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Research Article

Automated Attendance Management by Facial Recognition using Histogram

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Abstract

Face recognition is the identification of humans by the unique characteristics of their Faces. Face recognition technology is the least intrusive and fastest growing technology and also proves to be the easier tool for certain works. It works with the most obvious individual identifier the human face .This research aims at providing a system to automatically record the students' attendance during lecture hours in a hall or room using facial recognition technology instead of the traditional manual methods. The objective behind this research is to thoroughly study the field of facial recognition by image processing which is very important and is used in various applications like identification and detection. This system is been implemented with 4 modules namely Image Capturing, Segmentation of group photo (Face Detection), Face comparison (Recognition), Updating of Attendance in database.

Keywords: Histogram; Haar Cascade; Face detection; Face Comparison.

Introduction

Facial recognition is a biometric software application capable of uniquely identifying or verifying a person by comparing and analyzing patterns based on the person's facial contours. Facial recognition is mostly used for security purposes, though there is increasing interest in other areas of use [1, 2]. In fact, facial recognition technology has received significant attention as it has potential for a wide range of application related to law enforcement as well as other enterprises. There are different facial recognition techniques in use, such as the generalized matching face detection method and the adaptive regional blend matching method. Most facial recognition systems function based on the different nodal points on a human face [3].

The values measured against the variable associated with points of a person's face help in uniquely identifying or verifying the person. With this technique, applications can use data captured from faces and can accurately and quickly identify target individuals [4, 5]. Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it learn for themselves. The process of learning begins with observations or data, such as examples, direct experience, or instruction, in order to look for patterns in data and make better decisions in the future based on the examples that we provide. The primary aim is to allow the computers learn automatically without human intervention or assistance and adjust actions accordingly [6, 7].

Existing system

Eigen Value Method

The existing system (Fig. 1) was developed using Eigen Value Algorithm. This algorithm has many short comings. This algorithm can be applied for circumstances where light conditions are bright and does not change. This can't be applied for taking attendance in the class rooms, as the light conditions always plays a major role on day to day activities [8, 9].

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scan room with digital camera

