COMPARISON BETWEEN DIFFERENT FACE-RECOGNITION TECHNIQUE WITH DIFFERENT CLASSIFIER

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project titled "Compression Between Different Face-recognition technique with different classifier", submitted by **Mr. Ahmed Al Marouf** to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on September 2020.

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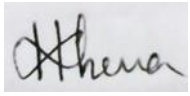

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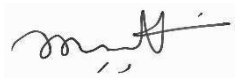

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We hereby declare that, this project has been done by us under the supervision of **Mr. Ahmed Al Marouf , Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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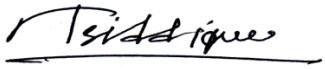

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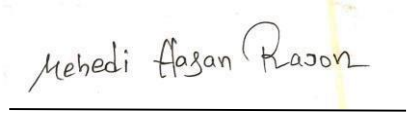

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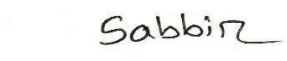

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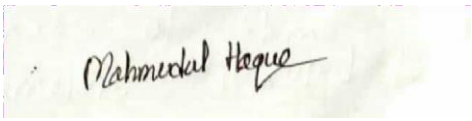

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Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

The purpose behind our research is to build a system which can recognize a human face without help of any human. We have collected two face database which are ORL and Yale. Both the database contains images of different individuals with different face expression. We have used 80% images to train and 20% to test our system. We have used PCA as our feature extraction method and SVM and KNN and our classifier. Our main goal of our research is to compare with different combination of algorithm to find out which combination is giving us the best expected result. We have also plan to add some more algorithm in future and use real time image in our system. This research will helpful to all platform like security, prevent retail crime, for different apps and for government purposes.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

Face of a human plays a big role in its identity. In recent past years by the key security using human face, biometric face recognition technology has come to a whole new era in terms or use of modern technology in our daily life. A face recognition system is capable enough to verify a person from any digital image or from any frame from any video. There is difference type of methods how that system works but mainly it works by comparing different features from different images from a given database. Additionally it wants to be represented as a Biometric computing primarily based application which will unambiguously determine an individual by analyzing patterns supported the person's facial textures.

1.2 Motivation

The necessity for personal security is increasing very rapidly .Traditional methods are not reliable thus it is gradually been replaced by biometrics system. Fingerprints eye, voice are most commonly used biometric features. But among these face provide more reliable identification method compared to others. But face recognition does not provide as accurate result as fingerprint. The face is the conventional way to identify people that’s why many researchers have a huge attention in these field. For this system the input is always a given photo or video frame. The output is the proper identification of the subject that is given as a input for verification.

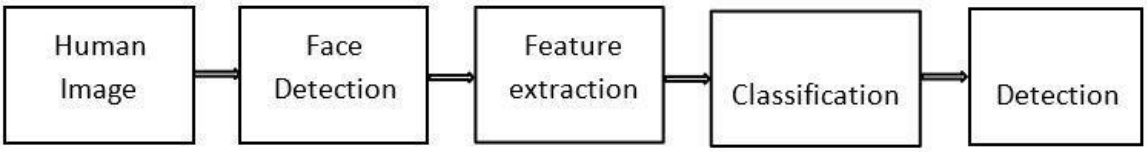

Figure 1.1: A workflow of face recognition system.

1.2.1 Application of Face Recognition in Real Life

Face acknowledgment has become a significant issue in numerous applications. For example, security framework, credit and confirmation in the zone of observation, Close circuit TV and criminal ID etc.. This system is also useful in human computer interaction, multimedia, online banking, driver licenses, automatic identity verification, home video surveillance system, investigation, personal security, passports, medical records, database recovery, border controls driver monitoring system, virtual reality etc.

1.2.2 General Identity Verification

Electrical registration, banking purpose, electronic commerce method, identifying newborns pupil, national ID holder, passports, employee IDs.

1.2.3 Identify People on Social Media

Facebook also utilizes face acknowledgment technology. When Facebook individuals show up in photographs it naturally recognizes. This makes it simpler for individuals to discover photographs they are in. It can also recommend when specific individuals should be tagged in photographs.

1.2.4 Security

Today like never before, security is an essential worry at air terminals and for aircraft staff office and travelers. The face acknowledgment system has been actualized at numerous air terminals around the globe that utilization air terminal assurance frameworks. PC security has also observed the use of face acknowledgment system. To forestall another person from changing documents or executing with others when the approved individual leaves the work station for a brief timeframe, clients are consistently verified, watching that the person before the PC screen or at a client is a similar approved individual who signed in.

1.2.5 Find Missing Person

Face acknowledgment can be utilized to discover missing kids and survivors of illegal exploitation. However long missing people are added to an information base, law implementation can become cautioned when they are perceived by face acknowledgment—be it an air terminal, retail location or other public space. Actually, 3000 missing kids were found in only four days utilizing face recognition technology in USA.

1.2.6 Unlock Phones

Face acknowledgment is additionally utilized in a variety of Smartphones. The most recent iPhone are presently utilizing face acknowledgment to open features. This innovation is an incredible method to secure individual information and guarantee that, if a telephone is stolen, delicate information stays out of reach by the culprit.

1.2.7 Prevent Retail Crime

Face acknowledgment is right now being utilized to quickly recognize when known shoplifters, composed retail lawbreakers or individuals with a background marked by extortion enter retail foundations. Photos of people can be coordinated against huge databases of lawbreakers so misfortune avoidance and retail security experts can be immediately told when a customer enters a store that forestalls a danger. wrongdoing are as of now profoundly lessening due to Face acknowledgment frameworks.

