International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 03 | Mar -2017 www.irjet.net p-ISSN: 2395-0072

Smart Doorbell System based on Face Recognition

Jaychand Upadhyay[1], Parkar Rida[2], Sunidhi Gupta[3], Noman Siddique[4]

[1]*Asst. Professor, Dept. of IT Engineering, Xavier Institute of Engineering, Maharashtra, India*
[2]*Dept. of IT Engineering, Xavier Institute of Engineering, Maharashtra, India*
[3]*Dept. of IT Engineering, Xavier Institute of Engineering, Maharashtra, India*
[4]*Dept. of IT Engineering, Xavier Institute of Engineering, Maharashtra, India*

Abstract - *In recent years appreciable progress has been made in the field of face recognition. Face recognition system is an intelligent application, which can recognize or confirm a man from advanced sources, for example, (computerized picture or a video stream). Through the work of computer engineering engineers, PCs can now beat people in many face recognition assignments, especially those in which substantial databases of human faces must be looked. The easy approach to perceive any face is by making an analogy with the facial components from the input picture (tested image) in a facial database. A system with the ability to distinguish and recognize faces has numerous potential applications including crowd and airport surveillance, private security and enhanced human-computer interaction. This project aims to supersede highly priced image processing boards by putting to use Raspberry pi board with ARMv7 Cortex-A7 as the core within Opencv library. This project is mainly based on image processing by porting the Opencv library to the Raspberry Pi board. The ultimate crucial errand in face recognition is how to find the most identical between the tested and training faces.*

In this paper, how to recognize a face is introduced; for evaluating the proposed system, the author has used two analysis algorithms which are Eigen face and Independent Component Analysis (ICA). The local dataset utilized as a part of this paper is pre-processed using statistical standard techniques. Pre-processing software, Face Identification Evaluation System Version 5.0 under Unix Shell scripts, was written via ANSII C code, which is provided by the Colorado State University (CSU). Independent Component Analysis algorithm (ICA) is written using Matlab R2012b for face recognition implementation. The system is based on the criteria of low power consumption, resources optimization, and enhanced operation speed. This paper reviews the related work in the field of home automation systems and presents the system design, software algorithm and implementation.

Key Words: Camera, Doorbell, Eigen Faces, Face Recognition, Independent Component Analysis (ICA), Raspberry Pi, Security.

1. INTRODUCTION

During the past 3 decades, intensive analysis has been conducted on automatically recognizing the identity of people supported their facial pictures. In spite of the existence of multiple technologies like fingerprint and iris recognition, the external body part remains one in every of the foremost widespread cues for identity recognition in biometry. Face recognition possesses the non-intrusive nature and is usually effective without the participant's cooperation or knowledge. It makes a decent compromise between performance dependableness and social acceptance and well balances security and privacy. Alternative biometric ways don't possess these benefits. Maybe, fingerprint recognition technique re-quire collaborate to join forces in creating cooperate physical contact with the device surface [1]. Similarly, iris recognition strategies need cooperation in putting their eyes properly relative to the camera.

Face identification represents one in every of the foremost used styles of biometry [1]. The face recognition embedded systems are good enough to be employed in totally different applications like terrorist's identification, security systems and identity verification access. After all it's enforced in several public and even dedicated areas. Due to the well-developed technologies linked to engineering, we will get satisfying results of face identification. The extracted details from faces are analyzed and compared with the already existing similar face operated details within the database. For example in monitoring systems the detection of an anonymous face more than once leads to saving this face traits in the database for further identification. This strategy is very useful in detecting criminals and thieves.

2. RELATED WORK

This project uses the Eigen faces algorithm using opencv library to perform face recognition. The script can capture a picture that is born-again to gray scale image, then apply the Eigen face approach and sites a face then crop the image in N^2 dimensions. To decrease the number of images, face pictures are re generated into two-dimensional array with eight bit intensity values, with the accurate trait extraction the algorithm calculate the common face image (in grey-scale mode for additional data reduction) and deduct the ensuing vector from every Eigen face vector to finally acquire the

essential vector so as to spot someone, this standardisation of every vector is termed principal component analysis and helps to search out the apt vector with least time interval, the aim of principle component analysis is to form a linear combination of a vector that optimally represent the input image with less memory footprint.[7]. Database for varied illumination, distinction and expression condition is saved and hence stored. During this step we have a tendency to evaluate the system underneath many constraints like variations in illumination, face rotation and scale variation, even with these changes the feature extraction algorithm extracts the mean image and an eigenface.

