An Integrated Approach of Face Recognition using Sparse and Template Matching

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Abstract— A face recognition system is a computer vision application for automatically identifying or confirm a person from a digital image. In this project an integrated technique is implemented in which face will recognize on both real time and on non-real time. Viola and Jones begins a method to precisely and quick detect faces within an appearance. This technique can be adjusted to precisely detect facial features. We consider the difficulty of automatically recognizing person faces from frontal views with varying expression and illumination, as well as occlusion and dissimulate. New premise from sparse linear representation offers the key to addressing this problem. Based on a sparse representation enumerated by `1-minimization, we propose a common classification algorithm for (image-based) object recognition technique. This innovative framework foresees novel insights into critical problems in face recognition i.e. feature extraction. The sparse representation-based classification (SRC) has been proved to be a robust facial recognition approach. However, its calculation difficulty is very high due to resolving a difficult -minimization problem.

Key words: Face Detection, Face Recognition, Facial Expression And Template Matching

I. Introduction

Comparing with other biometrics, the most supremacy of face biometric is its non-intervenient kind. Therefore, face is one of the most appropriate biometrics for surveillance applications. Supremacy is always followed by weakness. In typical surveillance conditions, humans are usually walking free, and it's impossible that humans are always keep their faces frontal or looking to the cameras. This show the ways to a problem in face recognition, unconstrained face recognition. Most face images captured by surveillance systems are often affected by many factors: pose illumination, expression, occlusion, distance, weather and so on. This research paper will mainly focus on the pose problem while considering the other factors together. Face detection is a process through which we can extract the face region from a human body. [2]

Facial acknowledgement used to reexamine the faces of an individual's to recognize or verify a person [4]. Face recognition system should be capable to automatically detect a face in an image. The challenges of facial recognition in the visible range include reducing the impact of uneven lightening and detecting a cover or picture. Some facial recognition systems use a real time process to detect a person's head and locate the face automatically. Major advantages of facial recognitions are that it is no-invasive, hand free, continuous and accepted by most operators.

There are a huge number of face recognition approaches, as well as their variations. They can be classified into two basic classes, i.e. model-based and appearance-based methods. In appearance-based approach, a $a \times b$face image can be signified by a vector of ab-dimension. Usually, ab is a very giant number, which leads to the dimension dilemma referred to as the heels of dimensionality. Therefore, a huge number of linear and non-linear transform techniques have been widely used at the feature extraction step to transform images from original image space into a new low-dimensional feature space. Typical illustrates of linear transform techniques include Principle Component Analysis (PCA), Linear Discriminant Analysis (LDA), and Independent Component Analysis (ICA). While kernel PCA and kernel LDA are two widely applied nonlinear transform techniques.

Recently, sparse representation (SR) has shown stout capability in solving computer vision dilemma. The core concern of spare representation approaches is to solve an l_1-minimization problem which is equivalent to an l_0-minimization problem under certain circumstances. in point of fact, the SR is based on the compressed sensing mechanism which is first build up in signal processing community for reconstructing a sparse signal by exploiting its sparsity structure. In stipulation of face recognition, it is known that samples from a single class lie on a linear subspace approximately. Therefore, a test sample can be uttered as a linear combination of those training samples from the division to which the test sample pertains. For the time being, we can state that the rest training samples in the training set cannot proffer a linear representation for the test model as compact as the ones from the genuine division of this test sample. This is the discriminative kind of SRC approach.

In my project, I have implemented integrated techniques through which face will recognize both on real-time as well as non-real time and also the result will display without calculate the value of accuracy, sensitivity and specificity, precision and recall. Only we have to give the value by checking that how many images have matched correctly out of total number of images contain in the folders.

II. Methodology

In this proposed methodology, the work done on both real time and non-real time. As the previous work done on still to still images and video. We had implemented an integrated approach which will work on static as well as dynamic on pose variations, illumination and different facial expressions.

First of all we trained the images that are present in the train name folder, in each folder 10 different facial expressions and rotation of a single person's image is present. We can add the image also as well as we can delete the folder. On the training part the features are extracted from the images as well as the preprocessing will be done at the same time. Feature extraction is done by using intensity values and the image is resized into 5*5 pixels.