1.2.8 Smart Advertising

Face acknowledgment can make publicizing more focused by educated guesses individuals of different age and sexual orientation. It won't be long until face-acknowledgment turns into an omni-present publicizing innovation.

1.2.9 Control of access

In a large number of the access control applications, the size of the gathering of individuals that should be perceived is relatively small. The face pictures are taken under common conditions .The face acknowledgment arrangement of this application can achieve high exactness absent a lot of co-activity from client. The following are the example. To monitor continuously who is in front of a computer terminal face recognition technology is used. It permits the client to leave the terminal without finishing documents and logging off. At the point when the client leaves for a predetermined time, a screen saver conceals the work and disables the mouse and console. Whatever other client who attempts to login without approval is denied.

So this is the main motivations behind our research. This let us to choose the topic.

1.3 Rationale of the Study

The objective of thesis is to performance comparison between different feature extraction techniques with different face database and performance comparison between different feature extraction techniques with different training and test ratio for different classifiers. The main goal of this thesis work are listed below:

- To apply the ORL and Yalee dataset in our project?
- Try to convert the images in matrix format.
- Train test using different features of the images.
- To understand how PCA works.
- To apply PCA to the face.
- To select main component based on cumulative co-variance.
- To classify the selected components by KNN.
- To classify the selected components by SVM.
- Performance comparison between KNN and SVM classifier for two datasets.

- Performance comparison between KNN and SVM classifier for two datasets with respect to PCA.

1.4 Research Questions

Every research project has a critical and fundamental part which is Research Questions. It is important that it needs to be focused, cleared, has a point. Basically, the research questions are related to the research project and it needs to be answered directly through the analysis of the data. The research related questions that we will be trying throughout the research paper are given below:

- How do we get our database?
- What is the main features of ORL and YALEE database?
- What type of algorithm have we used?
- How to compare the method with other methods in the same fields?
- How can we bring good for the people of our country with this research?
- Why haven't we use more algorithm to compare?
- Who will be the audience for the research?

1.5 Research Outcome

In this chapter the introductory topics of a face recognition system have been discussed. Humans have tremendous ability to recognize faces. Human brain can recognize faces even considering aging factors, illumination changes, rotated faces, pose variations, occlusion, expression variations etc. But, for computer to build a face recognition system is quite a challenging task. Because these factors described earlier cause a variations in the normal representation. So to build a face recognition system several steps have to be taken very carefully. The first step is to represent faces in an effective way. Next, is to extract features from those face images. The third & final step is to classify those images.

Here are some outcomes that we can expect from our research-

- We will pre-process every image in the database and make them into a matrix where our algorithms can be easily applied to make a system that can recognize the face.
- We will use 80% data of the images to train the system and will test remaining 20%. And we can expect our system will detect our individual with higher percentage of accuracy.
- We will successfully apply all the algorithm on our data base.
- Finally, we will come to a result where we will find out which algorithm will give the best output with compare to others.

1.6 Layout of Report

- Chapter One covers our project introduction, project motivation, research questions, expected outcome and layout of our report.
- Chapter Two covers Literature Review, our point of view of this section, related work, research summary, scope the problem and challenges.
- Chapter Three describes the Research Methodology.
- Chapter Four covers Implementation and Experimental Results of the project worked.
- Chapter Five includes Conclusion and Future scope.

CHAPTER 2
BACKGROUND

2.1 Literature Review

Some of the related works of recent times are being discussed in this chapter. The paper's overview, applied algorithm along with the success of those works and the future work or limitation have been included so that the overall summary of the works can be easily understood.

2.2 A Brief Study of Some Related Works

- Dakui Wang and Dongwe Li, in their paper describes the process of face recognition using a new method by applying data space and PCA. Second, they extracted the features using data field and then used PCA for face recognition .They used ORL database as their input data. These experiments are done comparatively. The result shows low frequency rate with PCA. Then the process is done with data field. It has high recognition rate with small training data set.

- Sukanya Sagarika Meher in their paper describes the process of face acknowledgment using PCA only. Firstly, for feature extraction they used PCA. Secondly for recognition they also used PCA . Results show that PCA based methods give better recognition and low error rate. So, this paper proposed that PCA algorithm has good recognition rate, simple calculation and quick speed.

- Jianhua Dong T in their paper propose a new method using KPCA and SVM. solve the nonlinear characteristic of the feature which PCA can't solve. PCA algorithm has a good effect on extracting face contour in this paper, the

KPCA and SVM methods were combined with and used for face recognition the feature vectors.

- Majid Safari, Mehrtash T in their paper propose a new method for face recognition which is face recognition using SVM. In the paper they used two step method. First two-dimensional discrete wavelet transform. Then PCA is applied. For classification they used SVM. By using DWT and SVM it reduces the error rate.

- Jianhua Dong T in their paper propose a new method using KPCA and SVM. solve the nonlinear characteristic of the feature which PCA can't solve. PCA algorithm has a good effect on extracting face contour in this paper, the KPCA and SVM methods were combined with and used for face recognition the feature vectors were extracted by KPCA, and the strategy of "one vs one" of SVM.

