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Class Attendance Using Face Detection and Recognition with OPENCV

K. Yamini[1], S. Mohan Kumar[2], S. Sonia[3], P. V. Yugandhar[4], T. Bharath kumar[5]

[1]Assistant Professor of Electronics and Communication Technology, Mother Theresa Institute of Engineering and Technology, Palamaner, Andhra Pradesh, India
[2,3,4,5]UG Students, Department of Electronics and Communication Technology, Mother Theresa Institute of Engineering and Technology, Palamaner, Andhra Pradesh, India

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Abstract – *Attendance is important for each and every students in schools and colleges. This paper deals with the process of taking the attendance with use camera and automating the attendance process that will mark the attendance for the students in easy and simple manner without wasting of time and reduce Statistical process. This proposed system uses face detection for identification of face from objects and face recognition for matching of faces from stored database images (authentication) and provide attendance according to the matched face. To attain this face detection and recognition, we use viola-Jones algorithm (Haar's Cascade) for face detection and linear binary pattern histograms for face authentication using python and importing the OPENCV framework to python IDE. This system updates attendance of the student and sends message to the Head of the Department.*

KEYWORDS*: *Python IDE, OPENCV, Haar's Cascade, Viola-Jones framework, LBPH recognizer, Camera.

1. INTRODUCTION

The present day attendance system is manual. It wastes a considerable amount of time both for teachers and students. The waiting time of the students is increased if attendance is taken manually. There are still chances for false attendance in the class when attendance is taken manual. Manual attendance always a have a cost of human error. When we manually mark attendance it is of time and increase in Statistical process. To solve the current problem is through automation of attendance system using face recognition. Face is the primary identification for any human. So automating the attendance process will increase the productivity of the class face. To attain this face detection and recognition, we use viola-Jones algorithm (Haar's Cascade) for face detection and linear binary pattern histograms for face authentication. This module can be utilized for different applications where face acknowledgment can be utilised for validation. The Main aim is to give the effective way of attendance marking system and reducing human handling by using Viola Jones algorithm for face detection and LBP histogram for recognition.

2. EXISTING SYSTEMS

1. RFID Scanner: Scanning ID cards using of RFID Tags
2. Biometrics: Authentication between two human fingerprints

2.1 Drawbacks of RFID Scanner

1. Costly
2. Easy disrupted
3. Reader and Tag Collision
4. Security, Privacy and Ethics Problem
5. RFID tags can be read without your Knowledge

2.2 Drawbacks of Biometrics

1. Copy of fingerprints
2. Waiting time is large

3. PROPOSED SYSTEM

This proposed approach deals with the automation of attendance system using face detection and recognition.

This approach has three modules:

1. Face Detection
2. Face Training
3. Face Recognition

Advantages

1. Increases security level
2. Less statistical process
3. Fast and Flexible

3.1 Face detection and training

The efficient algorithm used in face detection process is Haar's Cascades proposed by Viola- Jones for face detection.

The algorithm can be used as Cascade Object detector. We have used the built in method but we have modified its implementation to increase its accuracy. Detected faces are then converted into Grayscale images for better accuracy.

Viola Jones Algorithm Overview

Viola Jones face detection algorithm is used for real-time object detection. Although it can be trained to detect faces. The main disadvantage of this algorithm is its detector is most effective only on frontal images of faces.

Viola Jones method for detection of faces contains three techniques:

1. Features from Integral Image
2. Adaboost algorithm
3. Cascading Classifiers

Features from Integral Image

Rectangular features serve simple classifier. In this Viola Jones algorithm begins with the computation of simple rectangular features. Viola Jones algorithm uses Haar like features. The algorithm that is provided with use of Viola-jones algorithm needs a lot of positive images and negative images to train the Haar cascades classifier. Positive images are clear faces where negative images are without any faces. Each feature is represented as a single value obtained from the difference of the sums of pixels in white rectangle from the sum of all pixels in the black rectangle. As the number of classifiers increase the arithmetic computations seems to take a long time. We have a drawback, so we use the concept of Integral Image. The Integral Image is used to calculate the sum of pixel values in a given image – or a rectangular subset of a grid.

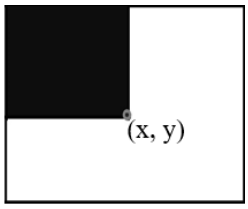

Fig-1: Integral Image Point (x, y)

Integral image is derived by using the formula.

$$I(x,y) = \sum_{x' \le x, y' \le y} i(x', y')$$

The integral image is formed by the sum of the pixels above and to the left of x, y.
Where I (x, y) is the integral image and I (x', y') is the original image.

