

# Face Identification System for Secure Lab Access

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**ABSTRACT:** Face recognition from image is a popular topic in biometrics research. It is widely acknowledged that the face recognition have played an important role in surveillance system as it doesn't need the object's co-operation. Many public places usually have surveillance cameras for video capture and these cameras have their significant value for security purpose. As human face is a dynamic object having high degree of variability in its appearance, that makes face detection a difficult problem in computer vision. In this field, accuracy and speed of identification is a main issue. The actual advantages of face based identification over other biometrics are uniqueness and acceptance. The goal of this paper is to evaluate various face detection and recognition methods, provide complete solution for image based face detection and recognition with higher accuracy, better response rate as an initial step for video surveillance. Solution is proposed based on performed tests on various face rich databases in terms of subjects, pose, emotions, race and light.

**KEYWORDS:** Face Detection, Face Recognition, Biometrics, Face Identification.

## I.INTRODUCTION

The face is that front part of the head, from the forehead to the chin. The face recognition will directly capture information about the shapes of faces. The main advantage of facial recognition is it identifies each individual's skin tone of a human face's surface, like the curves of the eye hole, nose, and chin, etc. Over the last few decade lots of work is been done in face detection and recognition as it's a best way for person identification because it doesn't require human cooperation so that it became a hot topic in biometrics. Face identification software's are used for recognition persons from images. This could be a difficult task when several factors such as motion blur, changes in illumination, pose etc. are considered. Hence it is relevant to develop an efficient system as the existing methods cannot handle it well. The focus of this paper is to develop software that can identify faces across motion blur. Changes in illumination and pose. It are mainly used in security systems. The information age is quickly revolutionizing the way transactions are completed. Everyday actions are increasingly being handled electronically, instead of with pencil and paper or face to face. This growth in electronic transactions has resulted in a greater demand for fast and accurate user identification and authentication. Access codes for buildings, banks accounts and computer systems often use PIN's for identification and security clearances. In current paper the author developed a system for the said method's evaluation as a first milestone for image based face detection and recognition for surveillance. The overview of current system is demonstrated in fig.

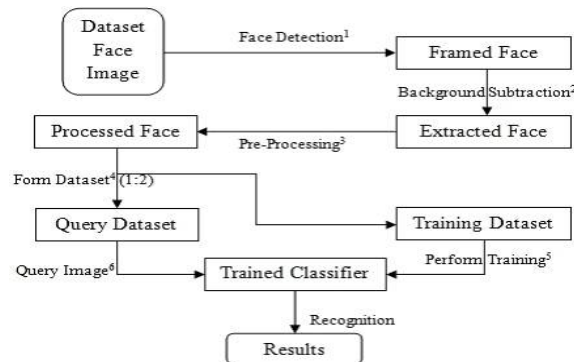


Fig.1 System's overview

## II. COLOR SPACE THEORY

Before skin color segmentation, the selection of the color space and the establishment of the skin color model are mainly involved. The color spaces which are often used for skin color analysis are as follows.

(1) RGB color space. RGB color space is one of the most common color space representation approaches. It generates various colors by adjusting the red, green and blue values, which applies to computer storage and display. As the three primary colors (R, G, B) contain both Intensity and color information, they have a high correlation.

(2) HIS color space. HIS color space is also called as hue, saturation, and intensity model. This color space reflects a way used by human in observation of color, and meanwhile, it is conducive to the image processing. In the use of color information, the advantage of this format lies in that it separates I (Intensity) and two parameters that reflect the essential characteristics of color, i.e., H (Hue) and S (Saturation).

$$I = \frac{(R + G + B)}{3}$$

$$S = 1 - \frac{3}{(R + G + B)}$$

$$H = \arccos \frac{0.5[(R - G) + (R - B)]}{[(R - G)(R - G) - (R - B)(G - B)]}$$

## III. RELATED WORK

Detecting faces in images is a fundamental task for realizing surveillance systems or intelligent vision-based human computer interaction. To build legible systems that work in a variety of lighting conditions and run on mobile phones or handheld PCs, robust and efficient face detection algorithms are required. Appearance-based methods are mainly employed to achieve high detection accuracy. They solve a two-class problem by using a probabilistic framework or ending a discriminate function from a large set of training examples. For example, neural network-based methods, support vector machines and other kernel methods have been proposed. Most of these algorithms use raw pixel values as features. However, they are sensitive to addition of noise and change in illumination. Instead Papageorgiou et al. Used Haar-like features, which are similar to Haar basic functions. The features encode differences in average intensities between two rectangular regions, and they can extract texture without depending on absolute intensities. Recently, Viola and Jones proposed an efficient scheme for calculating these features. They also proposed a method for constructing a strong classifier by selecting a small number of distinctive features using Ada Boost. This framework provides both robustness and computational efficiency. Existing solutions to under sampled face recognition can be

# International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 6, Issue 4, April 2017

typically divided into two categories patch-based methods and generic learning from external data. For patch-based methods, one can either extract discriminative information from patches collected by different images, or utilize/integrate the corresponding classification results for achieving recognition. The need of security is increasing day by day, so in order to enhance the security. Now face recognition is applied to many areas like entertainment, law, investigation etc. Face recognition is used to identify an individual based on his or her physiological traits. The physiological traits are face, fingerprint, iris etc. The most commonly used face recognition techniques are Eigen faces, Fisher faces, and Palladian faces, Neural Networks. In practice there is some difficulty in dealing with different illumination, pose, facial expressions, ageing. Another important problem is single sample problem. In order to avoid this single sample problem and using single sample for each individual.