3. DESIGN CONCEPT AND WORK PROCESS

3.1 Design Concept

The main goal of this work is to form an intelligent doorbell system based on human face identification. The primary half involves face detection with the help of haar-like filters [1], then look for likeness within the database entries. A flow diagram of the control procedures is shown in Figure 1. to attain the de-scribed functioning, we tend to sub divide the face recognition process into 3 sections: Face Detection, trait Extraction and Face Recognition (Fig-1).

Fig -1: Face recognition procedure

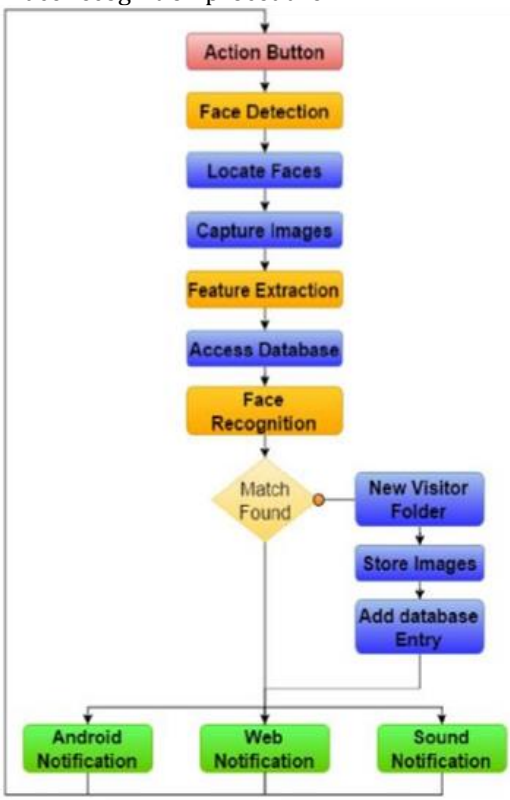

Fig -2: Flowchart of system procedures

3.2 Face Detection

The fundamental role of this section is to resolve the photographs so as to work out whether or not it's a human face or not, and pinpoint the placement of faces to go on for cropping. The resulting output of this method are patches characterizing every face image, to boost the effectiveness of the algorithm, face alignment and scaling filters are applied to the input image. Face detection is employed additionally for region-of-interest detection, video classification, retargeting images, etc. By applying the Haar-like features, the system might acknowledge the presence or the absence of human face.

3.3 Feature Extraction

After detecting the face within the image, human-face patches are extracted from the dataset images. To avoid environmental deficiencies like illuminations, face expressions, occlusion and clutter[1], feature extractions are implemented to extract information from the image so as to reduce the dimension, conspicuous extraction, and noise decreasing. Next, the face image is extracted and remodeled into a vector with fixed dimension with space vector containing points and their corresponding locations in a XML file (training file) or as a PCD file (Point Cloud Data). Faces are represented as polygons or objects.

3.4 Face Recognition

After getting ready the training file and interpreting the face vector, upcoming step is to use the matching rule be-tween the stored image and therefore the input image[1]. the system is functioning as follows: as an input image comes in, face detection can pinpoint the traits of a face, then feature extraction can apply the filters to extract solely the face and so compare the traits extracted to those out there within the database, major previous works were infirm with low recognition rate or with vague time response. In this branch 2 main applications are established: first is identification and the next is verification. On one hand, using face identification, the system might acknowledge the person through a given face image, or, in worst case, might precise the most probable identification with the help of an Eigen Face algorithm, several problems with face stimulant appeared in previous work in face recognition field, particularly once when the camera is exposed in the outdoors to environmental changes, this lead USA to form a brand new approach so as to work out the important distinctive traits of human face, this might have necessary implications for the employment of identification tools similar to eigen face, the algorithm represents each image as vector, calculate the mean of all images, eigenvectors, and so represent every face with a linear combination of the simplest eigenvectors calculated. On the other hand, systems use face verification might differentiate if a given face image

matches or not with a guess face to improvise on the verification.

