Support Vector Machine for Face Recognition Using Eigen-face Vector

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Abstract— This paper presents a face recognition system using a support vector machine. Face recognition system was always a complex task due to various conditions like degradation of image quality, different expressions for the same face, wearing huge glasses to cover major part of the face or the addition of beards and moustaches etc. Here the face recognition system is divided into two phases, the former being the detection and extraction and the latter being the matching part. The face detection is done by Gabor filters and Support vector Machines classifier. It is a supervised learning model with associated learning algorithms that analyze data and recognize patterns. The processed faces are finally forwarded to the recognition part and here the feature vector is evaluated by using Eigen Face Vector. This feature vector compares the detected faces with the stored database and displays the result along with the name and gender.

Keywords- Face detection, Support Vector Machine(SVM), Gabor Filter, Eigen face vector

I. INTRODUCTION

Face recognition is the technology in computer vision that helps in recognizing human faces. The main intention behind this approach is to find the best methodology to solve problems that emerge when there are multiple variations in the input image like facial sizes, illumination etc. The other solutions to this problem were template matching method and appearance based method. The template matching methods are used for face localization and detection by computing the correlation of an input image to a standard face pattern. The appearance based methods are used for face detection with Eigen faces and neural network. Face detection can be done by using Gabor Filter and recognition can be done by using SVM classifier. The image preprocessing is done based on the input image pixel intensities and occlusion. In this paper we will use support vector machine for classification. It constructs hyperplane or a set of hyperplanes in infinite dimensional space that can be used for classification. SVM finds the hyperplane that separates the largest possible fraction of points of the same class on the same side, while maximizes the distance from either class to the hyperplane. Here a run-time image is input to the system which is first scanned and then the Gabor Filter applies various patterns to it. The support vector machine then recognizes the pattern created by the Gabor Filter. Then the image is worked upon by the eigenface Vector which extracts the illuminated points of the face. The processed image is then matched with the existing images in the database and the result is displayed.

II. SURVEY OF RELATED WORK

Face recognition and detection is regarded as a major problem in the field of security and surveillance. Many software solutions are increasingly being used to provide safety critical applications. It is necessary that the reliability of system should be measured and evaluated. So to predict face recognition problem we need to perform certain actions. Over the past 20 years numerous face recognition papers have been published in the computer vision community. The number of real world applications (e.g. surveillance, secure access, human/ computer interface) and the availability of cheap and powerful hardware also lead to the development of commercial face recognition systems. Despite the success of some of these systems in constrained scenarios, the general task of face recognition still poses a number of challenges with respect to changes in illumination, facial expression, and pose. Face detection is a huge project and to furnish the project in specified period under given conditions each and every operation must undergo correctly. Therefore before the beginning of the project the chance or probability of occurrence of the failure must be estimated and it should be worked upon accordingly.

III. PROPOSED SYSTEM

For Face detection, Gabor Filters are used. Gabor Filters [3] are bandpass filters which are used in image processing for feature extraction, texture analysis. After the pattern is applied, Support Vector Machine (SVM Classifiers) [4] are used to detect the position of faces in an image file (.bmp, .jpg, or .png) based on the pattern produced by Gabor filter. It then crops the faces in the image automatically and the detected faces are saved in separate image files. Then selected faces are copied into clipboard and the size of the cropped faces is adjusted automatically before copying or saving them. For face recognition, a computer application for automatically identifying or verifying a person from a digital image is applied. One of the ways to do this is by comparing selected facial features from the image and a facial database. The proposal is based on the well-known eigenfaces [5]. In mathematical terms, the principal components of the distribution of faces are found, or the eigenvectors of the covariance matrix of the set of face images, treating an image as a point (or vector) in a high dimensional space. The eigenvectors are ordered, each one accounting for a different amount of the variation among the face images. These vectors can be thought of as a set of features that together characterize the variation between face images. Each image location contributes more or less to each eigenvector, so that we can display the eigenvector as a sort recognized face.

