FACE DETECTION AND RECOGNITION USING IMAGE PROCESSING

Project report submitted in partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

By

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UNDER THE GUIDANCE OF
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…….

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MAY 2018

DECLARATION

I hereby declare that the work reported in the B-Tech thesis entitled **" FACE DETECTION AND RECOGNITION)"** submitted at **Jaypee University of Information Technology, Waknaghat India,** is an authentic record of my work carried out under the supervision of **Dr. Nishant Jain** . I have not submitted this work elsewhere for any other degree or diploma.

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Date (21-05-2018)

CERTIFICATE

It is certified that the work contained in the project report titled "**Face Detection and Recognition Using Image Processing**," by "Virender Singh and Vimal Choudhary," has been carried out under my supervision and that this work has not been submitted elsewhere for a degree .

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ABSTRACT:

We are going to present a system which can estimate the size of the crowd detect the faces and can recognize them this system also introduces a new approach for the attendance in which the attendance will be done only by images. We propose it using face detection and recognition algorithm . Fisherman Faces algorithm is one of the algorithm by which we are going to implement our system which can automatically detects and recognize persons attending a lecture without interfacing the regular teaching process. It is very beneficial and very less time consuming. However there are many methods available today for the attendance of the student and employee like RFID scanning and Biometric scanning but our interest is in the images of the object, By processing those images by our system we would be able to get the desired results.

A key factor for improving the quality of the education is having the students attending classes regularly. Traditionally the students are stimulated to attend classes using the points the attendance which at the end of the semester constitute a part of the final grades. Traditionally this present work is performed by teachers and there is chance of human error as well as it waste a significant amount of time. Our main motive is managing attendance using image processing techniques. Our system is going to implement it by using a digital camera installed in the classroom. Which scans the room, detect and extract all faces for the acquired image. After that it matches it with the data set of images and on successful recognition, a list is generated consists of present student in the class.

CHAPTER 1

INTRODUCTION

1.1 PRESENT ATTENDANCE MANAGEMENT SYSTEM :

In present **A Learning management system (LMS)** is a software application for the administration, documentation, tracking and reporting the delivery of educational courses and training programs. It is used to track student progress and mange record keeping. It is used to deliver courseware an popularizing e-learning in schools, colleges and other institutions. In the last few decades companies have been using learning management system to give training to internal employee and customers. It links student /employee to the organization on the go . LMS also sets the goal for the organization. In today mostly the attendance of the students attending the lecture is done manually and then manually uploaded in the LMS.

1.2 PROBLEMS IN PRESENT ATTENDANCE MANAGEMENT SYSTEM :

LMS doesn’t fit our existing administration. Our LMS doesn’t provide the reports we need. Our LMS have all the manual operations. It is very much time consuming and chances of human error in that is so much.

1.3 AIM OF THE PROJECT :

We are going to develop a face detection and recognition system which is very much insensitive to the big variation in the direction of the light and facial expressions. Taking patterns from the classified approach, we are going to consider each pixel in an image as a coordinate in a high dimensional space. We are going to take advantages of the observation of a particular face under varying illumination but the pose will be fixed .Rather than explicitly modelin , we linearly project the image into a subspace in a manner which discounts those regions of the face with the large deviation. Our this project is based on Fisher’s linear discriminate and produces well separated class in a low dimensions subspace, even under severe variation in lighting and facial expression. The Eigen Face technique is another method based on linearly projecting the image space to a low dimensional subspace, has almost similar requirements. The Fisherman’s Faces algorithm has less data rate than Eigen face technique.

CHAPTER 2

LITEARTURE REVIEW ON CROWD COUNTING

2.1 INTRODUCTION: Most modern systems use many methods to count the crowd or to have the attendance of the persons present attending any event and to recognize a face. In some areas classrooms are equipped with a Barcode Scanner or RFID scanners. Some does it manually. Many organizations use Fingerprint scanners to have the attendance of the employees. The problem with these approaches is that they are very much time consuming and chances of human error is so much in that. One big problem is the proxy that is done by student or employee in the absence of the real one.

2.2 TYPES OF CROWD: There are two types of crowd Homogeneous and Heterogeneous crowd .

2.2.1 HOMOGENEOUS CROWD: These crowd may be anonymous like parliamentary assembles, people present in the stadium, random street crowd, crowd present in very large amount. Identification of a person in image in this type of crowd is very difficult. The homogeneous crowd is shown in IMAGE 2.1.

IMAGE 2.1

2.2.2 HETEROGENIOUS CROWD: These crowds are sects, cast and classes. These type of crowd is small in size. Identification of a person in this type of crowd is very easy .Heterogeneous crowd is shown in IMAGE 2.2.

IMAGE 2.2

2.3 METHODS TO DEAL WITH DIFFERENT TYPE OF CROWD :

We have different methods to count the number of people in crowd and to recognize the faces from that crowd, To have attendance of the crowd many organizations use RFID scanners[2]. Biometrics (fingerprint recognition, iris recognition etc) to identify users are time management systems used in many institutions. However, installing these systems in every classroom in a university would pose a bigger financial burden and using this type of system is very time consuming and chances of fake is high .

2.4 TYPE OF CROWD USED FOR CURRENT STUDY:

In our study mainly we will use heterogeneous crowd (Students present in a classroom or Lecture theater or any persons in any background) in some cases we will use homogeneous crowd (Crowd present in auditorium during the Festival season).Any example of image used for our study is shown on IMAGE 2.3.

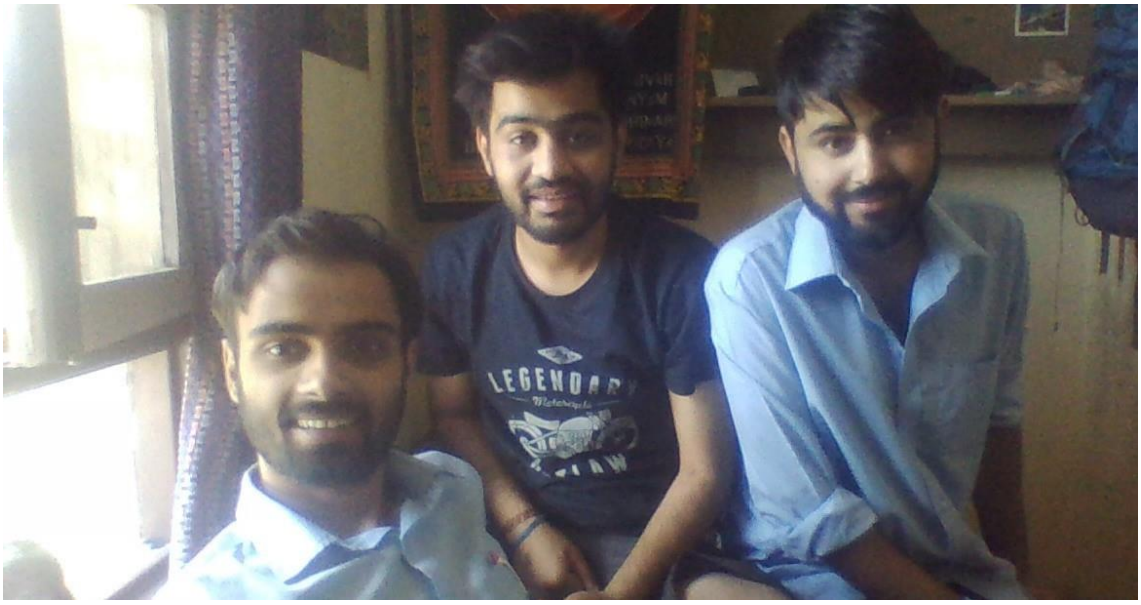


IMAGE 2.3

CHAPTER 3

DATASET COLLECTION

3.1 INTRODUCTION: We collected collected data for our current study we see in our daily life. For this we took data in any random area by capturing images of different persons with different changes, since there could be a difference in a images on the basis of contrast, brightness, lighting condition, camera specification. we applied our algorithm to a set of data set by us and then we are going to take some observations how well our algorithm works on different images with different conditions..