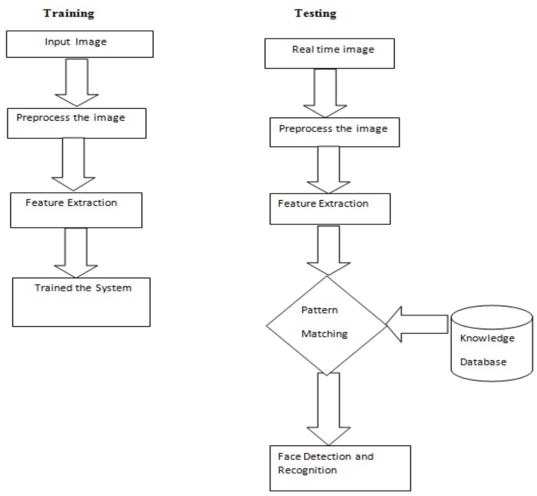

Fig.1. Proposed Methodology

Once the training part is completed the second button name feature, it will display the extracted features done by training button. Preprocessing stage the images get resize into pixels so as the images can be load quickly. After preprocessing, feature extraction is being done. There are numerous techniques for feature extraction but we are extracting features by using normalization or intensity values. The third button is test data, in which we compare the original image throughout the trained dataset and the best suited among them were displayed by clicking on the result button. The result has 2 box, in the upper box it will tell the image is belongs to which folder and the lower box ill tell the total number of image existing to that particular box.

We are dividing our proposed methodology into two categories:

– Static recognition
– Dynamic recognition
– Result

A. Static Recognition

1) Input Image

The very first thing is to train the image of a single person at 10 different pose variations and facial expressions and each person is having different folders of 10 images.. Image is being of any type (.jpg, .png, etc). We are taking input both as static and dynamic which gives the result in 0 and 1. While the training process is being done there is wait bar which shows how much the processing is being done. Once the processed is completed the wait bar also ends. The image gets preprocessed and feature extraction is being done on clicking the train button.

2) Preprocessed Image

Preprocessing is the second step on static and it will resize the image so that it will load quickly for further processing. This will do on static still to still images. After preprocessing the images get resized from its original size we take as an input image.

3) Feature Extraction

After doing preprocessing the third step is the feature extraction. There are numerous things which can be extracted from human face. The previous work is done on various features of face but we are taking normalization or intensity values so that the best suited face will get displayed. It will go through the values at m*n matrix form. Number of rows shows the features 5*5 i.e. 25 and the number of columns shows the images which we are taken of a single person at 10 different pose and facial expressions. Feature extraction is done also by extracting eye, nose, mouth etc.

4) Face Detection

Face detection is used in biometrics. Face detection can be applied for a wide variety of problems like image and film processing, human-computer interaction, criminal identification etc. This has motivated researchers to develop computational models to identify the faces, which are relatively simple and easy to implement. There are numerous techniques for face detection but we have to detect the face on real time and static both ways. So the best approach to detect face we are using Viola-Jones. Its speed and accuracy is good than any other face detection techniques. Viola and Jones introduced a method to accurately and rapidly detect faces within an image. This technique can be adapted to accurately detect facial features. However, the area of the image being analyzed for a facial feature needs to be regionalized to the location with the highest probability of containing the feature. By regionalizing the detection area, false positives are eliminated and the speed of detection is increased due to the reduction of the area examined.

5) Face Recognition

Facial recognition is a form of computer vision that uses faces to identify a person or verify a person's claimed identity". A facial recognition devices one that views an image or video of a person and compares it to one that is in the database. Face Recognition is used for a security purpose. Many applications are here both indoor and outdoor. Several face recognition techniques are there for different purposes. Many a times face recognition can be done on still to still images and now on video. Very few works has been done on real time, pose variations, illumination, facial expressions and rotate face at different angles. We are using sparse linear system for face recognition. As our final result will be displayed the best suited face and sparse matrix is best applied in our work which gives best result. In sparse linear systems if the sparse matrix become 0 then the result will get 100% efficiency.