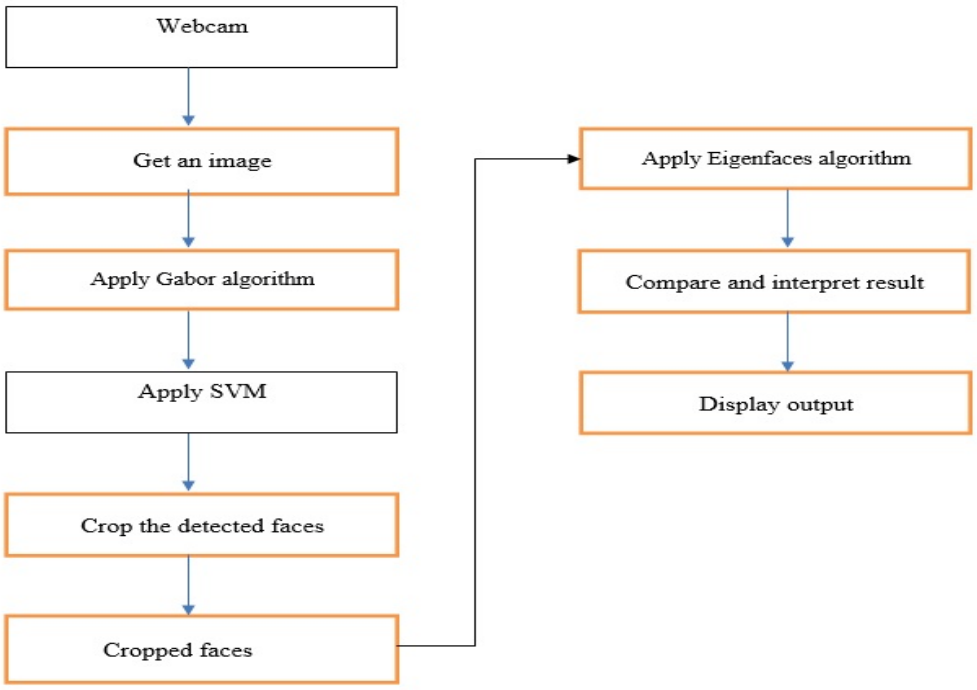

Figure.1 Architecture diagram for Face Recognition System

IV. DESIGN

The design strategy is particularly composed of two phases: Face detection and face recognition, each of which is divided into separate modules. In this category a single feature vector that represents the whole face image is used as input to a classifier. Global techniques work well for classifying frontal views of faces. However, they are not robust against pose changes since global features are highly sensitive to translation and rotation of the face. To avoid this problem an alignment stage can be added before classifying the face. Aligning an input face image with a reference face image requires computing correspondences between the two face images. The correspondences are usually determined for a small number of prominent points in the face like the center of the eye, the nostrils, or the corners of the mouth. Based on these correspondences the input face image can be wrapped to a reference face image.