- Jie Yang, Hua Yu in their paper another, brought together PCA algo for face recognition. The new calculation augments LDA design standard straightforwardly without independent of PCA step. The framework has provided a stage to growing new face recognition algorithms. We are presently chipping away at improving face acknowledgment accuracy by a grouping of video images.

2.3 Comparative Analysis and Summary

Surveying the research papers of the related field gives a good assumption and idea about the works and dimensions of the works of that very field. This is why, for a better understanding of the research works in this specific field we have studied the related papers.

our research work consists of face recognition method. Features are extracted by Principal Component Analysis. Classification is performed by SVM and K Nearest Neighbor (KNN)approach. To understand the basic operations of these algorithm several image processing, statistical, data mining methods have to be understood. We have also compared with the result of face recognition with different algorithm. That haven't been done in any of these papers. We have also used two data set in our research but most of the other works have been done with one database.

2.4 Scope the problem

In this scenario

- Analyze different types of datasets.
- The data's format changing problem
- Accuracy is not fully maintained.
- We have to give a huge time to build the matrix.
- The system cannot be run each in because the results are already loaded. If the run the program again the system will take time again because it has to perform train test part again.
- Measuring the value of k was also a big factor.
- The accuracy changes each time we run the program again because of the train test issue.

2.5 Challenges

Challenges that we face

- Our research work is a backend work. We have used database that are already been taken. For a dynamic research we need high end image processing hardware and software that are pretty expensive.

- There are some limitations of PCA face recognition. Its recognition rate decreases when illumination and pose variation occur.so we have to use another algorithm in future to solve this issue and to get an accurate result.
- These models are not robust when dealing with extreme change of expression.
- The faces need to be centrally aligned for better performance PCA.
- We also faced some issue when we implement our project on latest version of MATLAB.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Research Subject and Instrumentation

Here we discuss about the proposed methodology. The proposed methodology has been performed on a database which contains human images. The PCA face recognition is applied to ORL and Yale face database which contains human faces. In ORL face database detection algorithm is not required. The PCA feature extraction works by reducing the dimension size. Based on cumulative co-variance the feature is selected. Actually, the classification is being performed by KNN and SVM classifier. Here we use different types of database and for implementation we use MATLAB application.

3.2 Data Collection Procedure

Our Database of ORL Faces, contains a set of people face images. The image has been taken at the lab for recognize project. Which is administered in association with difference engineering department of the Cambridge University.

- There are ten different images of a single people.
- There are in total of 40 individuals.
- The images were taken in several period and with different facial expressions like with or without glasses, with and without smile etc.
- All the photographs were taken against dark (with tolerance for a couple of side movement).
- For the system we use the file as PGM format.
- the dimensions of every image are (height*width) pixels and with the grey levels per pixel.

- That ORL information base, the pictures are composed in 40 registries which include names inside such a sX, where X demonstrates the point number (somewhere in the range of 1 and 40).
- The total Face Database is in total 4.5 mb.

Figure 3.1: different types of ORL faces.

YALE Face Dataset

- That data set have half- dozen picture .4MB in size.
- It contains a hundred sixty-five grayscale pictures.
- All pictures in GIF format.
- There are pictures of fifteen people.
- eleven pictures of every individual.
- These pictures consists of people with different expression and light effect like focus assist,smiling face,w/wo glasses, ordinary, expression with wink e.t.c.

Figure 3.2: Images in Yale face database

3.3 Statistical Analysis

Feature extraction may be a method of spatial property reduction for the analysis. that AN initial set of information is reduced to additional manageable teams for process. A trait of those monster information sets might be countless factors, sizable number of variables used for this analysis. In our report we have a tendency to worked a feature extraction algorithm.

3.3.1 Introduction to PCA

PCA(Principal Component Analysis) is a part of modern data analysis. PCA is a sort of measurement decrease analysis. Appointment investigation endeavors to insert objects circulated in high dimensional space into lower dimensional space. In PCA, measurement is accomplished by projection to bring lower dimensional space utilizing linear change. Principal part Analysis has been referred to as one among the foremost valuable results from applied algebra.PCA algorithmic program is employed within the 'Eigenface' approach for the popularity of the images. It offers North American nation economical thanks to notice the lower dimensional house.

3.3.2 An Overview of PCA Algorithm

First, the coaching image set square measure remodeled in collection of eigen - faces. Principal part Analysis (PCA) could be a powerful applied math technique. that converts a set of related variables into a collection of linearly unrelated variable. The linearly uncorrelated variable is named principal part. it's a form of orthogonal transformation. The goal of Principal part analysis is to spot the foremost pregnant basis to re-express a dataset. This new basis can filter the noise and divulges hidden structure. Indeed, PCA makes powerful assumption however stringent: dimensionality. dimensionality immensely simplifies the matter for confine the set of potential bases the standard Eigen Face Approach has given a good importance in Face Recognition. The spatial property of face pictures is reducing here. we will select solely M/ Eigen-vectors with largest Eigen-values. As minimizing Eigenvector direction, such little eigenvectors are often neglected to additional cut back the dimension of house. This doesn't have an effect on success rate abundant & is appropriate betting on the appliance of face recognition.

3.3.3 Background Mathematics

In this part we will talk about the background part of math are are required to understand how our system works.