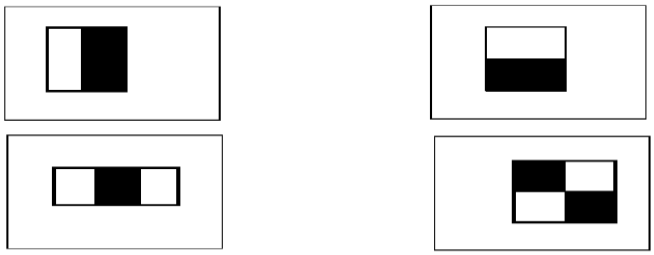

Fig-2: Rectangle features shown relative to the enclosing detection window (Haar cascade)

Adaboost algorithm

From the rectangle features available, an algorithm choose the features that give the best results for easy process. Viola Jones algorithm chose a variant of Adaboost to select features and to train a classifier. To reduce number of classifiers applied for calculation. We go with the improved Adaboost machine learning algorithm, which is inbuilt in OPENCV library that is cascade classifier, to eliminate the redundancy of the classifiers. The classifier which has a probability of having 50% of more in detection of features is treated as weak classifier. The Summation of all weak classifier gives a strong classifier which makes the decision about detection which reduces the classifiers. It is very uncertain to classify with one strong classifier we use the cascade of classifiers. We don't prefer to use classifiers on that region which is discarded. The region which passes all the stages i.e. all strong classifiers is consider as detected face. It trains a set of weak classifiers to develop a strong linear classifier.

$$hj(x) \in \{+1, -1\}$$

Cascade Classifiers

Cascade of classifiers increased detection performance and reduce computation time. Classifiers which are constructed which reject many of the negative sub-windows while detecting almost all positive instances. This removes false faces from each stage.

3.2 Face recognition

After the face detection next procedure is to extract the features of face which is called feature extraction. The module recognizes the face of students registered for the course. This module match the features of the student present in the class with the stored images in the database. For face recognition we used several algorithms.

They are

1. Histogram of Oriented Gradients (HOG),
2. Local Binary Patterns (LBP)

Histogram of Oriented Gradients (HOG)

HOG is a reliable feature extraction system mainly used in image processing for object detection. This system works similarly like edge oriented histograms but differs in that it is computed on a dense grid of uniformly spaced cells and uses overlapping local contrast normalization for improved accuracy. HOG works by dividing the image into very small connected regions which are called cells and for each cell, finding histogram of gradient direction inside the cell. HOG tries to describe every objects within the image with edge direction or intensity gradients

To improve the accuracy, block is defined as histograms can be contrast-normalized by calculating a measure of the intensity across a larger region of the image and then using this value to normalize all cells within the block. This normalization results in better invariance to changes in illumination and shadowing.

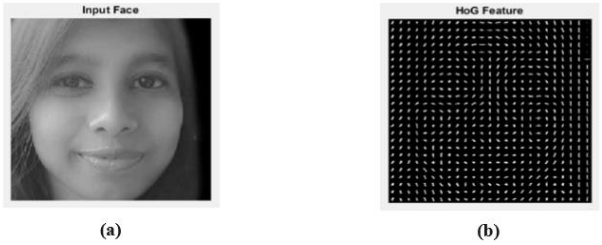

Fig-3: HOG Feature (a) sample image and (b) Extracted HOG Features of sample image**.**

Local Binary Pattern (LBP)

We use LBP histogram for face recognition. The local binary pattern (LBP) texture analysis operator is defined as, Basically , it is gray-scale invariant texture measure which is derived from a general definition of texture in a local neighborhood. It is a type of visual descriptor used for classification in computer vision. Face recognition algorithms assumes that the face images are well structured and aligned to have a similar pose. It is impossible to meet these conditions. Histograms of Local Binary Patterns have proven to be highly discriminative descriptors and best approach for face recognition. The area of face are first divided into small regions from which Local Binary Pattern histograms are extracted and concatenated into a single, specially enhanced feature histogram efficiently representing the face image. The operator has been extended to use neighborhoods of different sizes. Using a circular neighborhood and bilinearly interpolating values at non-integer pixel coordinates allow any radius and number of pixels in the neighborhood. The notation (P; R) is generally used for pixel neighborhoods to refer to P sampling points on a circle of radius R

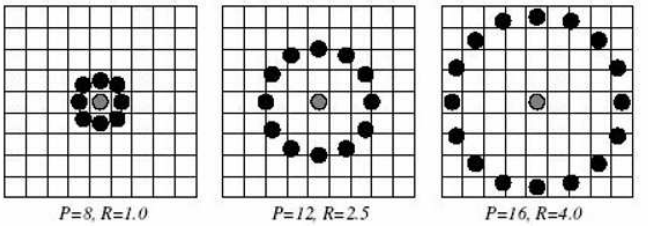

Fig- 4: Circularly symmetric neighbor sets

The calculation of the LBP codes can be done within in a single scan through the image.
The value of LBP code of a pixel (xc : yc) is given by

$$LBP_{P,R}g_p g_c = \sum_{p=0}^{P-1} s(g_p - g_c)2^p$$

4. PYTHON AND OPENCV

4.1 Python

Python is high level programming language with dynamics semantics. Python is also the scripting language where the application can be developed and can be used for many purposes. There are several modules two can be import while implementing the code from algorithm. Some of python interpreter and the extensive standard library are available without any charge. Python is simple to learn where reduces the cost of program maintenance.