for each detected object
    transfer the object in server
next object

for each face in server
    if face in students database
        record student as enrolled
        save face in students database
    else
        mark face as unrecognized
next face
```

Fig. 1. Overall structure of the system

Proposed system

The proposed system mainly developed to overcome the shortcomings of the existing system. The proposed system uses the algorithm called the Histogram. This system functions the same in all the light conditions. This feature is considered as the most valuable feature (Fig. 2). The image is processed to form a matrix (Fig. 3). The values are processed to form the Histogram which is unique for each face. This histogram values are then used for identification of the individual faces. Once the individual faces are identified, their presence is marked and updated in the database. The database is then made available to be viewed by the students and staff. The privilege of modification is provided to the admin people (Fig. 4).

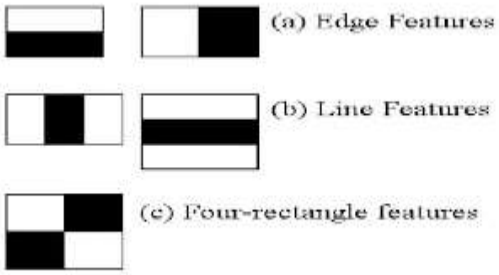


Fig. 2. Haar cascade features

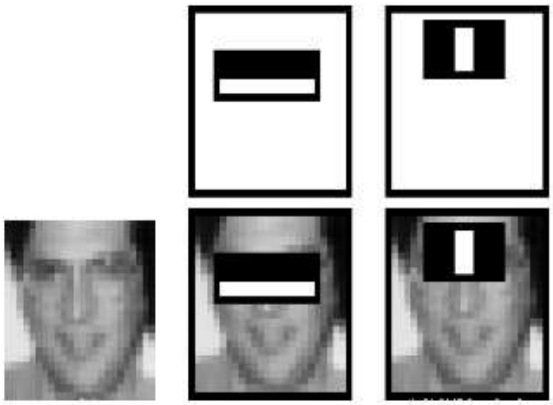
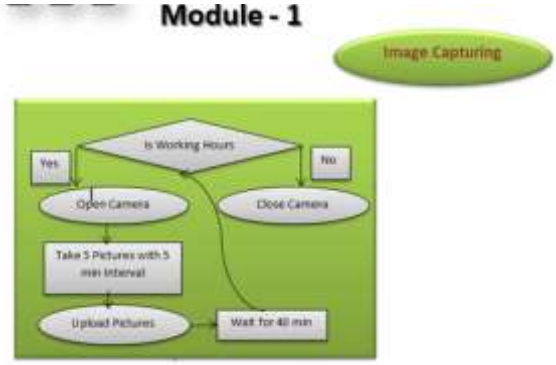
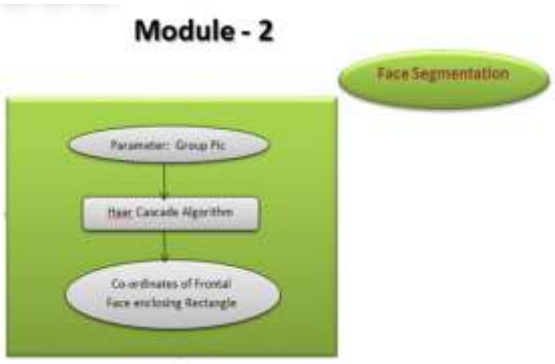


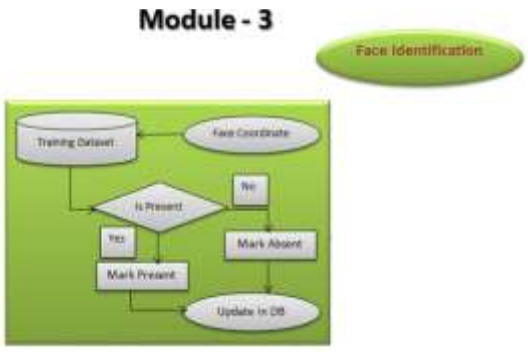
Fig. 3. Haar Cascade features in Facial Recognition



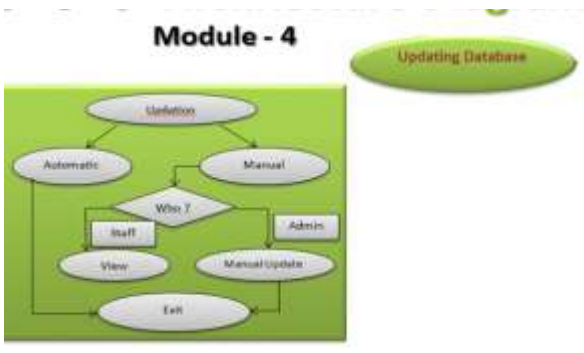
(a) Module 1



(b) Module - 2



(c) Module – 3



(d) Module – 4

Fig. 4. Various modules of proposed system

Implementation of Haar Cascade

Object Detection using Haar feature-based cascade classifiers is an effective object detection method proposed by Paul Viola and Michael Jones. It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images. The algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. Then we need to extract features from it. For this, Haar features shown in Fig. 5 are used. They are just like our convolutional kernel. Each feature is a single value obtained by subtracting sum of pixels under white rectangle from sum of pixels under black rectangle.