4. METHODOLOGY

The proposed system mainly consists of two parts, which are pre-processing and image recognition. [2] Fig-3 shows the overall system that is used in this article and refers to the system performance as well.

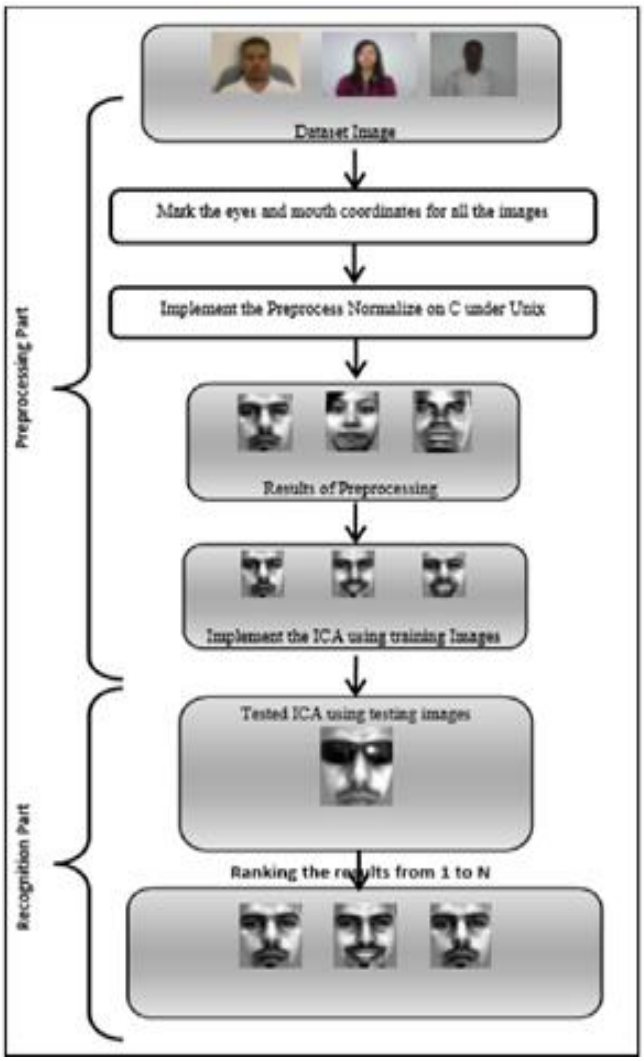

Fig -3: Overall System

4.1 Enrolement

By using local dataset images with extension .jpg for face recognition system, the local dataset have more than 40 students' images and each student has 8 images (Neutral, Smiling, Open Mouth, dim, bright, scarf, sunglass, scarf + sunglass). The datasets have been divided into two groups: training folder and testing folder. The training folder has 3 images (Neutral, Smiling, and Open mouth), and the testing folder contains other tested images (Dim light, Bright light, Sunglass, Scarf, and Sunglass + Scarf images). The local dataset has more than 360 images.

4.2 Pre-processing

The purpose of pre-processing is to remove artifacts from the dataset images. Pre-processing in this article has been done by implementing the following:

Image Recognition: A template matching problem considered the simplest approach of image recognition. Problems arise when performing recognition in a high-dimensional space. Significant improvements can be achieved by first mapping the data into a lower-dimensional space.

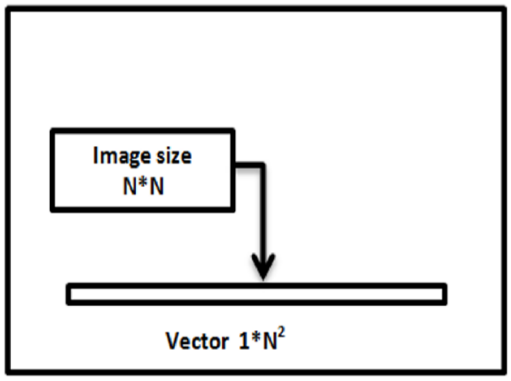

Fig -4: Explains Proposed Method

5. CONCLUSION

In this paper, face recognition system has been developed in order to study the potential application for home automation, door security with real time response and better recognition rate. Among the other bio-metric techniques, face recognition approach offers one great advantage which is user friendliness[1]. This work is aimed to be a complete system for face recognition: easy to build, cheap cost and effective.