3.2 PLAN PROPOSED: Our plan is to capture image of a person using digital camera. We will capture multiple images of the person. Then the images will be accessed and processed using image processing techniques to detect and recognize the face . It will be a time based. We can also use our algorithm for the automatic attendance system. By attaching 1 fixed camera in the Classroom faced toward the crowd in our case crowd is students present in the classroom The camera would start taking picture as soon as the class starts to commence.

3.3 THEORITICAL CONCEPT: The variance between faces in the database may come from distortions such as illuminations, facial expressions, and variation of poses and sometimes, these variations can be larger than variations among standard faces. Images of the particular face, under varying illumination but fixed pose, lies in a 3D linear subspace of the high dimensional image space. It is like without shadowing. The general idea is try to find a basis for projection that minimize the intra-class variation but preserve the inter-class variation. Rather than explicitly modeling this deviation, we linearly project the image into a subspace in a manner which discount those regions of the face with large deviations.

Inter- class :$||m1 - m2| = wT(m1 - m2)$

Intra class : $si2\sum$(y-mi)2

Want to maximize : $J(w) = \frac{|m1-m2|2}{s12+s22}$

$$y, m1, m2: [\quad | \quad]1\ (wTx - wTm1)[\quad | \quad]1$$

$$x, w.m1, m2: |sb, sw: [D]D$$

$$\tilde{s}_i^2 = \sum_{x \in D_i} (w^T x - w^T m_i)(w^T x - w^T m_i)^T = \sum_{x \in D_i} w^T (x - m_i)(x - m_i)^T w = w^T S_i w$$

$$\tilde{s}_2 + s^2 = w^T S w + w^T S w = w^T S_w W$$

$$|m_1 - m_2|^2 = (w^T m_1 - w^T m_2)^2 = w^T (m_1 - m_2)(m_1 - m_2)^T w = w^T S_B w$$

want to maximize: $J(w) = \frac{w_T S_B w}{w^T S_w w}$

$$S_B w = \lambda S_w w$$

3.4 CAMERA SPECIFICATION: The camera must be above 5 Megapixels. It can be a Ordinary QVJA camera also. In our study we have uses 8 Megapixel camera , 12 megapixels camera and 50 megapixel camera. It can be of any brand manufactured in any country. As the size of the classroom increases we have to increase the camera Megapixels to have the accuracy in the result. The plan was to check what effect comes with the change in the quality of the camera resolution and how our algorithm is going to perform with those changes. A typical camera used in our study is shown in IMAGE 3.1.

IMAGE 3.1

3.5 IMAGE COLLECTION: For our present study we have collected images of different persons for our database under different conditions in different background in different time intervals. After that we are going to process that image by our face detection algorithm. We also have taken pictures in different orientations to check the algorithm efficiency as well as drawbacks. Our main motto behind the data set of images was to check whether it run on every picture in a same manner or a difference in physical attribute bring change to the output. Some examples of collected images for our database\gallery are shown in IMAGE 3.3 and IMAGE 3.4 .

