



Real time Implementation of Face Recognition System on Raspberry Pi

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Abstract

Face Recognition is the ability to find and detect a person by their facial attributes. Face is a multi dimensional and thus requires a considerable measure of scientific calculations. Face recognition system is very useful and important for security, law authorization applications, client confirmation and so forth. Hence there is a need for an efficient and cost effective system. There are numerous techniques that are as of now proposed with low Recognition rate and high false alarm rate. Hence the major task of the research is to develop face recognition system with improved accuracy and improved recognition time. Our objective is to implementing Raspberry Pi based face recognition system using conventional face detection and recognition techniques such as A Haar cascade classifier is trained for detection and Local Binary Pattern (LBP) as a feature extraction technique. With the use of the Raspberry Pi kit, we go for influencing the framework with less cost and simple to use, with high performance.

1. Introduction

There is a need for a faster and accurate user identification and authentication method. Face recognition has become one of the most important user identification methods [2]. Everybody has the experience of not recognizing somebody they know, because of changes in posture, outward appearances, light and articulations. So it's not surprising that computer vision framework may confront similar issues[1]. Feature extraction ways have become essential for classification of information with huge inputs, like face recognition[6]. Reduction of input dimension is vital problems in several learning downside and data processing [7], since the success of input dimension reduction will be how to avoid the curse of spatial property. Real time human identification systems measure vital for security, police work and biometric applications. Typically it's fascinating to observe, track and acknowledge persons publicly areas like airports, searching centre's, in areas with restricted access like personal offices, houses etc. Human identification will be performed by analyzing its biometric info, like fingerprints, face, iris, palm prints, palm veins etc.

In any case, for speedy and helpful individual acknowledgment, still the preeminent proper biometric parameter is facial information. Distinguishing proof of people by misuse facial measurements stays troublesome assignment, attributable to the variable light, consistently changing outward appearances per mind-set changes, head introduction and make. Throughout the years, changed face identification calculations are produced. Some face acknowledgment ways investigate the geometric choices of facial pictures, similar to area and separation between nose, eyes, and mouth. However, these ways square measure delicate to the adjustments in light and facial highlights. because of this disservice, a large portion of the face acknowledgment frameworks attempt and concentrate some all encompassing choices from the underlying face pictures for coordinating. By misuse comprehensive ways confront is perceived abuse depictions upheld the entire picture

rather than on local alternatives of the face [11]. a few scientific space adapting fundamentally based all encompassing component extraction ways are produced, and also Eigen faces,Fisher faces, second PCA et al. amid this paper we tend to portray the all encompassing strategy alluded to as local paired example (LBP). In this paper we tend to propose relate implanted face acknowledgment framework which will be utilized as a framework to control attraction entryway bolt of the entryways, to recognize people at visitor or somewhere else.

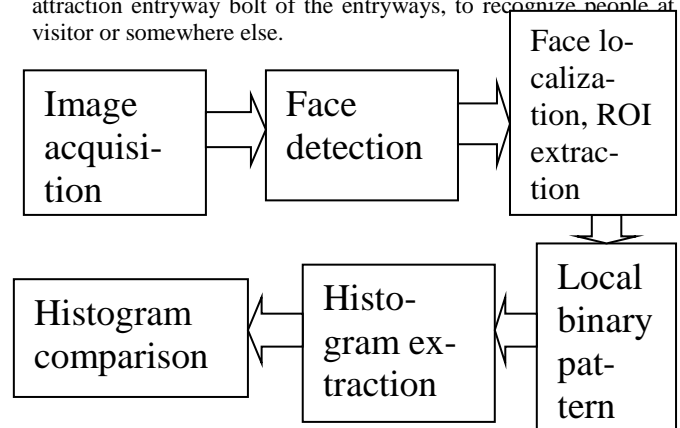


Fig.1: Block diagram of Face Recognition

2. Face Recognition Algorithm

The proposed calculation for confront acknowledgment can be partitioned into a No.of few stages. The course of action of en-

deavors of the proposed calculation used for stand up to affirmation is shown in Fig. 1. The initial step is to gain the picture. Next, confront recognition must be performed, to find whether the face appears in the captured picture or not. Face identification and face limitation is per-shaped by utilizing Haar include based course classifier [18] [19]. The rectangular features required for Haar classifier are enlisted using a widely appealing depiction for the photo that is known as a fundamental picture [18].