Fig. 5. Haar Cascade identification

Implementation of Histogram

Each face image can be considered as a composition of micro-patterns which can be effectively detected by the LBP operator. The histogram of LBP computed over the whole face image encodes only the occurrences of the micro-patterns without any indication about their locations. To also consider the shape information of faces divide face images into *m* local regions to extract LBP histograms (as shown in Figure below). The face images are divided into M small non-overlapping regions R0,R1,...,RM (as shown in Fig. 6) in order to collect the shape information. The LBP histograms extracted from each sub-region are used for calculation and combined into a single, histogram with spatial advanced features defined as in eq. (1).

Architecture view of Automatic Aqua Filler

The architectural diagram for the automated attendance management using facial recognition by histogram is presented in Fig. 7. The Fig. 7 represents the working of the entire system. This depicts the functionality of the system with an end to end implementation. The functionality of each module is been explained.

$$H_{i,j} = \sum_{x,y} I(f_l(x,y) = i) I((x,y) \in R_j) \quad (1)$$

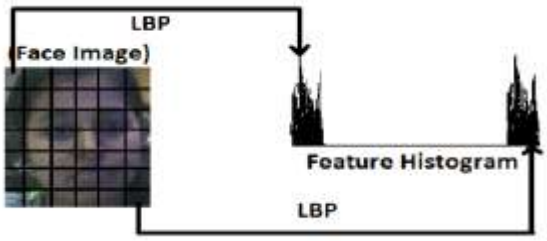


Fig. 6. Histogram Formula

Process involved in histogram

A 3×3 window is taken and moved across one image. At each move (each local part of the picture), the pixel at the center is compared, with its surrounding pixels. The neighbors with intensity value less than or equal to the center is represented by the pixel by 1 and the rest by 0. After these 0/1 values are read under the 3×3 window in a clockwise order, we will have a binary pattern like 11100011 that is local to a particular area of the picture. When we finish doing this on the whole image, we will have a list of local binary patterns.