IMAGE 3.3

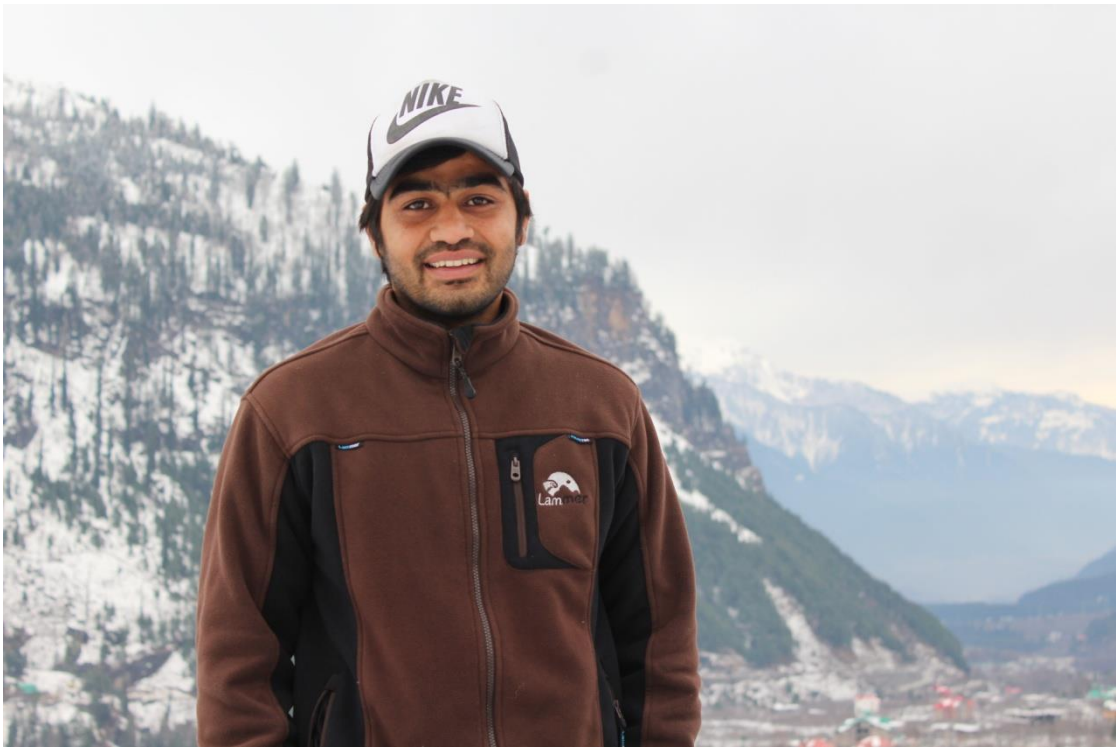


IMAGE 3.4

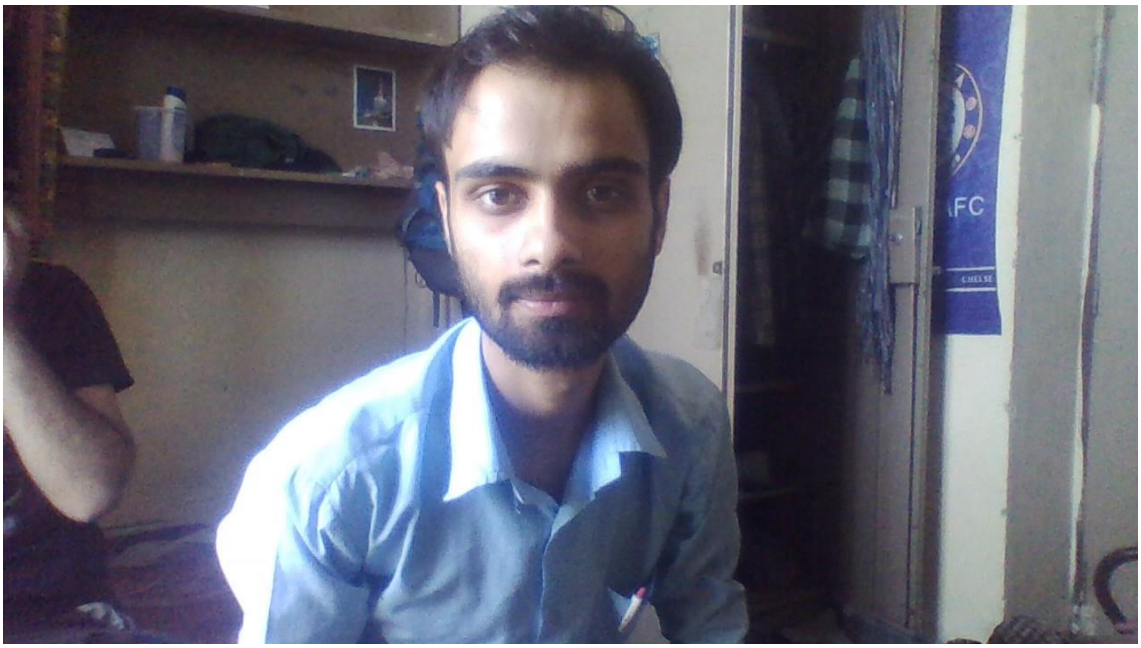


IMAGE 3.5

3.6 BACKGROUND: The background matters in image processing. Larger the background larger time will be used to process that image. The background we will use in our present study will be outdoor. It can also be Lecture theatre, Tutorial Rooms. The background should be clean with no light on it .It is the best condition for maximum efficiency .The color of background also play a important role in the processing of the image. An image with a dark background showed some positive results. Some backgrounds are shown in IMAGE 3.1 and IMAGE 3.2 and IMAGE 3.3.

IMAGE 3.1

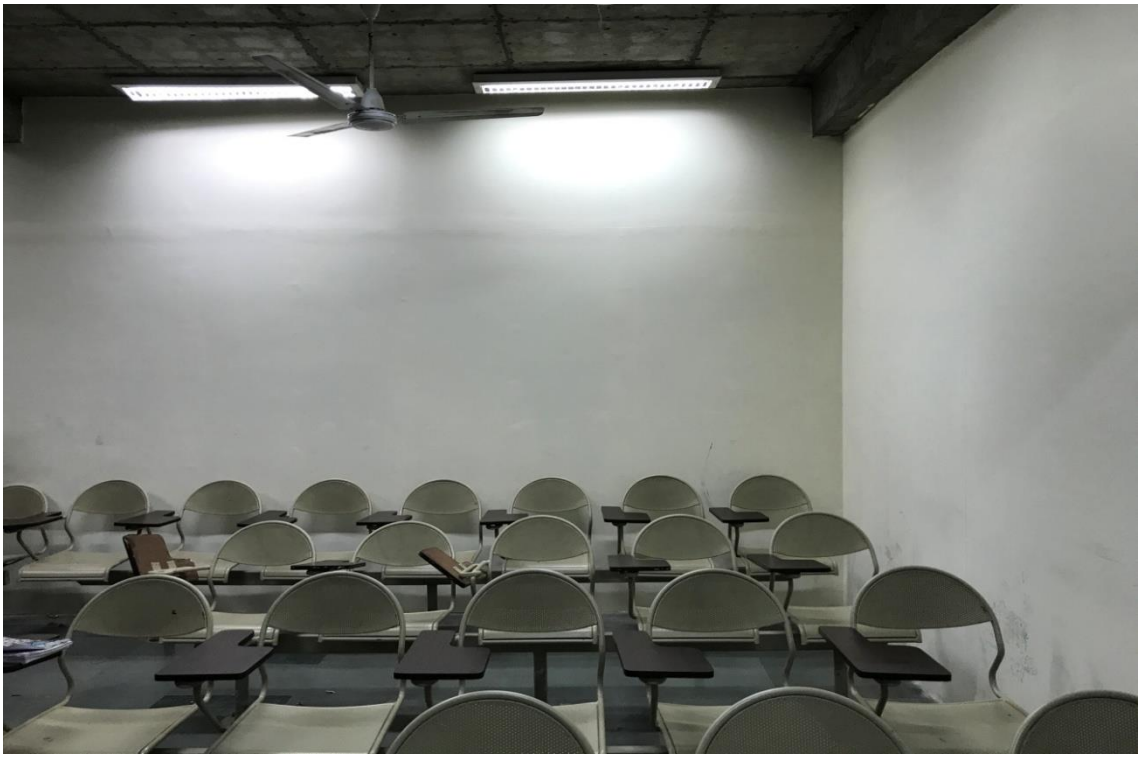


IMAGE 3.2

IMAGE 3.3

3.7 TYPES OF IMAGES :

3.7.1 TYPE1 IMAGE: Type 1 image we have captured in a outdoor in hills. In this we have a big background so it cannot be easily detected by the camera. We want to process that image in our system so that our system can recognize the face through it. Type 1 image is shown in IMAGE 3.3.

IMAGE 3.3

3.7.2 TYPE 2 IMAGE: Type two image we have a person on outdoor and in our database / gallery this person have a can on his head . Our interest is in recognizing face in that image without cap. This would help us understanding the complexity and the performance of our algorithm. Type 2 image is shown in IMAGE 3.4.

IMAGE 3.4

3.7.3 TYPE 3 IMAGE: Type 3 image we have collected from the University's hostel room. Our interest in knowing how our algorithm works with multiple faces in an image. Our motive is to test the accuracy of the algorithm in different condition. Type 3 image is captured from a laptop camera. With this we will come to know how our algorithm works with low resolution camera picture. Type 3 image is shown in IMAGE 3.5.