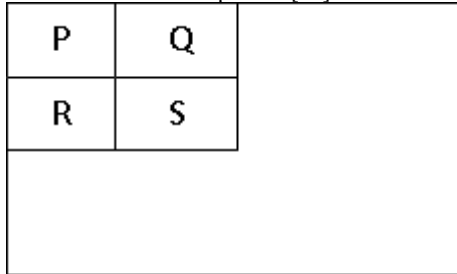


Fig.2: The summation of the pixel intensities in the rectangle S can be calculated by using 4 array reference

$$(P+Q +R +S)+(P) - ((P + Q) + (P + R))$$

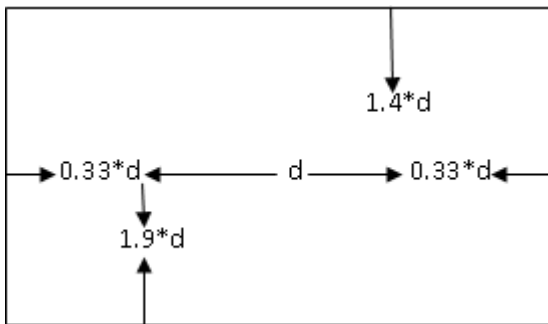


Fig.3: Coefficients of face area extraction

| | | |
|----|----|----|
| 1 | 64 | 69 |
| 23 | 42 | 43 |
| 18 | 32 | 97 |

| | | |
|---|----|---|
| 0 | 1 | 1 |
| 0 | 42 | 1 |
| 0 | 0 | 1 |

Fig.4: Local Binary pattern example of 3x3 adjacent, (P = 8, R = 1)

LBP binary value:11000011
LBP decimal value:195

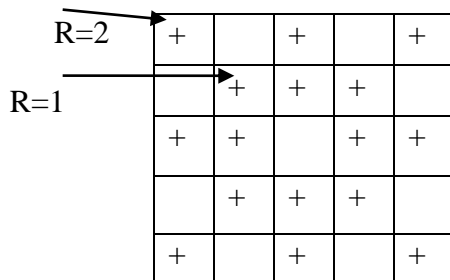


Fig.5: Labeling principle

The connected image at position x; y consists of the addition of the pixel intensities stop and to the left side of x; y, include:

$$x(p,q)=\sum_{p' \leq p, q' \leq q} f(p',q') \tag{1}$$

where $x(p,q)$ is the combined image and $f(p,q)$ is the inventive image. By using the below pair of occurrences with occurred frequently:

$$y(p,q)=y(p,q-1)+f(p,q) \tag{2}$$

$$u(p,q)=u(p-1,q)+y(p,q) \tag{3}$$

In which $s(x, y)$ is the sequential row addition, $y(p,-1) = 0$, and $u(-1; q) = 0$ the combined image could be calculated in one pass by the reference image [13]. By using the integral or combined image, any rectangular shaped concatenation will be calculated by original four array region(as shown in Fig. 2). Dissimilarity among two rectangular concatenations could be calculated in 8 originals. From the two-rectangle characteristics demonstrated in the top consists of neighboring rectangular concatenations. They must be calculated in 6 array originations, 8 in the situation of the 3 rectangular shape features, and 9

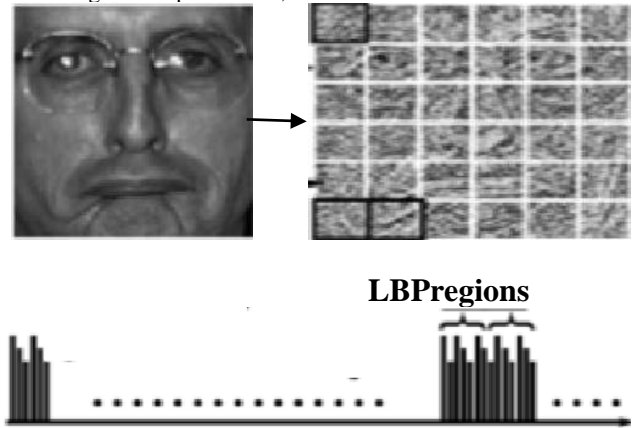


Fig.6:Example of LBP transform and arrangement of face include histogram from 6x6 reagions

Though, it is not the last area of interest that we are using, To compute the required Region of Intrest, Here we take the coordinates of a rectangular shape and recomputed the Region Of Inter face location. We use FERET face database for step by step assessment that consists of so many forward face images by their representative eye surroundings. By taking the rectangle from which we got the Haar classifier for training and the recognized eye locations, we proposed a process that statistically define particularly where in the image the eyes are more possible to be positioned.

