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Face Recognition Based Attendance Monitoring System using Raspberry-pi and OpenCV

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Abstract **-** *Recently face recognition is attracting much attention in the society of network multimedia information access. Areas such as network security, content indexing and retrieval, and video compression benefits from face recognition technology because "people" are the center of attention in a lot of video. Face recognition is the identification of humans by the unique characteristics of their Faces. Face recognition technology is the least intrusive and fastest bio-metric technology. It works with the most obvious individual identifier the human face. This system aims at providing a system to automatically record the students' attendance during lecture hours in a hall or room using raspberry-pi with the help of facial recognition technology instead of the traditional manual methods.*

Key Words: Raspberry-pi, Open CV, Recognition, Dataset generation

1. INTRODUCTION

Face recognition is a technique of biometric recognition. It is considered to be one of the most successful applications of image analysis and processing. Maintaining the attendance is very important in all the institutes for checking the presence of students. The face recognition approach is for the automatic attendance of students in the classroom environment without student's intervention. This attendance is recorded by using a camera attached in the classroom which captures images of students, detect the faces in images and compare the detected faces with the student database and mark the attendance. The facial recognition process can be divided into two main stages: processing before detection where face detection and alignment take place (localization and normalization), and afterwards recognition occur through feature extraction and matching steps.

2. LITERATURE SURVEY

This chapter contains synthesis of the available literature regarding our system. This synthesis merges the conclusions of many different sources to explain the overall understanding of the topic. We have referred scholarly articles, books, dissertations, conference proceedings and other resources which are relevant to our system.

After referring through many research papers, some of the relevant research papers are listed below:

Dr. Kishor S. Kinage performed Linear subspace analysis schemes (PCA, ICA LDA) for face recognition and represented his idea in Computer Science and Information Technology (ICCSIT), 2010 3rd IEEE International Conference. In this paper a multi-resolution analysis based on Independent Component Analysis (ICA) for face recognition is examined. [1]

Shang-HungLin conducted an experiment and represented his paper in Informing science special issue on multimedia informing technologies part 2, Volume 3 No 1, 2000 which is on various algorithms such as Eigen faces and neural networks. In this paper, a brief introduction for the face recognition technology is given. [2]

Anil K. Jain has published Handbook of Face Recognition in Beijing China, December 2004, which elaborates more about Introduction of face recognition processing, including major components such as face detection, tracking, alignment, and feature extraction. [3]

3. PROBLEM STATEMENT

Every institute has its own method to keep record of attendance of students. Some are taking attendance manually using the traditional pen and paper or file based approach but marking attendance is a lengthy process and takes lot of time and effort, especially if it is a lecture with huge number of students. Also dealing with the records of a large number of students often leads to human error. So we are implementing a system to automatically record the students' attendance during lecture hours in a hall or room using facial recognition technology. This project deals with one of the possible solutions.

4. SPECIFICATION

4.1 HARDWARE SPECIFICATION

This chapter includes the hardware required for our system.

1) Web camera

A web-cam is a video camera that feeds or streams its image in real time to or through a computer to a computer network.

Features:

- 20 Megapixels high resolution webcam
- Microphone: Yes
- Video Resolution: 320*240 30FPS, 640*480 15 FPS
- Image Focus: 5cm to Infinity
- White balance: Automatic white balance with LED light for night version

Specifications:

- Interface: USB 2.0
- Lens specification: 3P high quality lens
- Image sensor: CMOS
- Support: Windows XP/VISTA/8/8.1/10

Fig -1: Web camera

2) Raspberry Pi 3(Model B):

Features:

- Broadcom BCM2837 64bit ARMv7 Quad Core Processor powered Single Board Computer running at 1.2GHz
- 1GB RAM
- BCM43143 Wi-Fi on board
- Bluetooth Low Energy (BLE) on board
- 40pin extended GPIO 4 x USB 2 ports 4 pole Stereo output and Composite video port
- Micro SD port for loading your operating system and storing data
- CSI camera port for connecting the Raspberry Pi camera
- Upgraded switched Micro USB power source (now supports up to 2.4 Amps)
- DSI display port for connecting the Raspberry Pi touch screen display

Fig -2: Raspberry Pi 3(Model B)

4.2 SOFTWARE SPECIFICATION

This chapter includes the software required for our system.