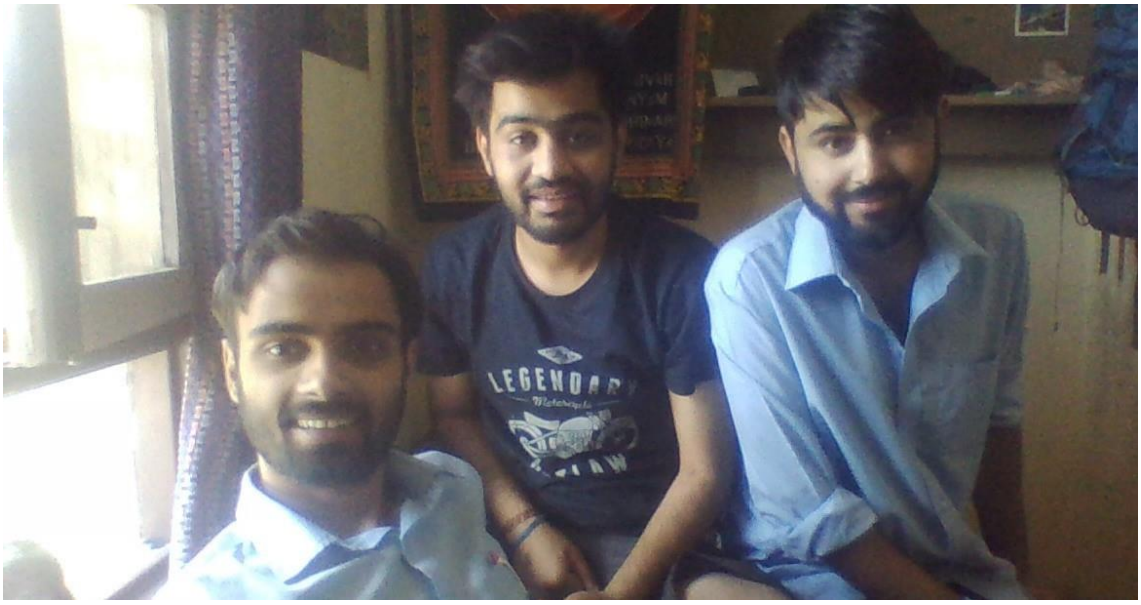


IMAGE 3.5

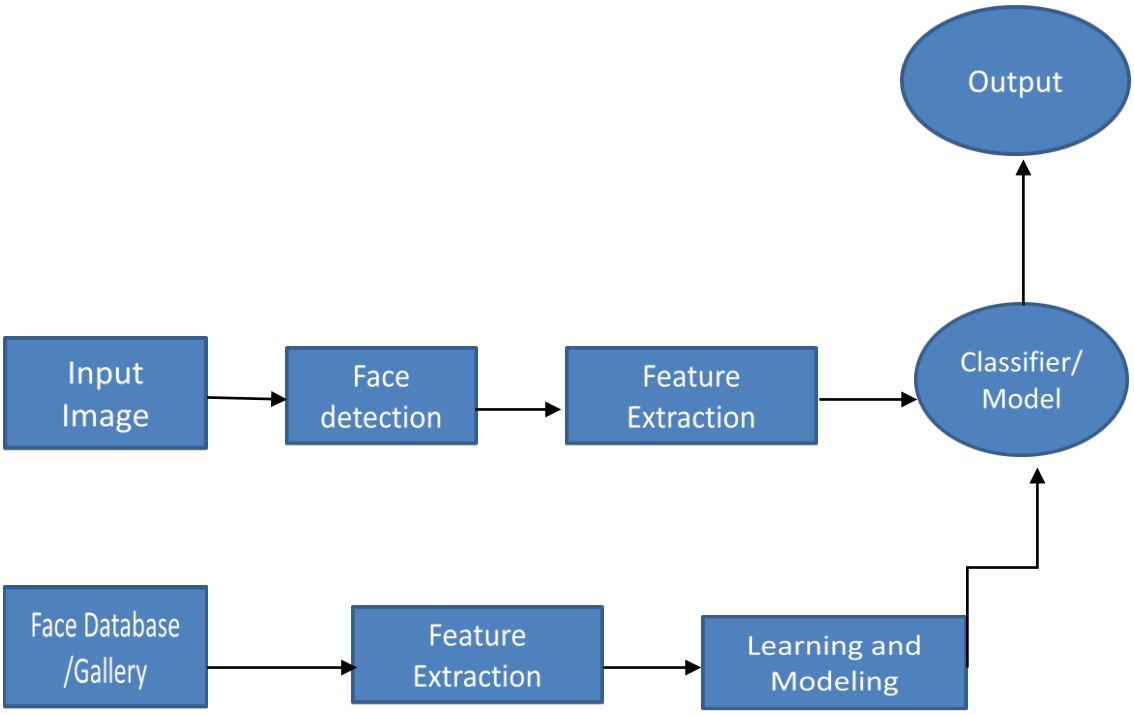
CHAPTER 4

METHODOLOGY FOR DESIGNING THE SYSTEM

4.1 INTRODUCTION: The need for the operation is a system. Which can get image as an input perform some operations in it and produce output in the form of recognition of faces. For the designing of the system we need to apply various image processing operations on the image like subtracting the desired object from the background to having the clearly view of the objects this is done firstly by creating color space transformation after that getting the skin area , setting appropriate threshold value , finding density ,getting its mean, counting number of people extracting feature of that image and matching that input image feature with the feature of our database images. This is a method we want to work with .We are going to implement this type of system using Fisherman Fishes algorithm. We are going to implement this in Matlab.

Knowledge based methods are based on human knowledge of the typical human face geometry and facial features arrangement. Taking advantage of natural face symmetry and the natural top to bottom and left to right order in which features appear in the human face, these methods find rules to describe the shape, size, texture and other characteristics of facial features (such as eyes, nose, chin, eyebrows) and the relationships between them (relative positions and distances). A hierarchical approach may be used, which examines the face at different resolution levels. At higher levels, possible face candidates are found using a rough description of face geometry. At lower levels, facial features are extracted and an image region is identified as face or non-face based on predefined rules about facial characteristics and their arrangement. The main issue in such techniques is to find a successful way to translate human knowledge about face geometry into meaningful and well-defined rules. Another problem of such techniques is that they do not work very well under varying pose or head orientations.

4.2 FLOWCHART OF THE COMPLETE PROCESS :



CHAPTER 5

EXPERIMENTS AND RESULTS

5.1 EXPERIMENTS WITH TYPE 1 IMAGE: Type 1 image is the first image we are going to use as out input to the algorithm .Type 1 image is shown in IMAGE 5.0.

IMAGE 5.0

5.1.1 INPUT IMAGE: Input image is shown in IMAGE 5.1. It is taken in a hilly background. In this type of picture we have person and one of their face is in our database. Our interest is in knowing the result obtained by this input image .