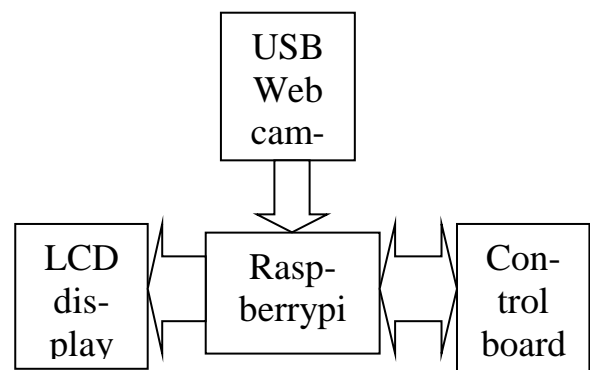


Fig.7: Block diagram of Hardware implementation

We take this process to find the estimated position of the individual's eyes to compute the Region Of Interest depends on the displacement in the middle of the eyes d . Displacement to each and every of the faces is computed from the coefficients as represented in Fig. 3. Thought, our advancement do not focus the

location of the eyes and by which, we cannot modify the rotation of the face image. After the Region Of Interest is identified, we calculate Local Binary Pattern conversion. Local Binary Pattern label each and every pixel intensities by cutoff the reference pixels by middle pixel intensities value and symbolizes the outcome as a zeros or ones. The example of the labelling process for 3x3 area is represented in Fig. 4. Binary result normally written in a decimal format and hold in the middle pixel location of the outcome image. Later that Local Binary Pattern transform graphs of labels used as a representation of the image. Local Binary Pattern can be organized by the help of dissimilar quantity of pixel intensities P on the sample circle and then dissimilar radius R by the middle pixel. Example of radius $R = 1$ and $R = 2$ with $P = 8$ is represented in Fig. 5. A graphical representation of histogram of the labeling image $f_l(x; y)$ can be computed and given by:

$$H_i = \sum_{p,q} X\{f_l(p,q)=i\}, i=0..n-1, \quad (4)$$

In which $n = 2^P$ is the number of dissimilar labels and

$$X\{A\} = \begin{cases} 1, & A = \text{true} \\ 0, & A = \text{false} \end{cases} \quad (5)$$

To save the spatial data from the object, Local Binary Pattern converted image is partitioned into many such sub-regions R_0, R_1, \dots, R_{m-1} . A spatially improved histogram graphs are computed by summation of the area graphs into one characteristic histogram graph:

$$H_{i,j} = \sum_{p,q} I\{f_l(p,q)=i\}, X(p,q) \in R_j \quad (6)$$

A case of LBP change and face highlight histogram framing with 6x6 locales of LBP picture is appeared in Fig. 6. Highlight histogram is utilized as a descriptor for every one of the given pictures. To look at two element histograms numerous techniques can be utilized. For instance, connection of the histograms, Chi-Square, histogram convergence, Bhattacharyya separate and different techniques. In our calculation we picked histogram convergence for two histogram examination. Research on utilizing LBP change for confronts acknowledgment from which this execution was inferred is distributed.

3. System Implementation

A webcam is a camcorder that sustains or streams its picture continuously to or through a PC to a PC arrange. a webcam is for the most part associated by a USB links, or comparative links incorporated with PC equipment, for example, PC. Well known uses incorporate security reconnaissance, PC vision and recording video.

Haar Like Feature for Face Detection Haar like highlights are advanced picture include utilized for question discovery yet here we utilized it for confront recognition. Its greatest favorable position over most different highlights is its figuring speed. Fig. 1 demonstrates the kinds of Haar like component. For the most part eye district is darker than other area from the face. Figure 3 indicates how Haar like element is utilized for confront recognition reason. the entire preprocessing steps, which incorporates double to dim scale picture change, Histogram Equalization strategy (HE), Laplacian of Gaussian channel (LG) and last advance is differentiate modification. Preprocessing is done in light of the fact that we need to evacuate impact cause by enlightenment variety for precise face acknowledgment

- Edge characteristic
- Line characteristic
- Center-surround attributes

Numerous examinations takes a shot at feeling acknowledgment and investigation have been done for 10 years because of uses in the field of human-machine association.