3.3.4 Standard-Deviation

First, we should perceive variance, for that require a knowledge set.Sample of population are main part concern for Statisticians.Here we will see an example for SD.

$$\boldsymbol{Y = [1\ 3\ 5\ 7\ 14\ 25\ 56\ 69\ 66\ 99\ ]}$$

Section 1.01 Y is used to mention to tag total set. Subscripts will be used to refer specific number if an single number want to be reffered.so Y4 refers to the 4th

number in the set which is 7.n will represent the the element num in the Y set.so the mean will be:

$$\bar{Y} = \frac{\sum_{i=1}^{n} Y_i}{N}$$

Here $\bar{Y}$ represent the mean. Let's talk about a set where the mean is same. Like:

[1 7 11 21] and **[9 8 12 11]**

Lets talk about the difference. Why Standard Deviation is called the spread out of data? How we can measure it? As formula:

$$SD = \sqrt{\frac{\sum_{I=1}^{N} (Y_i - \bar{Y})^2}{(N-1)}}$$

Here SD represent standard Deviation. Now let's calculate SD for the set.

Set1:

Y	$(Y - \bar{Y})$	$(Y - \bar{Y})^2$
1	-9	81
7	-3	9
11	1	`1
21	11	121
Tot		212
Division with (n-1)		70.66
Square Root		8.4063

Table 3.1: Representation of standard Deviation Set1.

Set2:

Y	$(Y - \bar{Y})$	$(Y - \bar{Y})^2$
9	-1	1
8	-2	4
12	2	4
11	1	1
Tot		10
Division with (n-1)		3.33
Square Root		2.882

Table 3.2: Representation of standard Deviation Set2.

Another example of SD:

[9 9 9 9]

Here its mean is 9 but standard deviation is 0 because all the numbers are same.

3.3.5 Measure of Variance

Variance is known as the measurement of the spread of data.The formula for variance is

$$S^2 = \frac{\sum_{i=1}^{n} (Y - \bar{Y})^2}{[n - 1]}$$

Here we can see that variance is the S2 stand for variance.SD and S2 are both used to measure the spread of data.We mostly use SD but variance is also used in some cases.

3.3.6 Covariance

The last two methods that we talked about is simply about single dimensional data.But many times we work with such data those have multi-dimensional data. SD and variance san only measure single dimensional data.so as a result it only

calculate each dimension in the data-set.So co-variance is used to measure such kind of data set. So if the is a 3 dimension data like (a,b,c) then the measure of co-variance will be between a and b dimensions, the a and c dimensions and b,d dimensions. Then the formula can be written as,

$$\mathbf{var(A)} = \frac{\sum_{i=1}^{n} (A_i - \bar{A})(A_i - \bar{A})}{(n-1)}$$

$$\mathbf{Cov(A,B)} = \frac{\sum_{i=1}^{n} (A_i - \bar{A})(B_i - \bar{B})}{(n-1)}$$

3.3.7 The covariance Matrix

Covariance is measured between double dim datasets. If there is more than one dataset then there will also be a multiple covariance. For example, of a 2-dimensional dataset:

	Hours(H)	Point(P)
Dataset	12	75
	12	32
	22	85
	13	42
	15	70
	11	34
	10	43
	17	53
	4	55
	21	45
	21	83
Total	158	617
Avg	14.36	56.09

Covariance:

H	P	$(H_i - \bar{H})$	$(P_i - \bar{P})$	$(H_i - \bar{H})(P_i - \bar{P})$
12	75	-2.36	18.91	-44.62
12	32	-2.36	-24.09	56.85
22	85	7.64	28.91	220.87
13	42	-1.36	-14.09	19.16
15	70	0.64	13.91	8.90
11	34	-3.36	-22.09	72.22
10	43	28.64	13.09	374.89
17	53	38.64	-3.09	-119.39
4	55	40.64	-1.09	-44.29
21	45	30.64	-11.09	-33.29
21	83	68.64	-35.09	-2408.57
Total				-2250.38
Average				**-204.58**

Table 3.3: covariance matrix data set.

This is how we can calculate covariance matrix.

3.3.8 Eigenvectors

Eigenvectors are a unit a special case. ponder the two multiplications between a matrix and vector in Figure within the initial example, the following vector is not degree number multiple of the first vector, whereas inside the second example, the instance is exactly fourfold the vector began with. Why is this? Well, the vector may be a vector in two-dimensional space. the other matrix the state of affairs, is believed of as an amendment matrix. If multiply this matrix o the left of a vector, the answer is another vector that is transformed from its original position. Imagine an amendment matrix that, once redoubled on the left, mirrored vectors inside the road y = x. Then it's seen that if there has been a vector that lay on the road y = x, it's reflection it itself. all multiples of it, as a result of it wouldn't matter but long the vector was), would be Associate in Nursing eigenvector of that transformation matrix.