We have used ICA algorithm out of many algorithms for face recognition. ICA is a very general-purpose statistical technique in which observed random data is linearly transformed into components that are maximally independent of each other, and simultaneously have "interesting" distributions.[9] Hence, as per our report we conclude that ICA is more efficient than PCA in terms of better facial recognition, increased security and clarity of images.

Our proposed system will be helpful for those who aren't at home most of the times and need to keep track on visitors. Its utility is to be set as an alert for home visitors and provide information about the visitors in a dynamic website and phone application, could be used in other fields like industries, offices and even air-ports for identifying wanted

people. Applications of ICA can be found in many different areas such as audio processing, biomedical signal processing, image processing, telecommunications, and econometrics. We believe that these results can be improved in terms of performance. In future we can develop the same system in 3D using Hadoop. We can inculcate call-handling by an IMS-HNB based interactive eDoorbell. Also, we can increase the level of security by using our project.

ACKNOWLEDGEMENT

With deep sense of gratitude we acknowledge the guidance of our project guide Prof. Jaychand Upadhyay. The time-to-time assistance and encouragement by him has played an important role in the development of our paper.

REFERENCES

[1] "Enhanced Smart Doorbell System Based On Face Recognition"; Ayman Ben Thabet, Tunisia Ayman; 16th international conference on Sciences and Techniques of Automatic control & computer engineering - STA'2015, Monastir, Tunisia, December 21-23, 2015.

[2] "Face Recognition using Independent Component Analysis Algorithm"; Zaid Abdi Alkareem Alyasseri; International Journal of Computer Applications (0975 – 8887) Volume 126 – No.3, September 2015.

[3] "Massive Face Recognition Algorithm Based on the Hadoop Technique"; Wen-Yuan Chen1, Ming-Ming Li2, Jian-Shie Lin3, Sheng-Chung Ni4; 2016 International Symposium on Computer, Consumer and Control.

[4] "An Efficient Face Detection and Recognition Method for Surveillance"; K. V. Arya, Abhinav Adarsh; 2015 International Conference on Computational Intelligence and Communication Networks.

[5] "Call-Handling by an IMS-HNB based Interactive eDoorbell"; Tarik Taleb, Andreas Kunz, Stefan Schmid , and Dario Bottazzi; This full text paper was peer reviewed at the direction of IEEE Communications Society subject matter experts for publication in the WCNC 2010 proceedings.

[6] "Home Security System for Alone Elderly People"; Jarupath Kulsiriruangyos, Varanya Rattanawutikul, Patcharaporn Sangsartra, Damras Wongsawang; 2016 Fifth ICT International Student Project Conference (ICT-ISPC).

[7] "PiCam: IoT based WirelessAlert System for Deaf and Hard of Hearing"; Pushpanjali Kumari, Pratibha Goel, Dr. S. R. N. Reddy; 2015 International Conference on Advanced Computing and Communications.

[8] "Wavelet Transform Based Texture Features For Content Based Image Retrieval"; Manesh Kokare, B.N. Chatterji and P.K. Biswas; Electronics and Electrical Communication Engineering Department, Indian Institute of Technology, Kharagpur.

[9] "Independent Component Analysis: Algorithms and Applications"; Aapo Hyvärinen and Erkki Oja; Neural Networks Research Centre Helsinki University of Technology.

[10] "Analysis of Different Face Recognition Algorithms"; Rakesh Saini, Abhishek Saini, Deepak Agarwal; International Journal of Engineering Research & Technology (IJERT); ISSN: 2278-0181; Vol. 3 Issue 11, November-2014.

[11] "Gabor Wavelets in Image Processing"; David Barina.

[12] "Gabor Wavelet Transform and its Application"; Wei-lun R98942073.

[13] "Face Recognition using Kernel Methods"; Ming-Hsuan Yang.

[14] "Eigen Faces for Face Detection/Recognition"; M. Turk and A. Pentland, "Eigen faces for Recognition" Journal of Cognitive Neuroscience, vol. 3, no. 1, pp. 71-86. 1991.