B. Dynamic Recognition

In our proposed work the second part is the dynamic i.e. real time face recognition. It will first capture the images at 5 different pose and facial expression and then one folder will create for this 5 images that is template and from the knowledge database all images will get trained and testing process be executed. On clicking the training button one window will be opened consist of two buttons i.e. capture and add. On clicking capture, on real time camera will take 5 pictures in a few seconds by using Viola-Jones algorithm. As these algorithm is very fast and accuracy of this algorithm is very fast. Once the picture is being taken then we click the ad button and on real time name folder it will get stored there. After capturing the pictures the next step is testing. On clicking the testing button another window will be open which also take one picture on real time by using the same Viola-Joes algorithm and then we train the images and there is one find button which will use the linprog algorithm and at the same time the images get resize. Now clicking on the result button it will compare the real time image by template images throughout the database and the best matched image is displayed with folder name, in which folder that image is stored.

In the main result it will display the accuracy, sensitivity and specificity, precision and recall value of static recognition and dynamic recognition both. It will tell the correctness upon the image of static and dynamic both. On how many image the result is true and false it will tell the values. We don't have to calculate the accuracy, sensitivity and specificity, precision and recall only we have to put the values on how many images the result is true upon the total number of images, then it will calculate it by own, we don't have to use the formula for calculation.

III. SYSTEM REQUIREMENTS

A. Hardware Requirements

- Processor - Intel i3 or above
- Speed - clocked more than 2.10 GHz
- Ram - 3 GB or more
- Hard Disk - 320 GB or more

B. Software Requirements

- Operating System - windows 8, windows 7, and vista.
- Software Used - MATLAB R2013a, 2014a.

IV. RESULT ANALYSIS

Our consideration on this work is to give a feasible and efficient solution for the face recognition using template matching and the approach used is sparse both will do on real time and non-real time.

A. Static Recognition

On doing the static recognition the result will display the best matched image displayed by using GUI. And it will also display the folder name in which the displayed images are stored and out of total number of images it will get matched. The below figure is shown below:

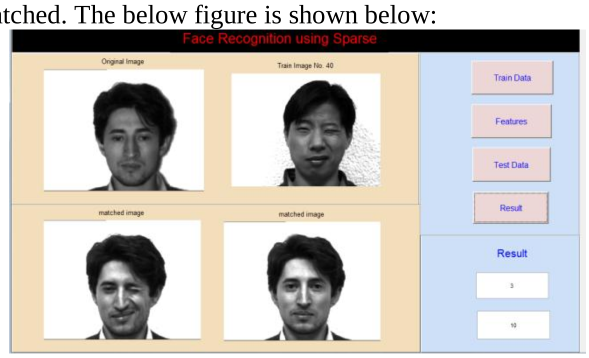

Fig. 2: Static recognition result

B. Dynamic Recognition

In the dynamic recognition, the image is taken by real time by using Viola-Jones technique and it will generate template and that template is stored in a folder and again one image will be taken on real time and get compared with the stored template throughout the folders and the best matched image is displayed on the screen along with its folder name as shown in the below fig. 3.

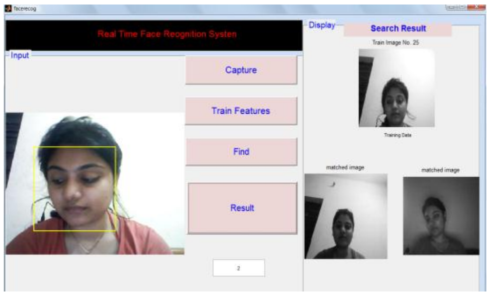

Fig. 3: Dynamic recognition result.

V. EXPERIMENTAL RESULT

The experimental result shows the proposed approach accurateness and the below table shows the percentage value of accuracy, sensitivity and specificity, and precision.