1) Open CV

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for businesses to utilize and modify the code. The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc. It has C++, Python, Java and MATLAB interfaces and supports Windows, Linux, Android and Mac OS. OpenCV leans mostly towards real-time vision applications and takes advantage of MMX and SSE instructions when available. As our system is face recognition based attendance monitoring system, Open CV is very useful for it. Also it requires low RAM usage (approx 60–70 MB), so we are using it in our system.

Fig -3: OpenCV Logo

5. METHODOLOGY

This chapter contains block diagram of face recognition based attendance monitoring system using Raspberry pi. The elements of block diagram of face recognition based attendance monitoring system using Raspberry pi are also explained. The process of person identification by using face recognition can be split into three main phases. These are registration and normalization, feature extraction and classification are explained in this chapter.

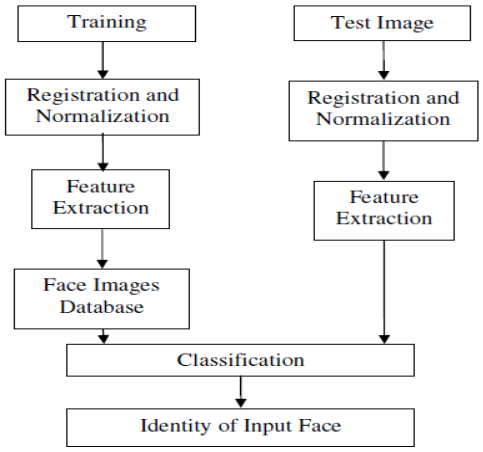

Chart -1: Face recognition based attendance monitoring system using Raspberry pi

5.1 Training and Testing:

The dataset whose identity is known to the classifier is called the Training data. It is used to define the characteristics of different classes to the classifier. The dataset whose identity is to be hypothesized is called the Testing data. Training and testing are two common concepts in image processing. You have a training dataset for which you know both input data as well as additional attributes that you want to predict. Training consists in learning a relation between data and attributes from a fraction of the training dataset, and testing consists in testing predictions of this relation on another part of the dataset since you know the prediction, you can compare the output of the relation and the real attributes.

5.2 Registration and Normalization:

In the registration and normalization phase, the image is transformed (scaled and rotated) till it has the same 'position' as the images from the database, e.g. this means that the eyes are at the same positions. Issues related to illumination difference are also resolved in this part. In image processing, normalization is a process that changes the range of pixel intensity values. Applications include photographs with poor contrast due to glare, for example. Normalization is sometimes called contrast stretching or histogram stretching.In more general fields of data processing, such as digital signal processing, it is referred to as dynamic range expansion.

5.3 Feature Extraction

In the feature extraction phase, the most useful and unique features (properties) of the face image are extracted. Extracted feature is as representative as possible. The images may be represented by their original spatial representation or by frequency domain coefficients. Features that are not obviously present in one domain may become obvious in the other domain.

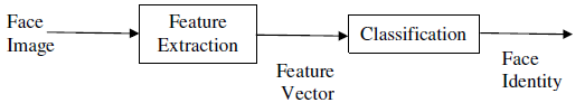

Chart 2 -: Feature Extraction

5.4 Face Image database

In our system, we created a database of some students in our class. Attendance is recorded by using a camera attached in the classroom which captures images of students, detect the faces in images. Now it will compare the detected faces with the student database images and attendance will be marked.

5.5 Classification

We have obtained various features of face in feature extraction, with these obtained features; the face image is compared with the images from the database. This is done in the classification phase. The output of the classification part is the identity of a face image from the database with the highest matching score input face image. Also a threshold value can be used to determine if the differences are small enough. We have used Haar feature-based cascade classifier for classification. Haar feature-based cascade classifiers are an effective object detection method whereas cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images Each feature is a single value obtained by subtracting sum of pixels under the white rectangle from sum of pixels under the black rectangle. Now, all possible sizes and locations of each kernel are used to calculate lots of features. Even a 24x24 window results over 160000 features. For each feature calculation, we need to find the sum of the pixels under white and black rectangles. To solve this, they introduced the integral image. However large your image, it reduces the calculations for a given pixel to an operation involving just four pi.

