

Implementation of Raspberry Pi for Human Face Detection & Recognition

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Abstract: *Face detection is concerned with finding whether or not there are any faces in a given image and, if present, returns the image location and content of each face. Security and surveillance are the two important aspects of human being. In this paper we propose face detection and recognition system that will be capable of processing images very fast while acquiring very high true positive face detection rate. This paper describes a simple and easy hardware implementation of face detection system using Raspberry Pi. The system is programmed using Python programming language. Both real time face detection and face detection from specific images, i.e. Object Recognition, is carried out and the proposed system is tested across various standard face databases, with and without noise and blurring effects. Efficiency of the system is analysed by calculating the Face detection rate for each of the database. The results reveal that the proposed system can be used for face detection even from poor quality images and shows excellent performance efficiency.*

Keywords: Python, Open CV, Raspberry Pi, LBP.

1. Introduction

One of the unique features of our brain is that it can think only in images not in words. Once you may forget to keep your Car's key but you will never forget to bring a face with you. God has given everyone a unique face. Face is the most important part of our body, so that it can reflect many emotions of a person. From a long year ago, we are using non living thing (plastic cards, keys, PINS, smart cards, tokens) for authentication and to get grant access in restricted areas like NASA, DRDO and ISRO etc. There are two types of biometric as physiological characteristics (face, fingerprint, finger geometry, hand geometry, palm, iris, ear and voice) and behavioural characteristics (gait, signature and keystroke dynamics). Sometimes your behavioural traits may changes because of illness, fear, hunger etc. Face detection and recognition system is more expensive, exact, easy to understand and non intrusive process as compare to other biometrics. The system will fall into two categories as face detection (1:1) and face recognition (1:N). In the face detection we have to classify between face versus non face region while in recognition process we have to compare that single face image with multiple images from the input image. While capturing an images from a web cam we have to come across some problems like pose (position of camera), presence of structural components (spectacles and beard), facial expression, occlusion (obstructed by someone), image orientation (variation in rotation), imaging condition (lightning and camera characteristics) etc. Face detection is a common feature of digital cameras since 2006. Automatic face detection and recognition system is placed at New Zealand airport only for that citizen since 2010 while airport in Europe started to be equipped with similar systems from 2008 for security purpose.

2. Literature Survey

In this paper internet of things has initiated tremendous growth in internet and products that are connected to internet. Internet of things components are cost effective, small in size computational power for application oriented components can be used in surveillance system by using open CV and python. Stored faces in cloud can be recognized [1].

The main strategy of this paper is taking attendance in organization etc. for these time periods are set after completion of time period. Attendance are directly stored this raspberry pi 2 module used. For high speed operation eigen face algorithm used but when a number of students faces increases the accuracy will decreases [2]. In this paper solve the problem of high image processing speed. The two viewpoints are face descriptor tool for face recognition and feature extraction by using computer vision, raspberry PI used to create the data base. Database can be used to match the input and then shown output of the screen [3].

A portable real time facial recognition system that is able to play personalized music based on the identified person's preferences was developed. The system called portable facial recognition JUKEBOX using fisher faces. Raspberry pi was used as the hardware. When implemented on a raspberry pi, the system is able to facial recognition. This paper presents a cost effective solution that is cross platform Linux OS and windows. Future work of this project would be to future increases the precision of the system by improving algorithm to be more robust to other environments [4].

Social platform and social media age and gender classification has become applicable. to an application. In this paper use in convolutional neural systems and the end use in direct convolutional neural system which used in measure of learning data is limited [5]. This paper propose

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that face recognition based on fusing the near infrared and visible images of face images with distributed sensing obtaining common component. Used distributed compressive sensing and innovation component of near infrared and visible image [6]. Unsoojang and Euichul lee proposed a methodology of pixel based face recognition method face recognition method are used in appearance based, texture based, geometry based. For this used in principle component analysis, linear discriminant analysis and local binary pattern [7].

Li Yong –Qiang and Panjin explain a one sample image recognition algorithm based on improved sub-pattern principle component analysis. For this face divide some blocks and sub pattern then PCA is used and recognize the face supports vector machine used. The results demonstrate that the proposed algorithm has improved the recognition rate and speed of face and has robust [8]. Maryam Moghaddam and Aped Meshiqini are presented automatic facial recognition for used the local directional pattern to represent the geometry and analyse the performances. Template matching and support vector machine are used and improved algorithm used entropy LDP+SVM [9]. Navin Prakash and Yashpal Singh presented support vector machine is the recent technology. This technology gives the decent broad view performance and SVM can be extended in many other ways and some ways SVM cannot gives better result than technology are extended in fuzzy support vector machine [10].

In this paper proposes an efficient head pose determination method. In face recognition variation related problem solve then detect face by using ad boost. Then pre-processing on detected face. For this PCA based face recognition approach depending on a single –pose face DB [11]. In this paper proposed that image capturing technique in an embedded system based on raspberry pi. an implement purpose embedded platform is very unique. In this use in image capturing and recognition algorithm. Raspberry pi and its peripherals and then actualized embedded image capturing using raspberry pi system [12].

In this paper G. Ghinea propped the novel methodology to recognize the face images. For this use in Yale face database and ORL face database and gradient orientation approach are used and also used in schurvectors for subspace learning in future to improve the accuracy of face recognition [13]. Mounika B. R, Reddy proposed a Neural Network based face detection by using Gabor Features. The complex classifier are used to better the algorithm by representing Gabor faces use in distance measures in future improve the detection rate and speed of the detection process [14].