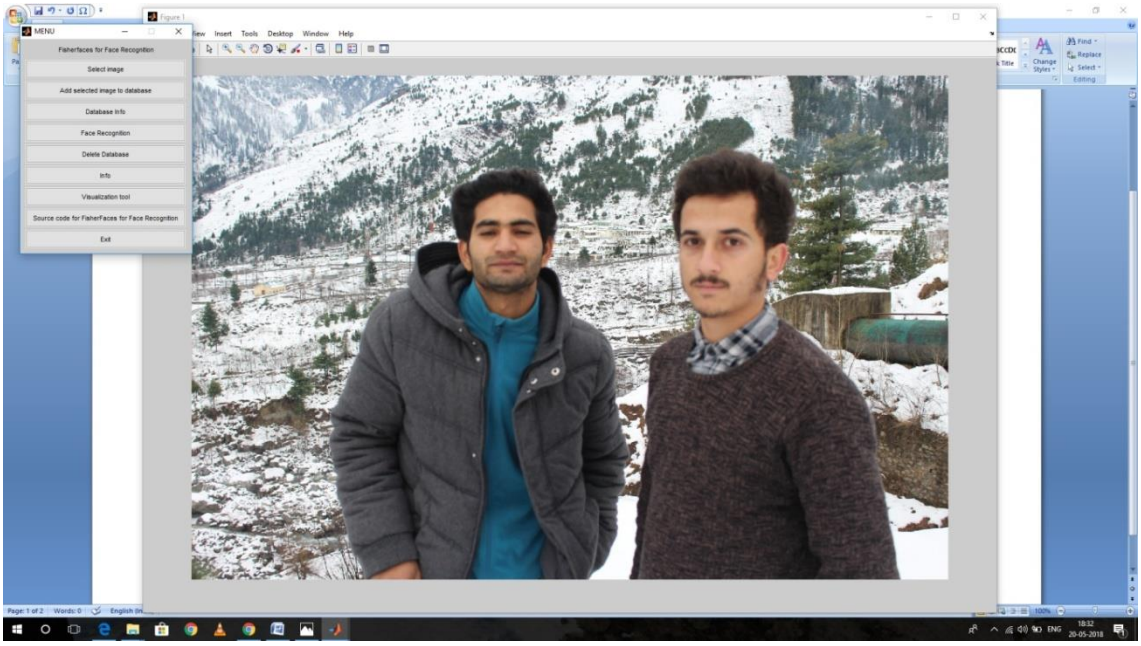


IMAGE 5.1

5.1.2 OUTPUT IMAGE : The output image is shown in IMAGE 5.2 .

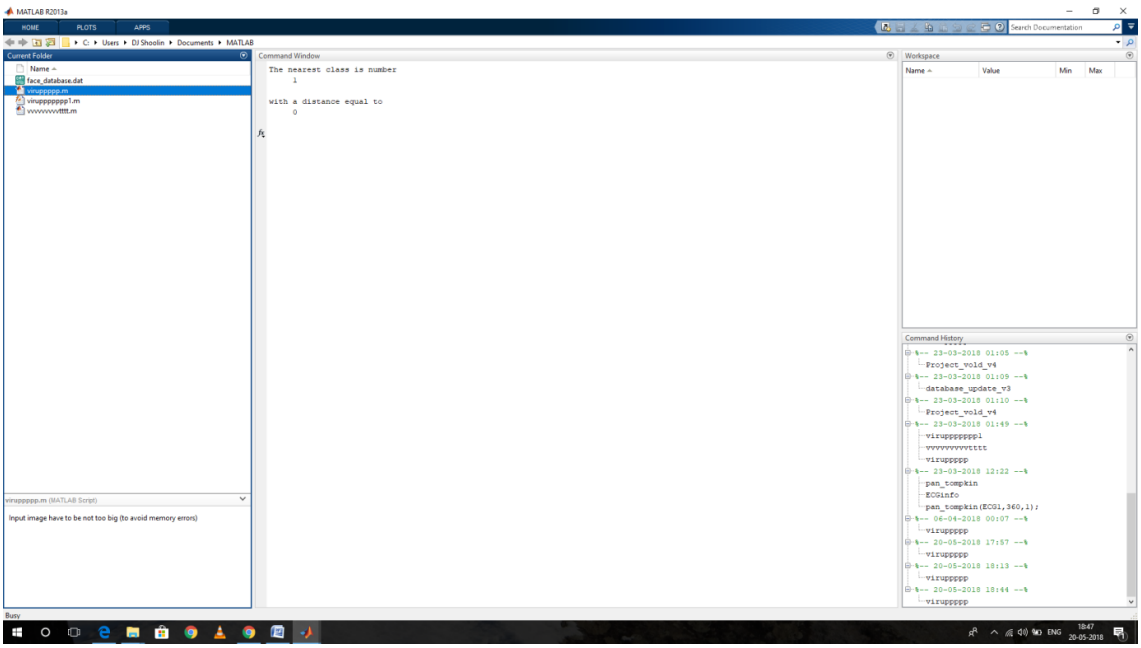


IMAGE 5.2

5.2 EXPERIMENT WITH TYPE 2 IMAGES:

Input image is shown in IMAGE 5.3. In this type of image a person standing in outdoor hills .His face is in our database but there he is wearing a cap on his head. Our aim is to test how accurately our algorithm recognizes that face. By this we will come to know about the capability of our algorithm in recognizing the face when there are certain in the physical attributes.

IMAGE 5.3

5.2.1 INPUT IMAGE: Input image is shown in IMAGE 5.4. In this image a person standing outdoor hills. We have his face in our database but in that database he had a cap on his head. We want to test the accuracy of our algorithm.

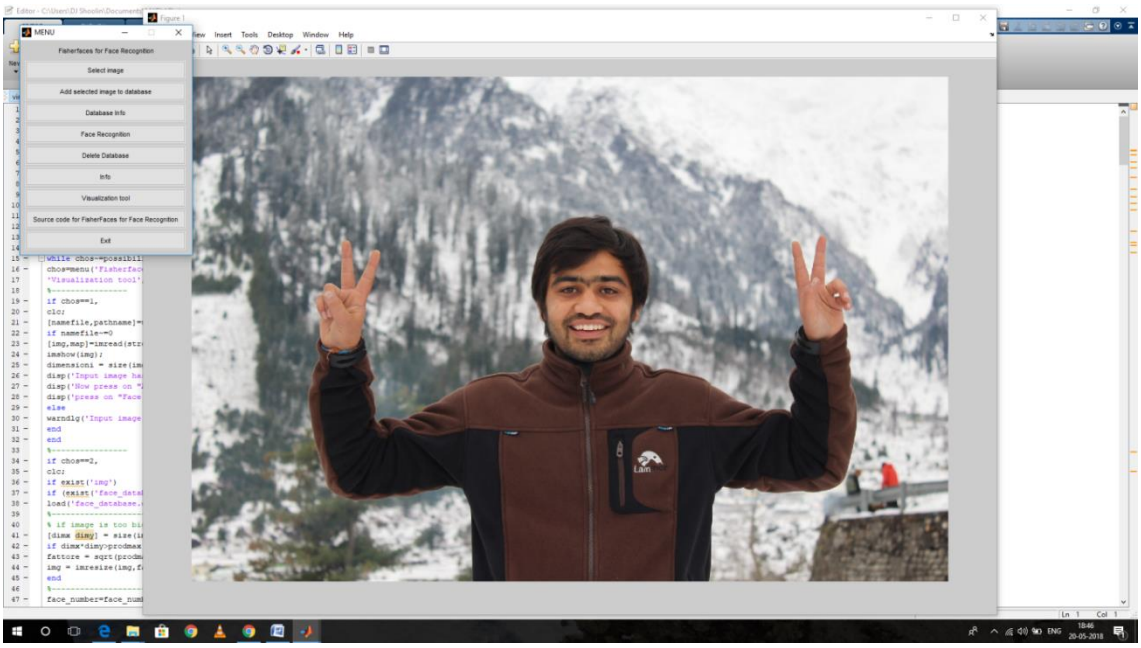


IMAGE 5.3

5.2.2 OUTPUT IMAGE: The output image is shown IMAGE 5.4. In database we had given him identity 2. It will be interesting to see weather our algorithm is able to recognize that face or not.