In the case of passport, adhar card, driving licence, voters id, etc. only one image is available for training. Some face recognition techniques are proposed to solve this single sample problem. The Face recognition method is classified mainly into two. They are holistic matching method and local matching method. The holistic matching method considers the entire face image. And this method uses Principle Component analysis (PCA), Linear Discriminate analysis (LDA) and the Independent Component Analysis (ICA). PCA is applied to training set based on Eigen faces.

Where each image is the Represented by Eigen vector for each image Eigen value is calculated and Eigen vector with highest value is used to represent a particular image. Comparison is done by Euclidian distance between Eigen vector coefficients. LDA is based on Fisher Faces. It uses multiple image of a person, it maximizes inter-class and minimizes intra class scatter. Likewise ICA is used. Local matching method is suitable for single sample per class than holistic method. In local matching method the author will be considering single facial features rather than the whole image. Here, Low dimensional local vector features represent the original features. And the different facial features improve classifiers diversity. Local features can be length, breadth, contrast, brightness etc. Discriminative Robust Local Binary Pattern (LBP) method was first proposed in an image texture descriptor. Now it's applied on face-recognition application. LBP method provides better result in terms of speed and discrimination performance. One advantage of using LBP, it is less sensitive to Illumination variation and scaling variation. Gabor feature based face recognition is used mainly in image processing, pattern recognition, computer vision etc. Gabor filter exploits spatial localization, orientation selectivity and spatial frequency characteristics. Gabor filter extracts essential features of face and creates binary face template. Discriminative Robust Local Binary Pattern (LBP) method was first proposed in an image texture descriptor. Now it's applied on face-recognition application. LBP method provides better result in terms of speed and discrimination performance.

One advantage of using LBP, it is less sensitive to Illumination variation and scaling variation. Gabor feature-based face recognition is used mainly in image processing, pattern recognition, computer vision etc. Gabor filter exploits spatial localization, orientation selectivity and spatial frequency characteristics. Gabor filter extracts essential features of face and creates binary face template.

## IV. SYSTEM ALGORITHMS

Face recognition algorithms identify facial features by extracting landmarks, or features, from an image of the subject's face. For example, an algorithm may analyze the relative position, size, and/or shape of the eyes, nose, cheekbones, and jaw. These features are then used to search for other images with matching features. Other algorithms normalize a gallery of face images and then compress the face data, only saving the data in the image that is useful for face recognition. A probe image is then compared with the face data. One of the earliest successful system is based on template matching techniques applied to a set of salient facial features, providing a sort of compressed face representation.

This section describes the software algorithm for the system.

The algorithm consists of the following steps:

- Laplacian face recognition algorithm.
- Color thresholding algorithm.
- RGB to HSV color algorithm.
- RGB to Gray scale algorithm.

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Vol. 6, Issue 4, April 2017

- Blurring algorithm.
- Scaling algorithm.
- Matching & template basis algorithm.

In the first step image is captured from the camera. There are illumination effects in the captured image because of different lighting conditions and some noise which is to be removed before going to the next steps. Median filter is used for removal of noise in the image. There are other techniques like FFT and low pass filter for noise removal and smoothing of the images but median filter gives good results. Next is the description of each step in the above algorithm with effects on the images after each process. Darkness in it which should be removed for good results. In thresholding procedures involved setting of boundaries based on gray values or intensities of image pixels. Thresholding is to be done based on color values in natural image. Color thresholding technique is being carried out based on the adaption and slight modification of the gray level thresholding algorithm. First the RGB image is converted to the gray scale image for enhancement. Images will almost certainly noisy-blurred so the next step is used blurring algorithm.

Scaling algorithm is to find appropriate spot to put the empty spaces inside the original image and fill all those spaces with livelier colors. Good scaling algorithm is one that can do up and down scaling without introducing too many condition in its implementation code even better if there is none. Then matching template basis algorithm compares match templates against enrollment templates. A series of image is acquired and stored against the enrollment ides that a user attempting 1:1 verification within facial scan system may have 10 to 20 match attempts takes place within 1 to 2 seconds.

## V.IMPLEMENTATION

- Add Image
- Clip Image
- Recognition of Image
- 

A module is a small part of our project.