3.3.9 Eigenvalues

Eigenvalues square measure closely associated with eigenvectors, in fact, in Figure three. Eigenvectors and eigenvalues perpetually are available pairs. When a fancy programming library calculate the eigenvectors it additionally typically gets the eigenvalues as well. Exercises For the subsequent sq. Matrix. For an example

$$\begin{pmatrix} 4 \\ 3 \end{pmatrix}$$

This is an eigenvector and the length will be

$$\sqrt{4^2 + 2^2} = \sqrt{20}$$

Again

$$\begin{pmatrix} 4 \\ 3 \end{pmatrix} \div \sqrt{20} = \begin{pmatrix} \frac{4}{\sqrt{20}} \\ \frac{3}{\sqrt{20}} \end{pmatrix}$$

3.4 Proposed Methodology

The last stage of the methodology is classification. that uses extracted countenance to performance recognition (determining who's face it is) or classification. All classifiers are instances of face recognizer. There are one or 2 of default implementations. the foremost common is that the face recognizer which can use any variety of progressive commentator to perform the actual classification. All recognizers are also capable of progressive learning (i.e. new examples are also added at any point). Presently, there are executions of dynamic pundit that actualize common machine learning algorithms at the side of k-nearest-neighbors and naive Bayes. Batch annotators (Batch Annotators), sort of a Support Vector Machine commentator can also use by pattern Associate in Nursing device to convert the Batch commentator into Associate in Nursing progressive commentator. In our paper for face recognition we've got a bent to used two classifiers. They are:

- KNN
- SVM

3.4.1 Method

The easy own made-up information set is employed. It's solely got a pair of dimensions, and the reason why it's been chosen as a result of it will give information.

3.4. 2 The mean calculation

To do the mean calculation we need to own made data so we have to input all x and y value that produce an information whose mean zero.

The following data:

X	Y
2.6	2.5
0.6	0.8
2.1	2.8
1.0	2.1
2.4	2.6
2.1	1.5
1.6	1.7

Table 3.4: mean calculation data set.

The adjusted data:

X	Y
0.65	.45
-1.29	-1.18
0.35	.95
0.07	.25
1.20	1.05
0.15	-.29
-0.80	-.80

Table 3.5: The adjusted data set.

Plot diagram:

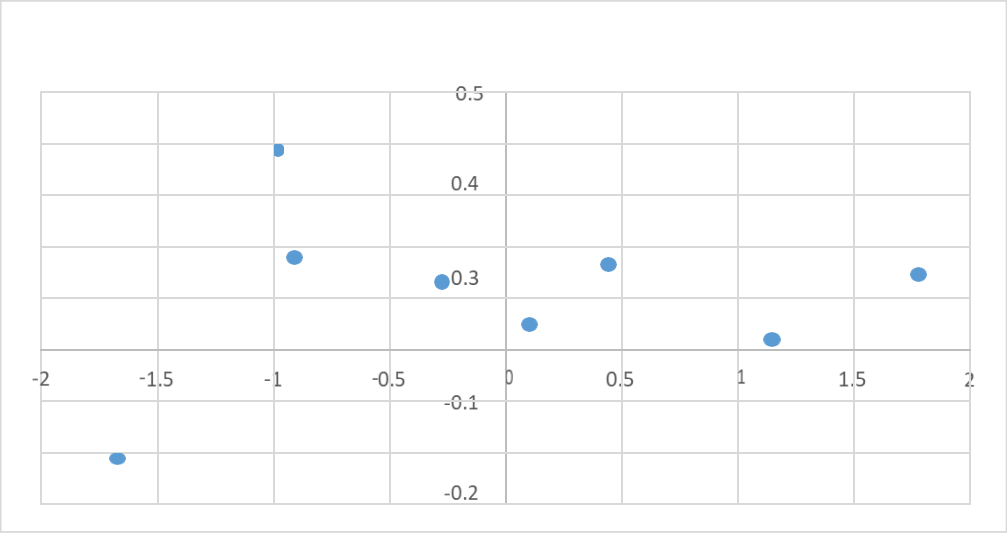

Figure 3.3: A plot of the data. original data on the left, data with the means subtracted on the right

3.4.3 Calculate the covariance matrix

Since the data is in pair so the covariance matrix will be in 2*2 from.so the result will be:

$$cov = \begin{pmatrix} .6256666565 & .624555555 \\ .624555555 & .725666665 \end{pmatrix}$$

3.4.4 eigenvectors and eigenvalues of the covariance matrix calculation

The eigen-value and eigen-matrix will be calculated as per the variance matrix is square. square measures is vital, because it provides with helpful data regarding the data. The eigenvectors and eigenvalue:

$$eigenvalues = \begin{pmatrix} .0490833989 \\ 1.28402771 \end{pmatrix}$$

$$eigenvectors = \begin{pmatrix} -.735178656 & -.677873399 \\ .655764488 & -.724267567 \end{pmatrix}$$

Plot:

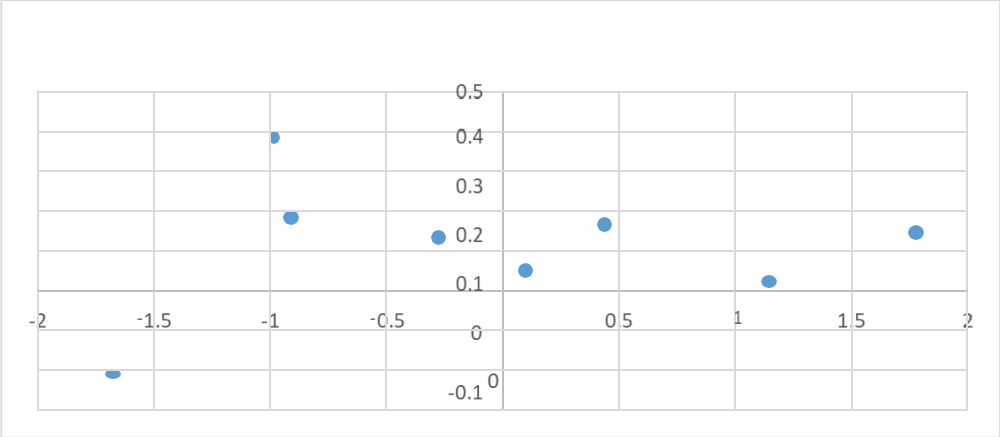

Figure.3.4 normalized data with the eigen-vectors of the covariance-matrix

3.4.5 Getting transform data

For PCA transform we need the old data back for the comparison. Transform data from own made data:

X	Y
1.14457217	.0464172582
.438046137	.0177646297
1.22382056	.162675287
1.78758033	.145257227
-.972187494	.354354989
-1.67581152	-.207497461

Table 3.6: Transform data set.