No. of Classes	Accuracy	Sensitivity	Specificity	Precision
10	82%	68.67%	100%	65.67%
20	98%	98%	98%	98%
30	98%	98%	98%	98%
40	95%	69.67%	100%	67.56%

Table 1: Experimental Result

The graphical representation of the above terms accuracy, sensitivity and specificity, and precision of both static recognition versus dynamic recognition is shown below:

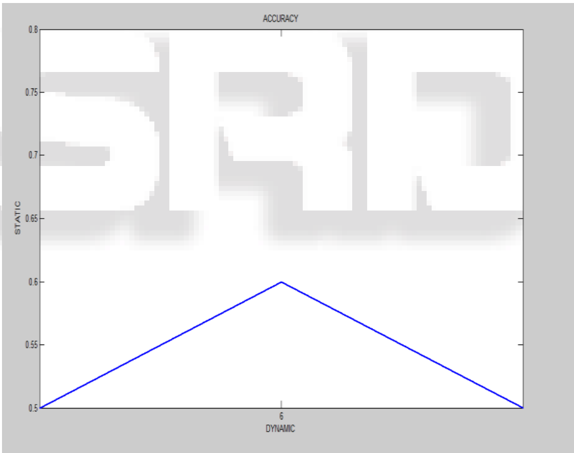

Fig. 5: Accuracy Graph of Static vs. Dynamic

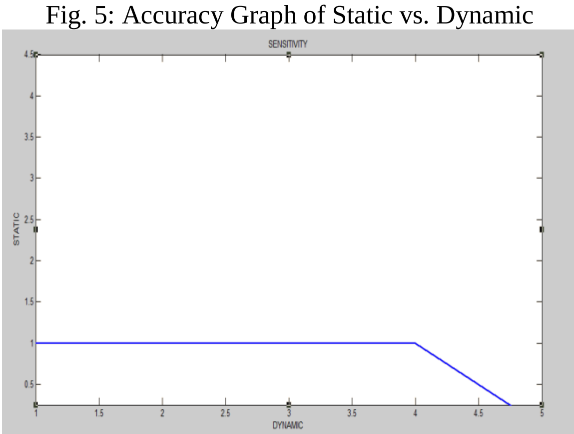

Fig. 6: Sensitivity Graph of Static vs. Dynamic

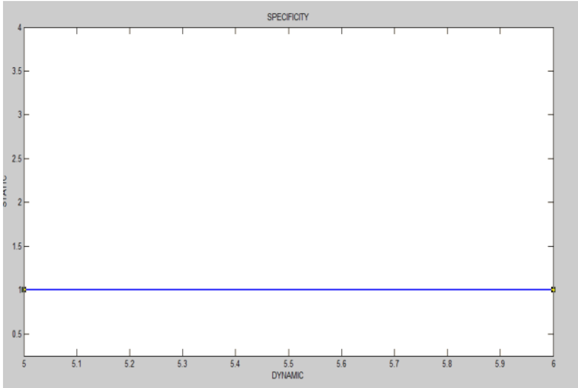

Fig.7. Specificity Graph of Static vs. Dynamic

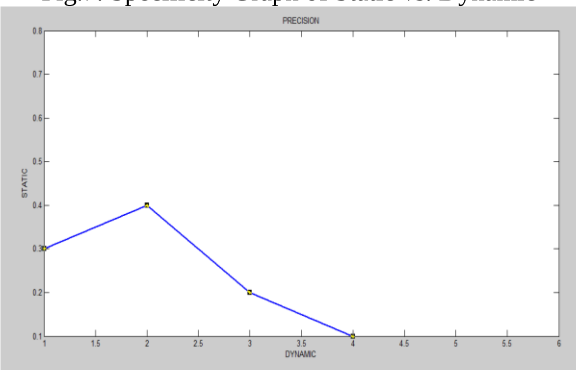

Fig.8. Precision Graph of Static vs. Dynamic

VI. CONCLUSION

In this project work we have done the face recognition on both real time and non-real time In my dissertation work there is an integrated approach which is done by static recognition and dynamic recognition. The final result will display the best suited face both on real time and non-real time recognition. We have tried to improve the better result on pose variation on both static and dynamic recognition. On the previous paper it uses DCT, DWT and PCA approach for recognition, result is better but by using sparse linear approach the accuracy is high as compared to the previous one. Viola-Jones is the best algorithm for real time face detection and tracking. Its speed and accuracy is high.

VII. SCOPE OF FUTURE WORK

In our future work we will try to do the background subtraction on real time face recognition. And also we have planned to develop an integrated approach by using video to video recognition on real time and also improve the recognition rate.

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