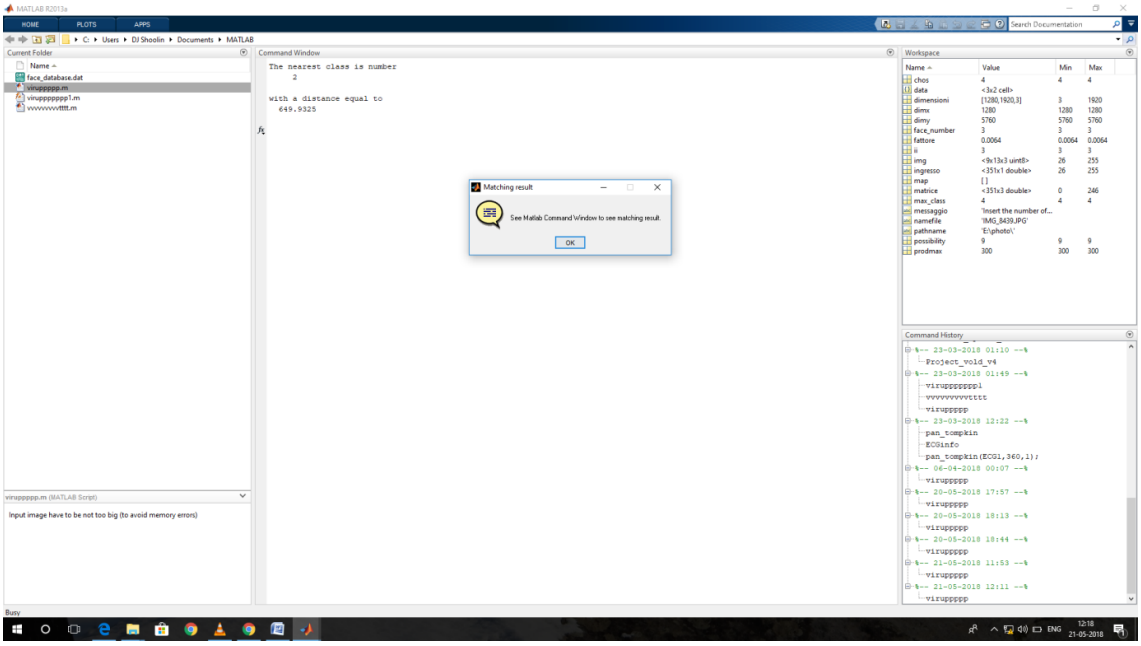


IMAGE 5.4

5.3 EXPERIMENTS WITH TYPE 3 IMAGE: In Type 3 Image we have large randomness . There are three persons in that image. We are going to take this image as an input to our system. One of them is in our database. Our interest is in knowing weather our algorithm is able to detect and recognize the face when there are many persons. Type 3 image is shown in IMAGE 5.5.

IMAGE 5.5

5.3.1 INPUT IMAGE: The input image taken is shown in IMAGE 5.6.In this type of image the background is indoor, different from the previous images.

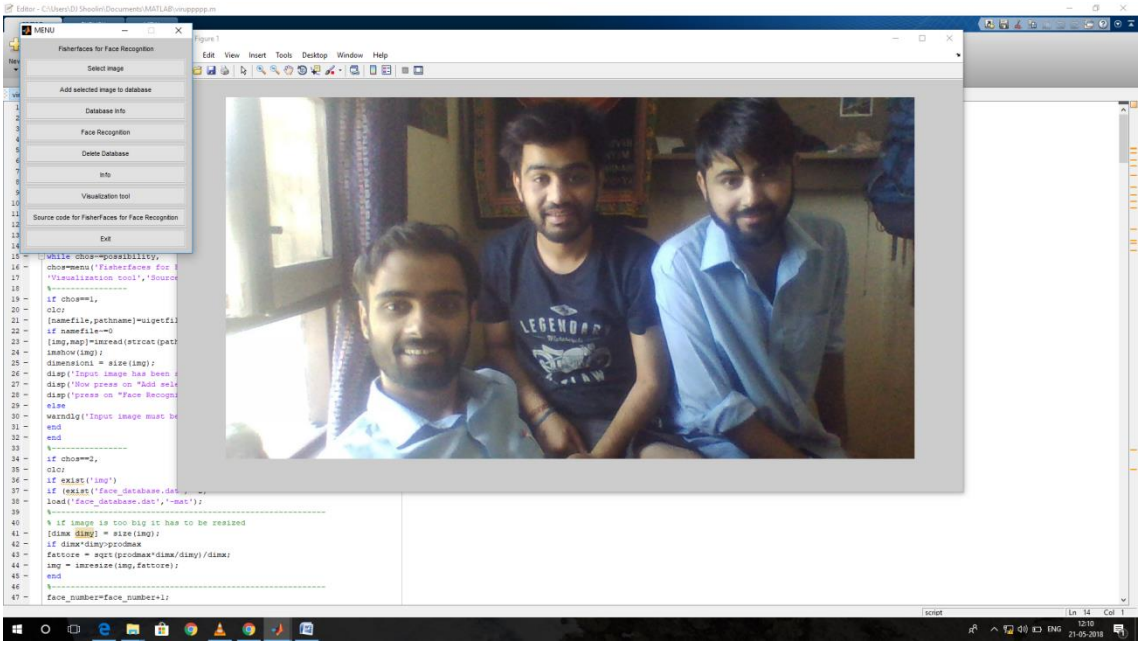


IMAGE 5.6

5.3.2 OUTPUT IMAGE: After creating a new database away from the hills. We had given the database face number 1. Output of the image is shown in IMAGE 5.7.

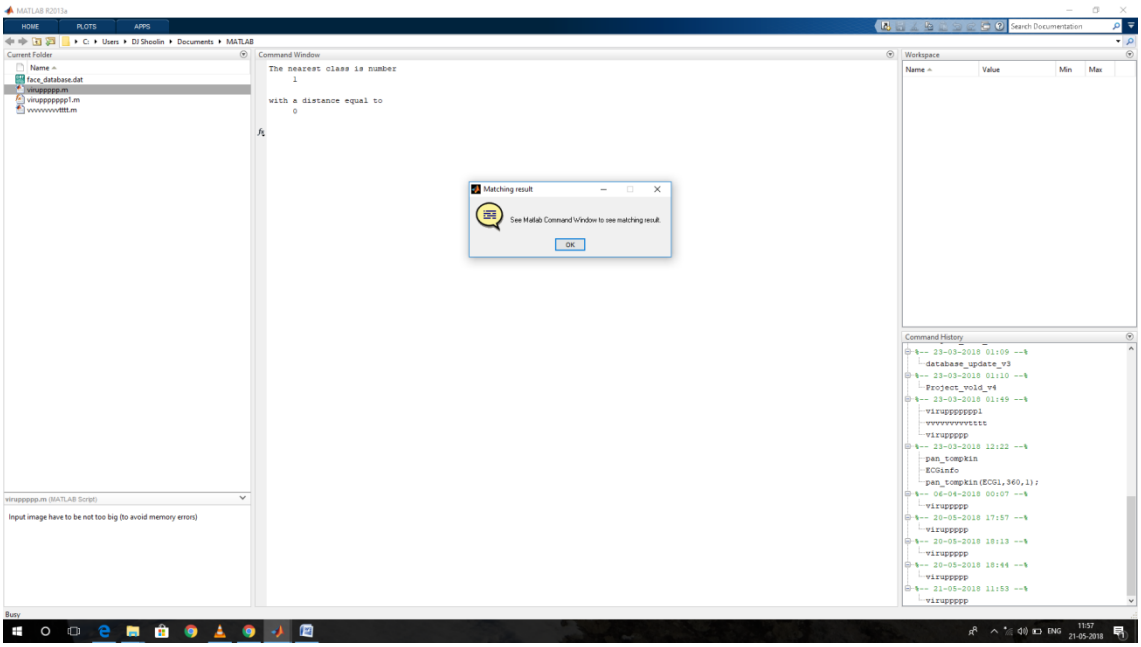


IMAGE 5.7

CHAPTER 6

DISCUSSION ON RESULTS

Here is a table of results obtained by our algorithm.