### ADD IMAGE

Add Image is a module that is considered with adding image along with the complete details of the person. In this the author add Image by importing from the Internet and store them in there system and database. This module is mainly considered for adding details of the members like name, age, gender, location, state etc. At the time of the adding image of particular person, so that it can be easily added to the database with any duplication of the data.

### Face Detection

This feature will process the image captured by the camera. In this process the image will be 1st checked if it in proper format required for further processing. If image required should be in '.jpg' format. Also if image is not in the grayscale format then this process will convert the image to grayscale format. Then this converted image will be submitted for face separation. In this process the faces will be detected from the image. Then these detected faces will be cropped and saved in directory in '.pgm' format for further matching process. This directory will be test directory. Each time new faces are cropped from new image this directory will be nil before storing new cropped images in it.

#### 1. Stimulus/Response Sequences

Once the image is captured the face detection process will then start. The output of this phase will be a face detected from the image.

#### 2. Functional Requirement

REQ-1: Computer system

REQ-2: Required software

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## CLIP IMAGE

### 1. Description and priority

This feature will capture the image of student and will send it to system for further processing. This feature depends upon the camera quality used for the image capturing.

### 2. Functional Requirement

REQ-1: Camera

REQ-2: Its connection with our system.

### 3. Description and priority

This feature will process the image captured by the camera. In this process the image will be 1<sup>st</sup> checked if it in proper format required for further processing. IF image required should be in '.jpg' format. Also if image is not in the grayscale format then this process will convert the image to grayscale format. Then this converted image will be submitted for face separation. In this process the faces will be detected from the image. Then these detected faces will be cropped and saved in directory in '.pgm' format for further matching process. This directory will be test directory.

### 4. Stimulus / response sequences

Once the image is captured the face detection process will then start. The output of this phase will be a face detected from the image.

### 5. Functional Requirement

REQ-1: Computer system

REQ-2: Required software

Face matching.

Description and Priority:

Once the faces are detected and saved in directory next step is to match the face with the faces already stored in the database. Upon successful matching the particular student will be marked as present. The database is nothing but the train directory containing face images of each student with different expression and taken from different angle. Right now the author is using 4 images of every student. But to improve the reorganization rate of this module the author suggest storing more images of each student with different expression and images captured form different angle.

## RECOGNITION OF IMAGE

Face recognition typically extract facial features and compare them to a database to find the best match. The task in facial recognition is to compare two images and determine whether they show the same person. Try identifying which of the image pairs shown here are correct matches.

## VI. PROPOSED WORK

To overcome the drawbacks that were in the existing system the author develop a system that will be very useful for any face identification required system like college, company, hospital or more public area. Here the program keeps track of the record number of each slice during the construction of identifiable human face and calculate maximum number of slices of the similar record number.

Our system aims at providing such a system that will not interfere with regular paper work process. It will mark the Faces of employee entering the labs. Our System will then match those faces with the already stored images in our database. This system is also useful during exam sessions. This is implemented using digital camera installed in lab. Which detects the faces which then are compared with the existing database of student, employee images and upon successful recognition attendance list is generated for authorized persons and saved on a database?

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## VI. PERFORMANCE EVALUATION

The performance evaluation of the system is carried out with a few variables and constants. The constant parameters in this context are: Illumination and Face Posture. While the varying parameters are: Internal Resize Width of the Image processing engine and False Acceptable Rate (maximum error rate) in face template matching.

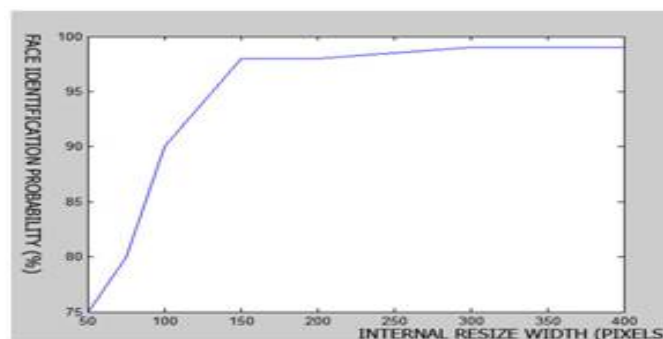


Fig.2. Relationship between Face Identification Probability and Internal Resize width.

While testing for optimum face identification probability by varying the internal resize with, higher internal resize width gives a higher identification probability. These values are exponential proportion until resize width reaches about 300 pixels. This can be seen to produce optimum result for the face identification parameter. Although increasing the resize width increases the probability of identification, it also has an adverse effect on the performance of the system, creating unnecessary time lags in image processing. Figure shows the relationship between Face Identification Probability and internal resize width.

## VII. CONCLUSION

Today, every field is going for computerization. It makes your job simple and easy. The purpose of face identification system is to identify employees. In past years this process is carried out by humans. So the author built a system which will automatically take the photos of persons with the help of face detection and face recognition. Most of the existing systems are time consuming and require some manual work from the clerk or Employee. This process gives the exact image of the Employee. The main aim of our project is to overcome the drawbacks of human based authenticated system by using the machine based face identification process.

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