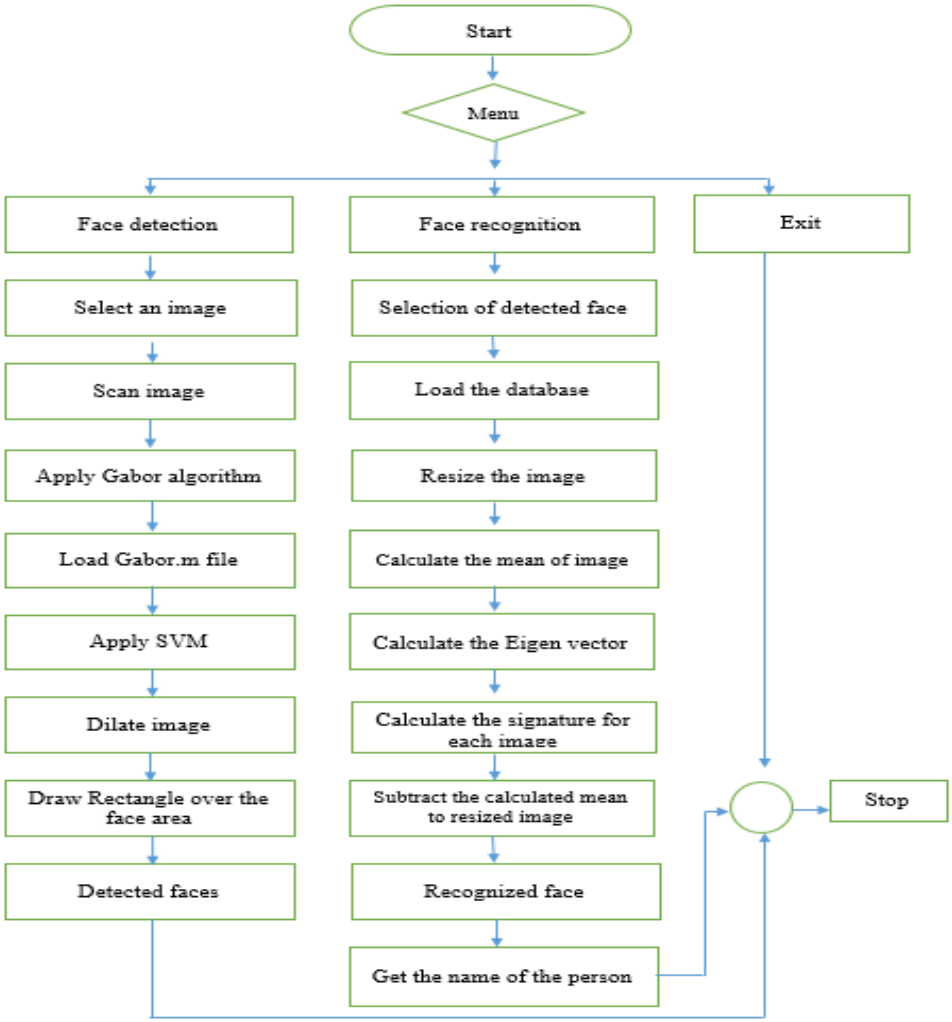

Figure.2 Design Strategy of the scenario

V. DETAILED TEST PLAN

The face database (Training Set) can be extended by adding faces (sample) of different person. There must be sufficient overlap between the samples chosen, yet they should look different from the previous sample. Ten appropriate different samples for each face are chosen and added to face database. After that by applying two processing steps the task is being divided into two processes. First the face is found as a result of feature extraction from any image and then in the second process, the face from the feature database (training set) is recognized. The face detection is done by capturing a face through webcam then it is stored in the face database (training set). After storing an image, the image is then computed through Gabor filter and SVM classifier which results in a detected face.

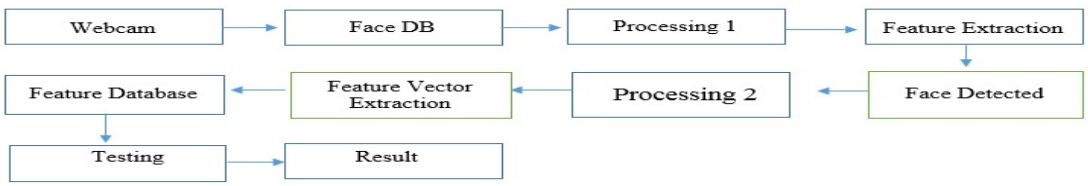

Fig.3 Test Scenario

A sample is a matrix where each row corresponds to an observation or replicate, and each column corresponds to a feature or variable. Therefore, Sample must have the same number of columns as the training data. This is because the number of columns defines the dimensionality of the data space.

A test image is called a query image, which is chosen. The query image is then compared with the varying images in the DB. The closest match is displayed as the result.

Matching of image is performed by subtracting the query image from the database and the image that produces the minimum difference is the resulting image.

200	150	200	150
200	150	200	150
200	150	200	150
200	150	200	150

Query Image

200	200	200	200
200	200	200	200
200	200	200	200
200	200	200	200

Database Image

0	50	0	50
0	50	0	50
0	50	0	50
0	50	0	50

Difference Image

Column total: 400

The smaller the value in column total, the better is the match. By comparing the query with all images in the database, such numbers are generated. This result is in a tabulated form. The one that produces the minimum is the best match and that particular image is identified.

VI. EXPECTED RESULTS

Performing different tests on the database requires two separate directories, one for the DB and the other for the query images are created.

Test1: All known samples are tested. Samples are different views of the same person

Test2: Some unknown samples for each subject are tested. Subject refers to a person.

Test 3: Unknown subject is tested by taking some images.

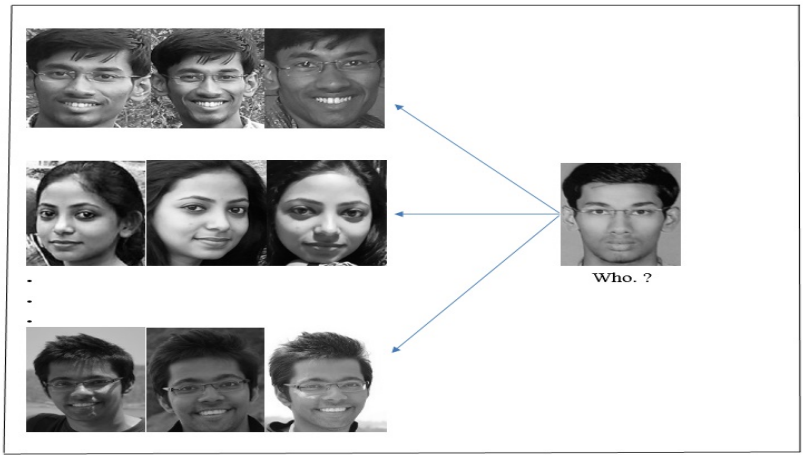

Fig 4**:** Expected Outcome

VII. CONCLUSION

In this paper a global technique for face recognition is presented and evaluated as per their performance with respect to robustness against pose changes. The whole system was evaluated in MATLAB, using an image dataset of 400 images with different facial expressions. The whole face was detected, extracted from the image and used as input to the classifiers. The system was tested on a database which included faces. The detected images were then classified against all images in the dataset to find the closest match, thus producing the recognized face.

One of the major challenges encountered by the current face recognition technique lies in the difficulties of handling varying poses i.e. recognition of faces in arbitrary in-depth rotations. The face image differences caused by rotations are often larger than the inter-personal differences used in distinguishing identities. Current automatic face recognition systems often require users to face towards the capturing camera. It is made sure that the user faces towards the camera so that the frontal view of the face can be captured and transformed into an image effectively.

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