Plot-diagram:

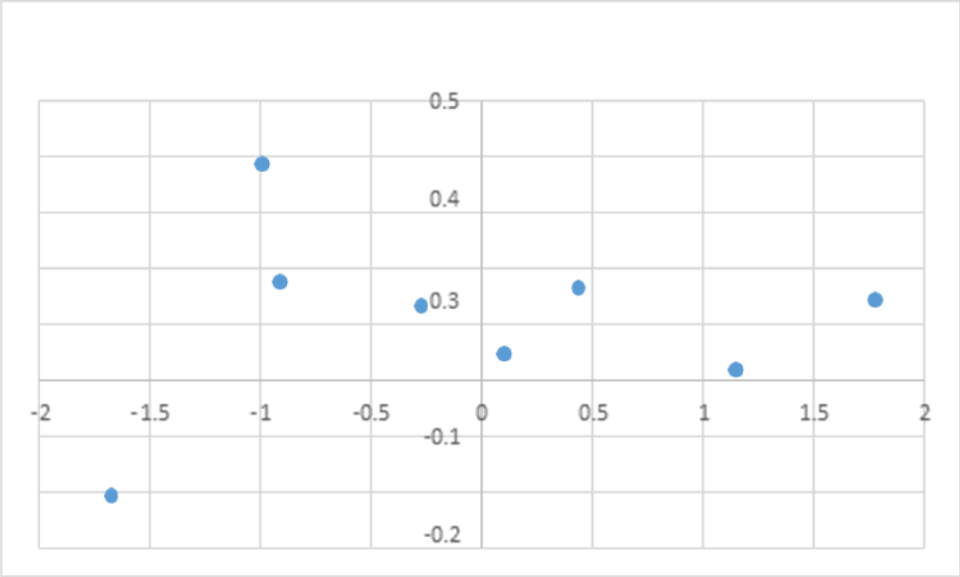

Figure:3.5 A plot using PCA with both eigen-vectors

3.4.6 SVM

SVM is a classifier for data segmentation. To use the classifier we build a face recognition system. SVM use two-dimensional factor.

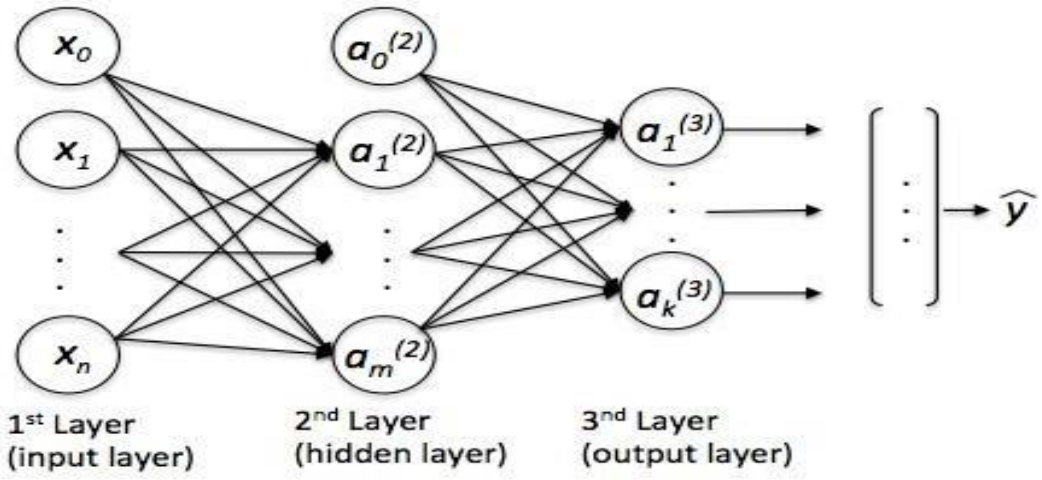

Figure 3.5.1: SVM classifier process.

Some problem is noticed by here. square measurement is monition several minimum options. We use the higher data set to classify the hyper plane.