	TYPE 1 IMAGE	TYPE 2 IMAGE	TYPE 3 IMAGE
No. of faces	2	1	3
Face detected and recognized	Yes	Yes	Yes

Table 6.1

6.1 TYPE 1 IMAGE: Result is shown in IMAGE 6.1 and IMAGE 6.2.

In the 6.1 image there is one person in a hilly outdoor. Our Aim is to check weather this face matches with our data base in other word we can say that we want to test weather our algorithm works properly or not . It was the first time we are going to measure the performance of our algorithm and it performed well. We had giver serial no.1 to that person in our data base.

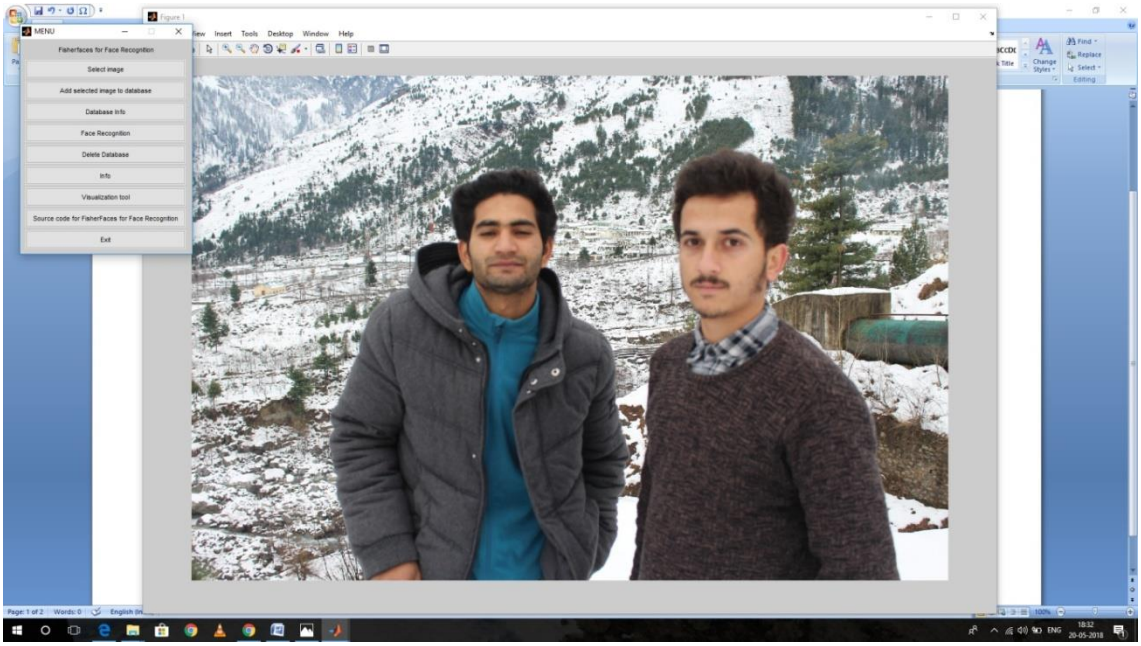


IMAGE6.1

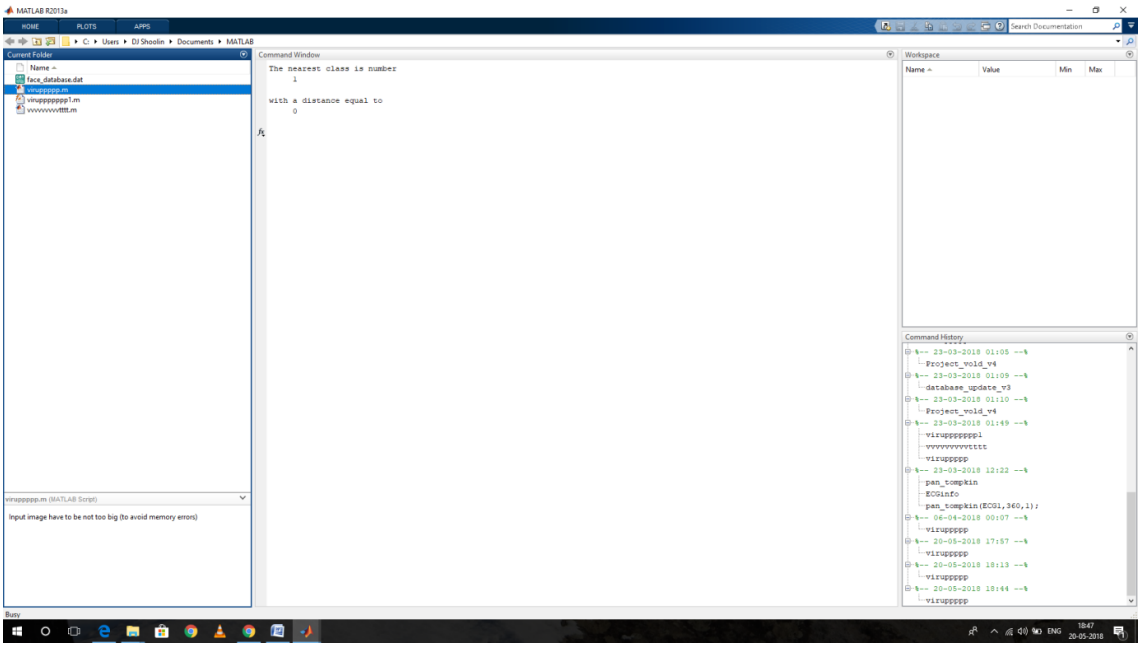


IMAGE 6.2

6.2 TYPE 2 IMAGE: Result is shown in IMAGE 6.3 and IMAGE 6.4.

The image 6.3 and IMAGE 6.4 show a positive result. When we were creating database for our study we clicked that person with a cap on his head. Our motive was to check weather our algorithm recognizes that face and how our algorithm is going to perform in that kind of situation where there is something different wearing in the images of the database and input1. We had given no.2 in the database and in output we can se that our algorithm again performed well in that conditions. It successfully detected and recognized the face.