6. TESTING

This chapter tells all about testing and troubleshooting of system. Test summary report is a formal document that summarizes the results of all testing efforts for a particular

testing cycle of a project module or a sub module. Generally, test leads or test managers prepare this document at the end of testing cycle.

6.1 DATASET GENERATION

For real time processing the first and basic step for any image detection feature is to generate database of that respective object. So, for our system we have written the code for dataset generation. So, after simulating the code approximately 50 images of each and every person have been taken and then the separate id has been given to each person such as 1.1 to 1.50, 2.1 to 2.50 and so on.

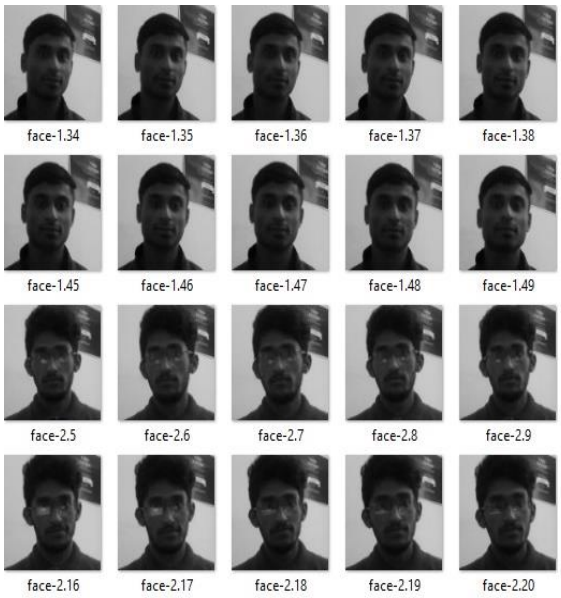

Fig -3: Database Generation

6.2 FACE DETECTION AND RECOGNITION

A For real time featuring, we have captured the images from web camera then that image has been converted into gray scale image after that histogram equalization feature has been applied to it, So that we get normalized image. After that the main challenge is to detect human face. We used eye recognition technique. Hence by detecting human eye, we have given a rectangular box to that image by applying some specific margin. Then by applying some cropping feature, that rectangular box (face) has been proceeding for further operation. We have used a separate code for face recognition hence detected face has been taken and then by applying haar based cascade feature, threshold value for that image is calculated and then respective id is given to the image. If threshold value of that image matches with the threshold value of the database image, respective name is given to that image.

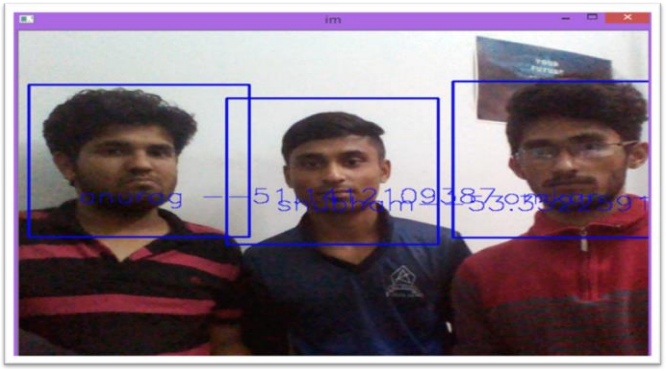

Fig -4: Face recognition

7. CONCLUSIONS

Using this system attendance of the students will be automatically updated on the web page which we have created by using face detection and face recognition techniques, as well as according to requirement of the system image normalization is also done with the help of Raspberry-pi and Open Cv software.

8. REFERENCES

[1] Shang-Hung Lin, "An Introduction to Face Recognition Technology" (Ph.D. IC Media Corporation**),** Informing science special issue on multimedia informing technologies part 2, Volume 3 No 1, 2000.

[2] Dr. Kishor S. Kinage, "Face Recognition based on Independent Component Analysis on Wavelet Sub band", Computer Science and Information Technology (ICCSIT), 2010 3rd IEEE International Conference.

[3] Anil K. Jain, "Handbook of Face Recognition ", Beijing China, December 2004.

9. BIOGRAPHIES

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