks a set of feature points across the video frames. After applying KL Transform, a set of Eigen faces are created. Then, the recognition is performed by comparing the face that is to be recognized with the set of Eigen faces that is calculated by applying the KL Transform.

To reduce the computational time, the size of images must be reduced by cropping. The Euclidean of each image with images of other face space is computed and set it as the threshold. Then, the minimum difference between input and output image is calculated. If difference is less than the threshold, then display the appropriate face match and the difference. Otherwise, display face is not found.

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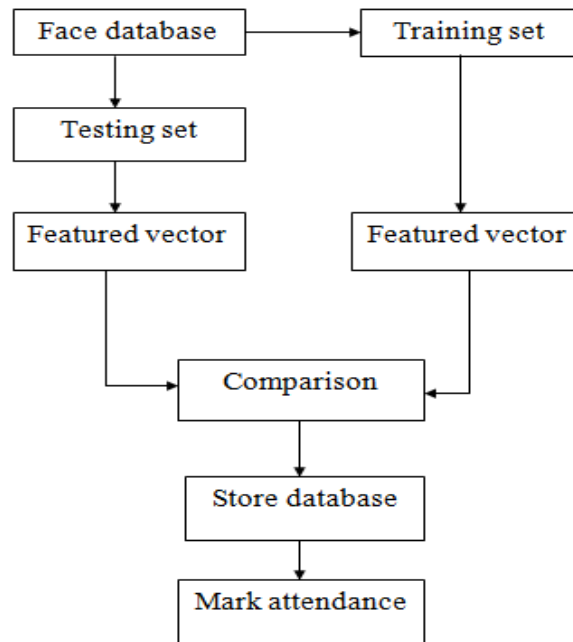


Fig 4.Face Recognition System

C. CLASSIFIER

The problem of identifying the new observation belongs to which group on the basis of training data in which observation is defined by a machine is known as classification. The algorithm that implements classification is known as classifier. Classification can be supervised and unsupervised. In supervised learning the training set of correctly identified observations are available. While in unsupervised learning identified observations are not available and the grouping is done based on some measures.

FANNC classifier is one of the supervised classifier which uses the database of students as the training set of data.

C.1 MODEL

To achieve higher accuracy and high speed, FANNC classifier is used. It consists of four layers as shown in Fig 5: a) first layer units b) second layer units c) hidden layer units d) output layer units. The data enters the network through the input layers. The nodes at input layer allow the entire information to get into the second layer units. These units ensure better classification of inputs at an initial level.

The first layer units are the input layer units. The second and third layers are hidden layers which are connected to each other. Second layer is connected to all input units through Gaussian weights. And these in turn classifies the input units.

The second layer units are related to third layer units which are already calculated weights of the student database given and compare them with second layer units. And the output of third layers connected to output units. The third layer units classify the outputs internally, by which supervised learning implemented.

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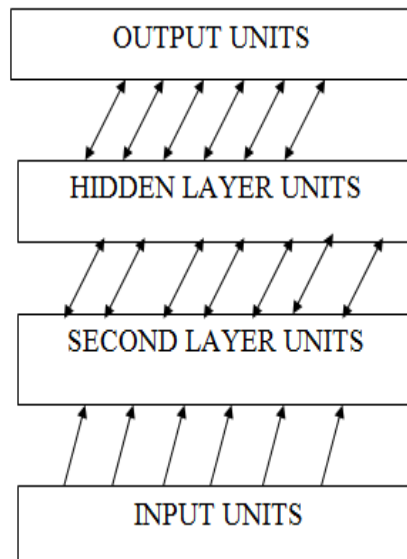


Fig 5.FANNC Model

C.2METHOD

Assuming that instances input to the input units are $A_k = (a_k^1, a_k^2, \dots, a_k^n)$, where k is the index of instance, $k = 1, 2, \dots, m$, and n is the number of input units.

$$b_{lnij} = \exp - (a_i^k - \theta_{ij} / \alpha_{ij})^2 \quad \text{----- (eq: 4)}$$

The second unit j comprises its activation value according to,

$$b_j = f(\sum_{i=1}^n b_{lnij} - \theta_j) \quad \text{----- (eq: 5)}$$

Where θ_j is the bias of unit j and f is the sigmoid function,

$$f(u) = 1 / (1 + e^{-u}) \quad \text{----- (eq: 6)}$$

The activation value of third layer unit h is computed according to,

$$c_h = \sum b_j v_{jh} - \theta_h \quad \text{----- (eq: 7)}$$

Here v_{jh} is the feed-forward weight connecting unit j to unit h . It is always 1.0. θ_h is the bias of unit h . The output is transferred to fourth layer units. The activation value of output unit l is computed according to,

$$d_l = c_h w_{hl} \quad \text{----- (eq: 8)}$$

Where d_l is the activation value of unit l . c_h is the activation value of h . w_{hl} is the feedback forward weight connecting unit h to unit l . The error between the real network output and expected output is calculated. If the error is in allowable range, input classification and output classification are adequate. The process of learning an instance fed to FANNC is accomplished by this. If there is an instance that has not been fed, FANNC starts to deal with it. Else the learning course terminates.

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V.EXPERIMENTAL ANALYSIS

The system is simulated in MATLAB2014. The machine used in our experiment is Intel Core i3 with 4GB RAM.

A. FACE DETECTION

The Viola Jones algorithm detects face under variable illumination, poses and expression. The system gave satisfactory results of more than 70% true detection. Face detection experiments under different situations are explained in the Table 1.1. Straight faces or faces at 0 degree with respect to camera are detected with 72.2% accuracy while the faces with 90 degree does not detect properly.

B. FACE RECOGNITION

The face recognition is carried out using KL Transform along with FANNC with an accuracy of 69.4%. The result is more accurate for straight and near faces with respect to camera. The details of face recognition experiment conducted are listed in the Table 1.1. From the table, it is clear that the face is sometimes recognized incorrectly. It is mainly due to the illumination and distance. This can be corrected by increasing number of images in the database and using gradient feature.

Table 1.1: Face detection and recognition experiments

SITUATION	DISTANCE (m)	ANGLE (degree)	NUMBER OF FACE DETECTED	DETECTION IN %	NUMBER OF FACE RECOGNISED	RECOG- NITION IN %
BRIGHT	1	0	4	100	4	100
		45	4	100	4	100
		90	3	75	3	75
	2	0	4	100	4	100
		45	4	100	3	75
		90	3	75	2	50
NORMAL	1	0	4	100	4	100
		45	3	75	4	100
		90	2	50	3	75
	2	0	4	100	4	100
		45	4	100	3	75
		90	2	50	3	75

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DARK	1	0	3	75	2	50
		45	2	50	2	50
		90	1	25	1	25
	2	0	2	50	2	50
		45	2	50	1	25
		90	1	25	1	25
Total in Percentage		72.2			69.4	

VI.CONCLUSION

An advanced attendance management system is proposed using FANNC and various techniques supports student's detection, recognition and attendance marking. The system reduces the paperwork and save time. It also reduces the proxy attendance marking. The results from the experiment show that the detection and recognition is carried with an efficiency of 72.2% and 69.4% respectively. Thus the overall performance of the system is found to be 70.8% efficient.

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