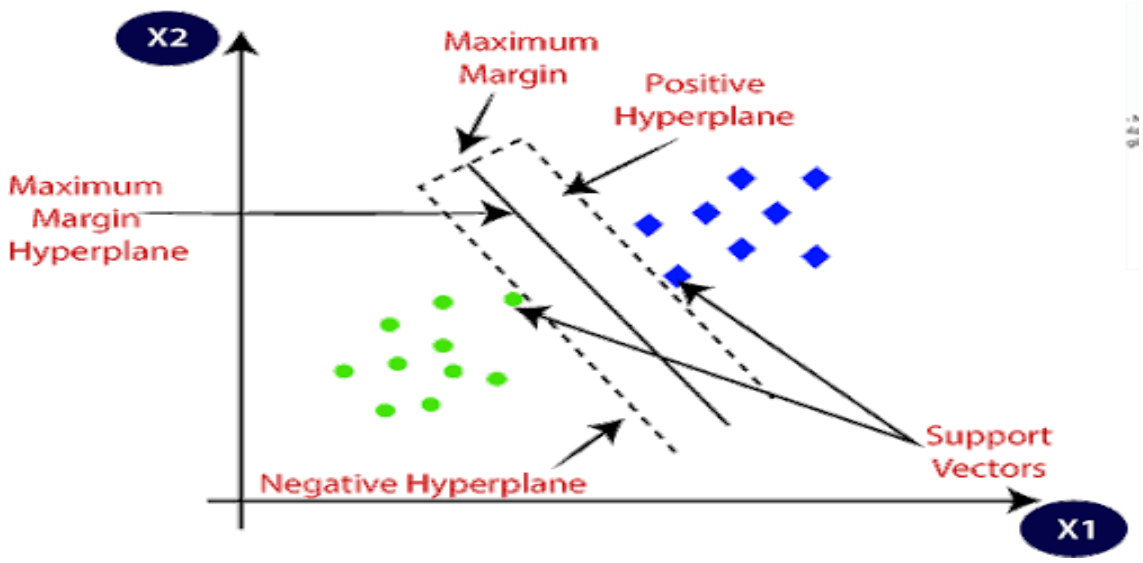

Figure 3.6: Hyperplane of SVM classifier.

3.4.7 SVM algorithm pseudocode

Input:

Training dataset

Then Size of the final sample

Final sample Do s = 1 to S 1.

Randomly take a record Ds from D 2.

Put Ds into F 3. Put Ds back into D

End;

In this chapter, the diagram of projected methodology is bestowed. the outline of each method is additionally bestowed with the mathematical equations. For feature

extraction Principal component analysis (PCA) approach has been used. PCA faces some drawbacks. Afterward feature extraction by PCA is applied on the PCA and LDA knowledge. we tend to accomplish those dimensions wherever most variations exist. Finally, KNN and SVM categorified is applied to predict a take a look at image class.

3.3.12 K- Nearest neighbor

KNN used non parametric technic. K -NN gives the result category membership recognition. this method chooses the closest number matched and classify it.it choose wroth typical value.

Advantage with KNN:

- Non linier useful data is used
- K-NN used the simple algorithm
- K-NN gives us better result with the high accuracy.
- It gives us Versatile to useful classification.

Disadvantage with k-NN:

- K-NN is expensive because it stored all data.
- K-NN use the high memory performance.
- K-NN gives the result slowly.
- K-NN also give prediction result slowly.

In this chapter the basic idea behind the representation of face recognition have been explained. Like, for feature extraction we explained PCA the mathematical explanation of SVM and KNN algorithm is also given in this chapter.

3.5 Implementation Requirements

Human recognize faces very easily. People can memorize face even after many years. Variation in illumination, pose, expression, alignment plays a very little role for humans. But building a face recognition system for computer under different conditions (e.g., illumination, variation of pose, different expression etc.) is quite difficult. the work of face recognition approach is proposed. The top Eigen faces are selected based on cumulative covariance. For classification KNN classification and SVM classification technique is used.

3.5.1 Implementation procedure

This work is consisting of the following steps:

- First the database has been loaded
- Then it has been converted into data matrix
- The data is spitted into train and test data
- Then PCA extraction techniques have used on the training data
- Then the KNN and SVM classifier has been used for recognition

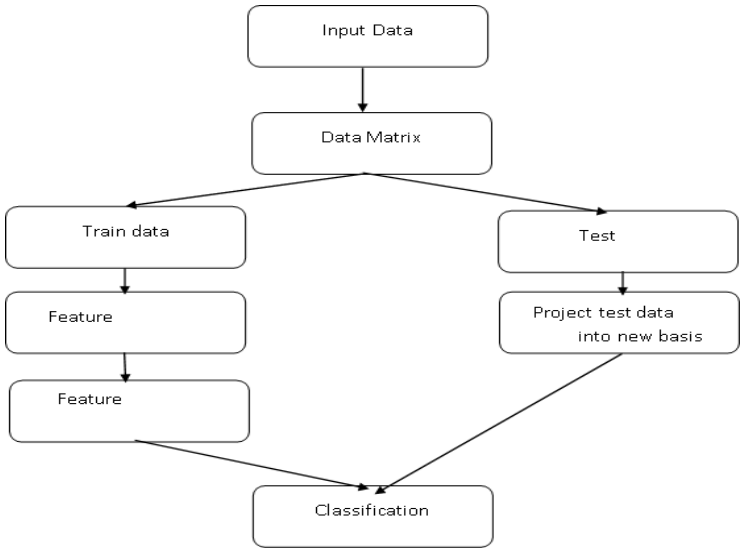

Figure 3.6: Flow diagram of implemented face recognition system

We want to do the recognize system because there help people for different field. That's why we want to implementation that recognized system.

CHAPTER 4

EXPERIMENTAL RESULTS AND DISCUSSION

4.1 Experimental Setup

At first, we input the ORL and YALE data set in the using classifier the data matrix is spitted into 80% for train and 20% for testing the system for both data sets. Then 80% train data is again spitted into 50% for train and 30% for testing.