After we get a list of local binary patterns, we can convert each one into a decimal number using binary to decimal conversion (as shown in Fig. 8) and then you make a histogram of all of those decimal values. A sample histogram looks like Fig. 9.

Updation in database

The last phase is the updating the attendance in the database (Fig. 10). Once the image is been recognized then the mapping takes place where the names are mapped for the particular image. Then the names are marked with either present or absent.

Conclusions

An automatic attendance management system is a necessary tool for any Organization. Most of the existing systems are time consuming and require for a semi manual work from the teacher or students. Our approach aims to solve the issues by integrating face recognition and Machine Learning in the process. This system has been enhanced to

identify each student present in the class. Since a modular approach is been followed, any advancement can be integrated into the system. Any changes based on the environment can also be incorporated into the system. This system makes use of the new trending technologies to effectively perform the day to day activities.

ARCHITECTURE DIAGRAM

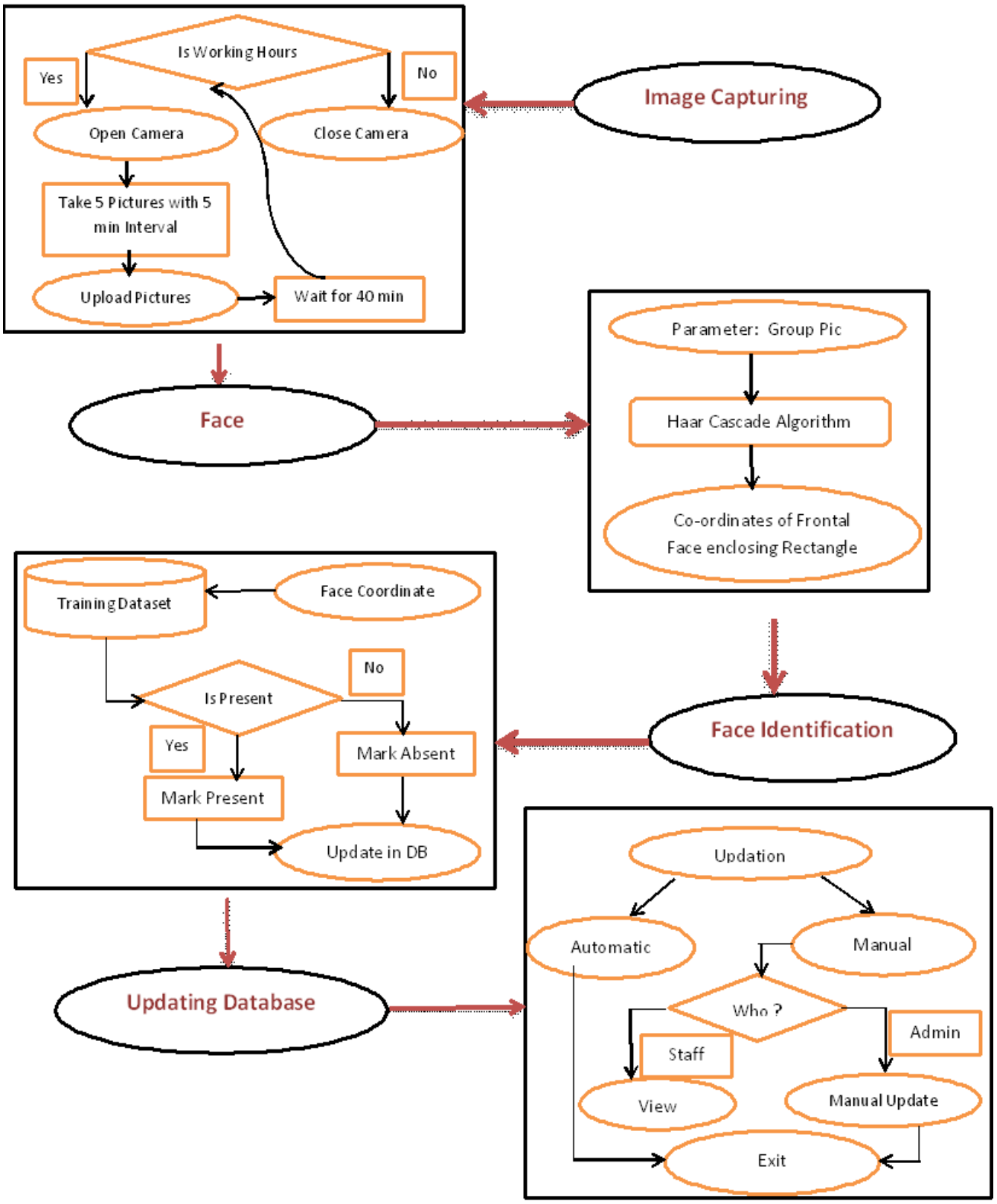


Fig. 7. Architecture view

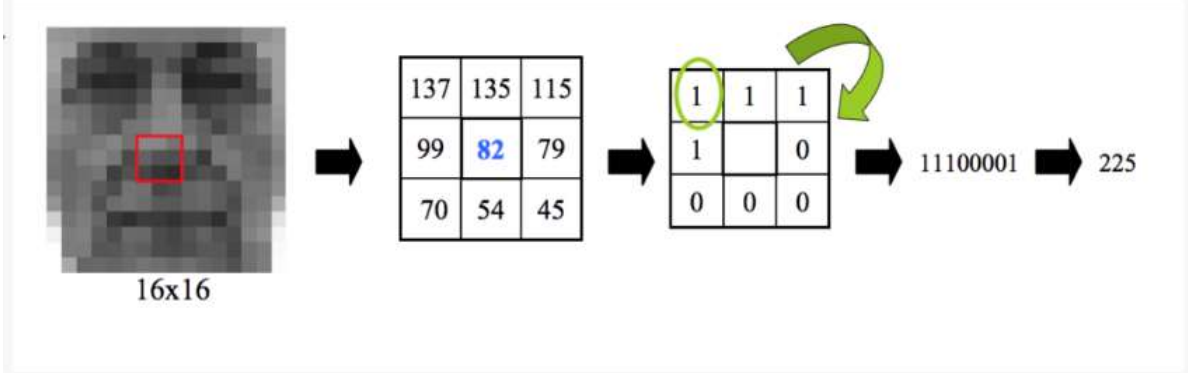


Fig. 8. Histogram Matrix

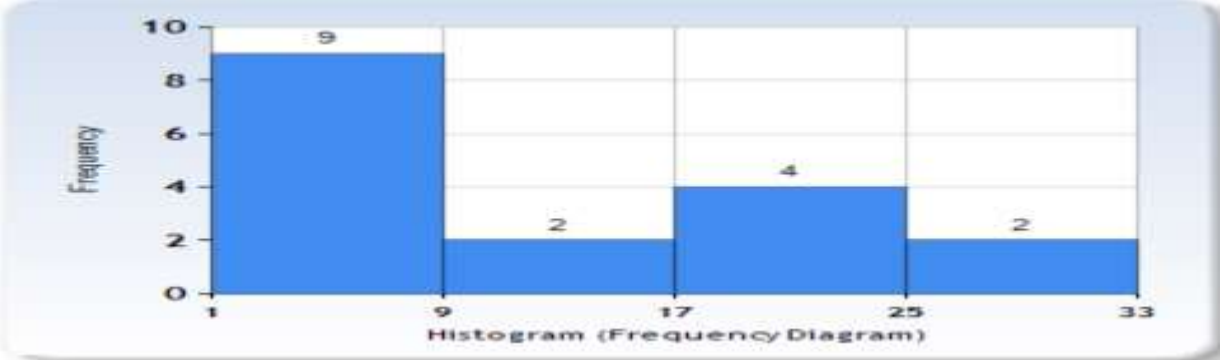


Fig. 9. Histogram Chart

Options

student_id	name	DOB	dept_id	batch_id	year	section
1	Gaya	2018-02-26	CSE	2019	2018	A
987876565345	Gayathri M	2018-02-26	CSE	2019	2018	A
312314104049	Gayathri M	2018-02-27	CSE	2019	2018	C
312314104003	Aashikha	1997-06-21	CSE	2019	2018	A
312314104014	Anjana	1996-11-23	CSE	2019	2018	A
312314104047	Ensha	1996-11-21	CSE	2019	2018	A

Fig. 10. Database structure

Conflicts of interest

Authors declare no conflict of interest.

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