Python supports multi-paradigms:

1. Object-oriented
2. Imperative
3. Functional
4. Procedural
5. Reflective

4.2 OPENCV

OPENCV is popular library for computer vision. This is used as image processing framework. This use machine learning algorithm for detection of faces and recognition of faces. There will be thousands of small patterns and features that must be authenticated. The algorithms breaks the task of identifying the face into thousands of smaller, bite-sized tasks, each of which is easy to solve. These tasks are also called classifiers. OPENCV data used to detect objects. We initialize the code with the cascade we want, and then it does the work.

We import OPENCV framework with use of module “CV2”

```
import CV2
```

5. WORKING OF PROPOSED SYSTEM

1. Creation of Student Dataset
2. Turning on camera
3. Capturing the video of present student
4. Detect faces and extract feature
5. Matching
6. Marking attendance and sent to mail

Creation of Student Dataset

At first student database is created without any errors i.e., no other faces are accepted while saving the database of single students and python program is implemented using CV2 module to create the datasets of the students.

Turning on camera

Camera is one of the important part, which is used to capture the frames of faces.

Detect faces and extract feature

Detection of Faces is done using viola-Jones algorithm. So that detection of face can be easy and face features are extracted from the frames. Python program is implemented using CV2 module for training and recognition of multiple faces

Matching

Face Recognition is done through LBP histograms. This is easy to compare the features of two image. So as to match the images that are stored in database with the input image. Python program is implemented using CV2 module for matching of two images.

Marking attendance and sent to mail

Attendance is being updated once for a day when the student enters into the class along with time. When he entered in the class and at the last hour of the day mail is sent to the Head of department. Python program is implemented using CV2 module for updating of the attendance in Notepad and sending message through mail.

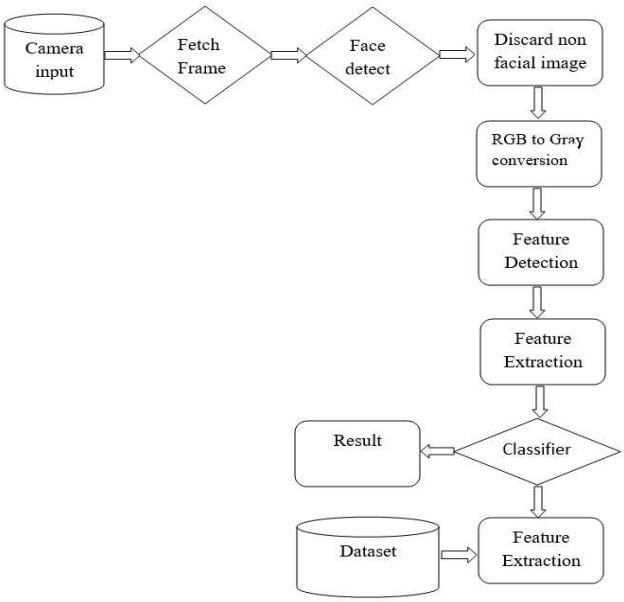

Fig-5 Flowchart

Initially, image of the students is provided by standing near to the camera for about 2 seconds. Then Frames of images captured and they are being compared with the datasets in which each and every student datasets are stored. While capturing faces 24*24 window is created to detect only face. While storing the datasets of the students color of the students i.e., RGB gets turned to GRAY SCALE Image. If the input image is match with any of the datasets of the student and their face is matched and attendance is provided to them and get printed on the Notepad and again at the last hour of the day message is sent to the Head of the department. When this process goes with full automation, easy and with high security. It can detect multiple face and match the features with datasets within seconds and saves huge time and maintain accuracy in detection of faces and authentication of faces.

6. RESULTS

6.1 output of the project

Fig-6: Output of the project

6.2 outputs sent to mail

Fig-7: Output sent to mail

7. CONCLUSION

Hence we have accomplished to build up a solid and productive participation framework to actualize an image handling algorithm to identify faces in classroom and to perceive confronts precisely to check the attendance. So to defeat RFID and fingerprint framework and provide better solid arrangement from each keen of time and security using face detection and recognition.

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