Fig 8: Raspberry pi Board

For ongoing feeling acknowledgment framework, a couple of methodologies have been proposed. Initial phase in procedure of feeling acknowledgment is confront identification in given picture. In [12] proposed a calculation for confront discovery which has four phases Haar feature. Selection, making an indispensable picture, Adaboost preparing and cascading classifiers. After face discovery relying upon facial component extraction three kinds of methodologies which geometric methodologies, appearance based approach and half and half approach mix of geometric and appearance can be utilized. In [18] utilized Local twofold example (LBP) strategy to remove highlights, which is an appearance construct approach depends with respect to pixel estimations of facial picture. In [13] utilized Active shape show (ASM) to separate 77 facial focuses. Dynamic Shape Model is famous geometric based approach in which distinguished picture is iteratively twisted to fit shape model and concentrate facial focuses after correlation with shape show. In [14] utilized blend of Active Appearance Model (AAM) and Local Binary Pattern (LBP) for instance of half and half approach, extricated 68 facial focuses, in which AAM is geometric based approach and LBP is appearance based approach. After extraction of highlights, diverse classifiers are utilized for the grouping of feelings. Minimum mean square technique, Neural Networks (NN) Support Vector Machine (SVM) [19], Hidden Markov Model [15] and Ad boost are diverse kinds of classifiers utilized for characterization. In grouping process first preparing must be done to prepare the product later testing is finished utilizing guinea pig.

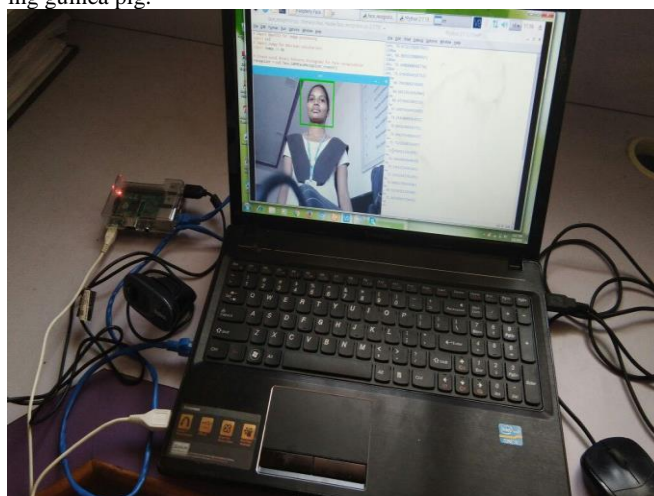


Fig.9: Screenshot for Raspberry Pi II interfacing camera and laptop as display monitor

4. Results

The outcomes of the categorization for 5 different emotions for frontal images are taken. To determine the correctness of our developed system in real-time, we examined by using some of the subjects which performs emotions by capturing using webcam connected to Raspberry Pi II

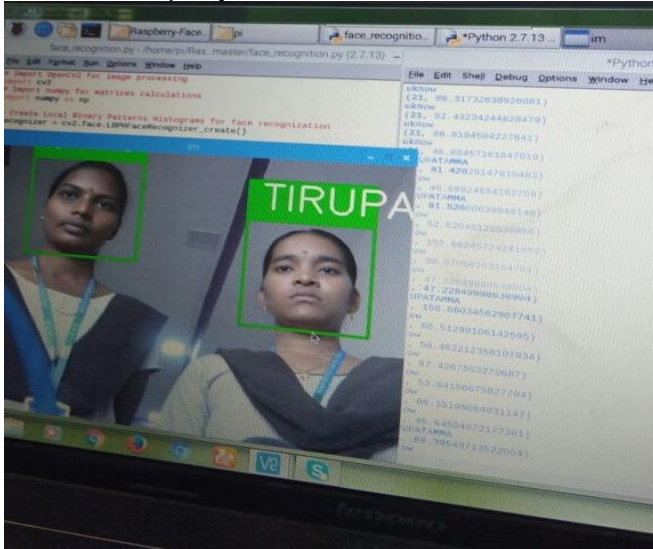


Fig.10: Screenshot of Face recognition with their names

as represented in Fig. 9. Recognition precision of 94% is obtained by average dispensation time of 120ms on Linux environment by the help of Raspberry Pi II as represented in Fig.10. Accomplishment of real time expression recognition in Raspberry Pi II is a process and it is can be utilized in a diversity of uses as it is very tiny, light weighted and very little power supply is wanted. It is mounted by less size of robot and utilized for wide range of applications.

5. Conclusion

In this research, we had developed a process for expression recognition in real scenario, depending on geometric characteristic features using Raspberry Pi II. We had got an overall correctness of 94% by the average processing time of 120ms on Linux environment by the help of Raspberry Pi II (ARM1176JZF, 900MHz). The Raspberry Pi II is very little hardware kit with less weight which can be placed on a travelling robot. If a portable small display screen is kept to the mobile robot, it will display the expressions of a individual dynamically under the inspection / social platform like hospitals, old age home etc.,. Presently developed system is very useful to the world for various uses in which emotion finding take a major part. In next work, various step by step process can be presented to qualify the recognition correctness. Coming Robots can be prepared to recognize expressions by neurological motivation. Many other methods like voice can be concatenated along with image for expression identification.

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