Tudor BARBU proposed a novel approach of face recognition which based on Gabor filtering and supervised classification. The 2D filter bank are used and then produces 3D robust face for vector average distance used in supervised classifier and threshold based face verification method used by using this technique a high facial recognition rate is obtained [15].

3. Methodology

3.1 Webcam

A webcam is video cameras that feeds or stream its image in real time to or through a computer to a computer network. a webcam is generally connected by a USB cables, or similar cables built into computer hardware such as laptop. Popular uses include security surveillance, computer vision and recording video.

3.2 Haar Like Feature for Face Detection

Haar like features are digital image feature used for object detection but here we used it for face detection. The biggest advantage of it over most other features is its calculation speed. Fig. 1 shows the types of Haar like feature. Generally eye region is darker than other region from the face. Figure 2 shows how Haar like feature is used for face detection purpose. the complete preprocessing steps, which includes binary to gray scale image conversion, Histogram Equalization method (HE), Laplacian of Gaussian filter (LG) and final step is contrast adjustment. Preprocessing is done because we have to remove influence cause by illumination variation for accurate face recognition.

- Edge feature
- Line feature
- Center-surround feature

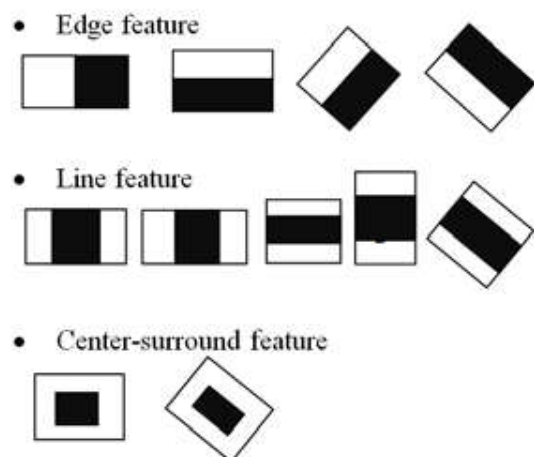


Figure 1: Types of Haar Like Features



Figure 2: Haar Like Feature for Face Detection

4. Training for face Recognition

USBCam connect to Raspberry PI. For image acquisition camera through continuously read the frame. Means acquire the image. For preprocessing image are going to standard size. The gray scale converter are used. They check only two values black and white, lesser time are required. Then check the detect faces used Haar classifier. Whether faces or object are not. Region of interest detect the faces.

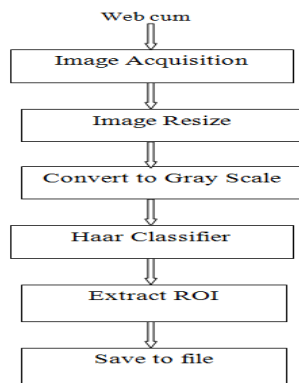


Figure 3

4.1 Face Recognition

The detected faces check the data base and then compare LBPH value and then match the present data base and face are recognized.

4.2 Local Binary Patterns

Local binary patterns (LBP) are a type of visual descriptor to automatically classify and identify textures and patterns in images. Local binary patterns are a type of visual descriptor used for classification in computer vision.

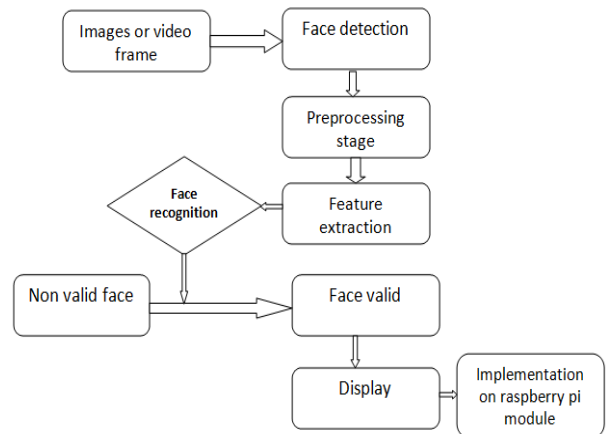
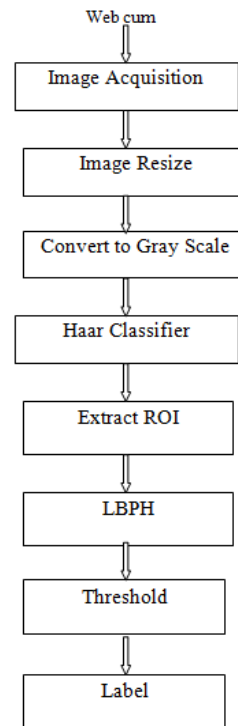


Figure 3: Block Diagram for Face Detection and Recognition

4.3 Advantages

- 1 It is used in Real time processing.
- 2 It is cost effective.
- 3 LBPH is efficient as compared to PCA.

4.4 Limitation

If number of data base are increase then frames iteration are increase and hence system will work slow.

4.5 Application

1. Employment Attendance system.
2. Student Attendance system.
3. Social Networking.

5. Conclusion and Future Scope

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We have to study face detection and recognition system on Raspberry Pi module. Face detection and recognition is currently a very active research area. Some of the more algorithms are still too computationally cheap to be applicable for real time processing. Other processors are costlier than Raspberry Pi along with large memory, accuracy and speed. Using Python and Open CV in Raspberry Pi, made our project flexible. But in future it can be used in Orange Pi and Banana Pi board. Which has more RAM as compared to Raspberry Pi.

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