4.2 Experimental Results & Analysis

The input for the proposed methodology is a face image. Performance for the proposed methodology is given below:

4.2.1 Result for ORL dataset

Number Of component	Accuracy		
	PCA+ KNN	Overall Accuracy for Model Selection with PCA+SVM	Overall Accuracy for Independent test with PCA+SVM
20	68.89	86.67	86.67
30	73.33	88.89	86.67
40	73.33	93.33	90.00

Table:4.2.1 The performance of proposed method with PCA, KNN, and SVM

4.2.2 Performance Analysis on ORL Database

ORL dataset built with 400 images. There are forty peoples each person has 10 images. Those faces are centrally aligned. Among those 400 images 80% is used for train and 20% is used for test. In KNN classification k=3 is used. For classification SVM classifier is used. Independent test is performed for SVM with 20% test data. PCA transforms face images onto Eigen faces. But not all the Eigen faces carry relevant information. Some of the Eigen faces carry noise. So, considering all the Eigen faces will make difficult for the classification algorithm. So, principal components are selected based on cumulative variance. As cumulative variance increases, the number of principal components also increases.

4.8 Discussion

Face recognition works well in all techniques. But with the change in the number of features the performance increases and decreases. For both datasets performed accuracy shows that with minimum features PCA+SVM and PCA+KNN works best and between KNN and SVM classifier SVM performed well. With the increase of features PCA+SVM and PCA+KNN technique gives better performance. PCA have poor performance with minimum features or small datasets. PCA performed well in large dataset with respect to another algorithm. If, feature increased in PCA After certain point of increase in feature with the increase in the feature recognition rate decreases in all the techniques in this research.so PCA have some lacking when the number of features is high.so we will work with some other Method like LDA in future. we will see how that works with PCA.

CHAPTER 5

IMPACT ON SOCIETY, ENVIRONMENT AND SUSTAINABILITY

5.1 Impact on Society

Face acknowledgment has become a significant issue in numerous applications. It also useful to interaction with computer easily .in this work some changes are follow in our society if we maintain that's types of work. there is also some bad impact on the society because behind all good works have a side impact. Now we discuss about good impact on our society.

- In this face recognize system we easily recognize a people for Varification or his passport number and different types of information about him/her.
- To use the recognition system, we easily find a people in the social media or others. Nowadays Facebook also use that system .so it is easy to find a people.
- Now days security is the most important thing, in our personal security is very important, so now days we use face lock for protect our mobile or personal computer and that types of lock maintained by the face recognition system.
- To use the face recognition system, we easily find the missing person.
- To use that application, we prevent retail the crime in our society.

There is also some bad impact for our society if use that application bad way,

- To use this recognition system personal information can be leak by others.
- Now days Facebook use that application and to find the face easily and auto tagged to his/her profile.

5.2 Impact on Environment

Face recognize system is an application to recognize people face easily. There is none a bad impact on our environment.

If we use the system many works will done by easily, people work from home and that system people cannot do crime easily that was very good impact on our society.

5.3 Ethical Aspects

Every work has some ethical issue. there also some an ethical aspect on that work.

- People have monitored by the smart video surveillance that are CCTV. To use CCTV all are recorded and easily find.
- Now days CCTV are used is the airport, mall, and public place, house and many other places to reduce crime.
- For the surveillance crime are reduce in our society, for surveillance people can easily monitored by the camera and recognition system easily find the people.

5.4 Sustainability Plan

In our work we use some database that are stored some picture and use some algorithm to find people face earlier. we use ORL and YALE dataset for the recognition system.

- In future we want to use random picture for the system and find the presentences of find the people
- We collect some video to find the rate of recognition face from that video.
- In our thesis work, no face detection techniques have been used. Performance can be improved of face recognition. So, in future efforts can be made for geometric alignment, face detection and for robust face recognition.
- so, we have plan to use PCA+LDA combination in future.
- We have also plan to add MRMR feature selection method to our work.
- In future we maintained our accuracy rate for the face recognition.

CHAPTER 6
SUMMARY, CONCLUSION, RECOMMENDATION AND IMPLICATION FOR FUTURE RESEARCH

6.1 Summary of the Study

Face acknowledgment has become a significant issue in numerous applications. It also useful to interaction with computer easily .in this work some changes are follow in our society if we maintain that's types of work. there is also some bad impact on the society because behind all good works have a side impact. Now we discuss about good impact on our society.

6.2 Conclusion

In this work an effort was made to recognize face using PCA for feature extraction. Classification is performed by KNN and SVM classifier. To get better accuracy with a smaller number of features we used cumulative co-variance. Recognition is run on the KNN classifier which is based on Euclidean distance measurement and SVM which is based on kernel function. The shortest K components are first selected and then the majority of the k item's classes are labeled as the predicted class level.

6.3 Implication for Further Study

Although the recognition rate is good in the given techniques, but still has few limitations such as: There are some limitations of PCA face recognition. Its recognition rate decreases when illumination and pose variation occur. These models are not robust when dealing with extreme change of expression. The faces need to be centrally aligned for better performance PCA.

6.3 Implication for Further Study

In our thesis work, no face detection techniques have been used. Performance can be improved of face recognition. So, in future efforts can be made for geometric alignment, face detection and for robust face recognition. And we have also faced some issue with PCA when the number of features is high.so we have plan to use PCA+LDA combination in future. we wanted to do it now but because of covit-19 we could not finish our work in time. We have also plan to add MRMR feature selection method to our work.

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