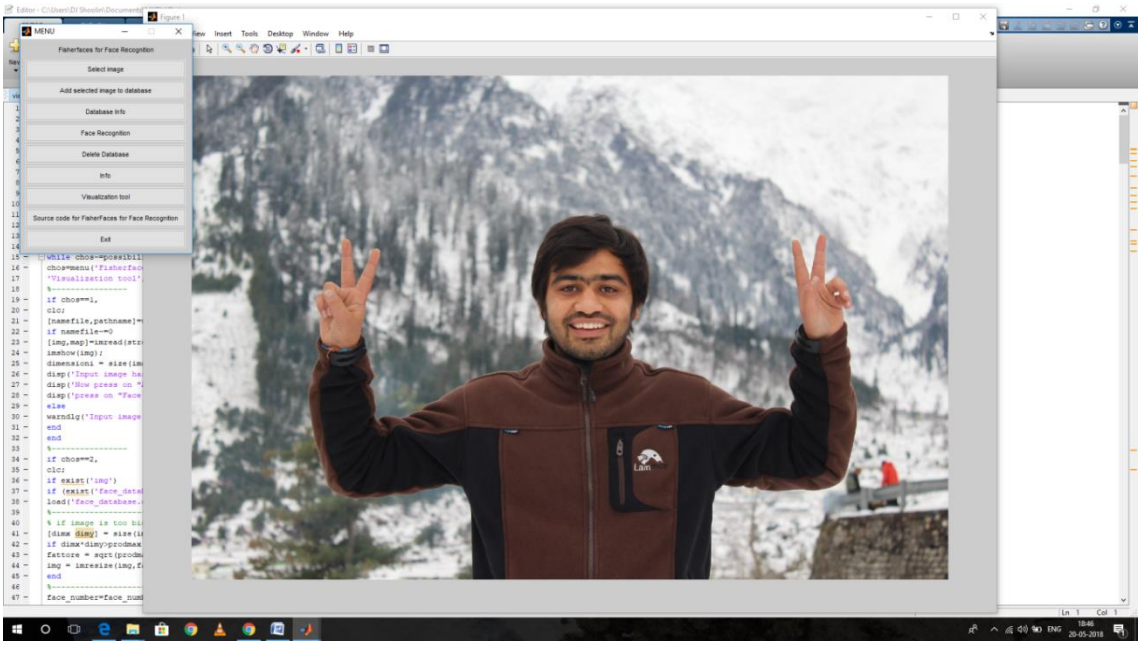


IMAGE 6.3

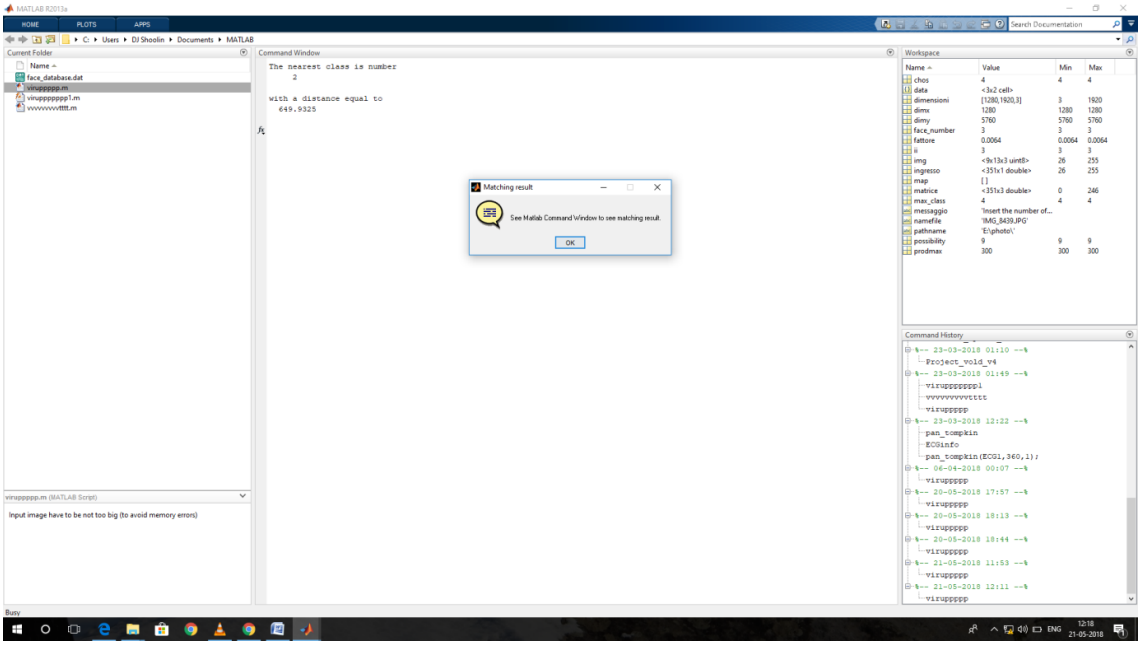


IMAGE 6.4

6.3 TYPE 3 IMAGE: Result is shown in IMAGE 6.5 and IMAGE 6.6.

This picture is taken inside the university's hostel through a low resolution camera .By this we will come to know the accuracy of our algorithm when there are multiple faces in the background will be indoor. The image can also be during the night time so the lighting conditions are very poor. Also the picture has random subjects in arbitrary positions. The background was dark but our algorithm recognized the face successfully.

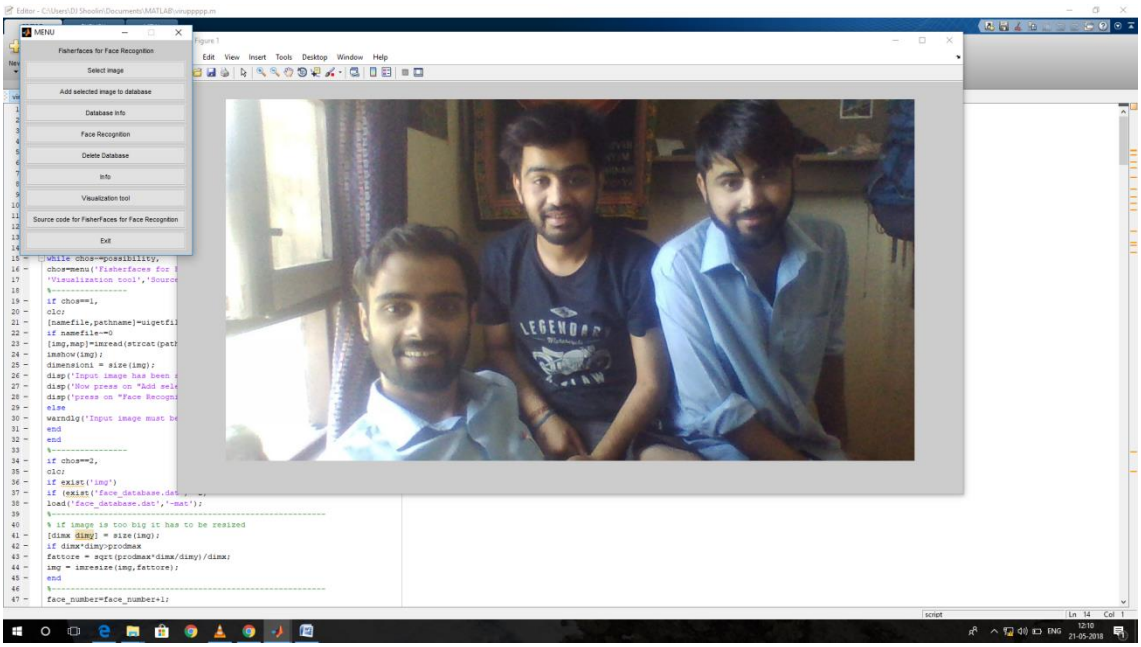


IMAGE 6.5

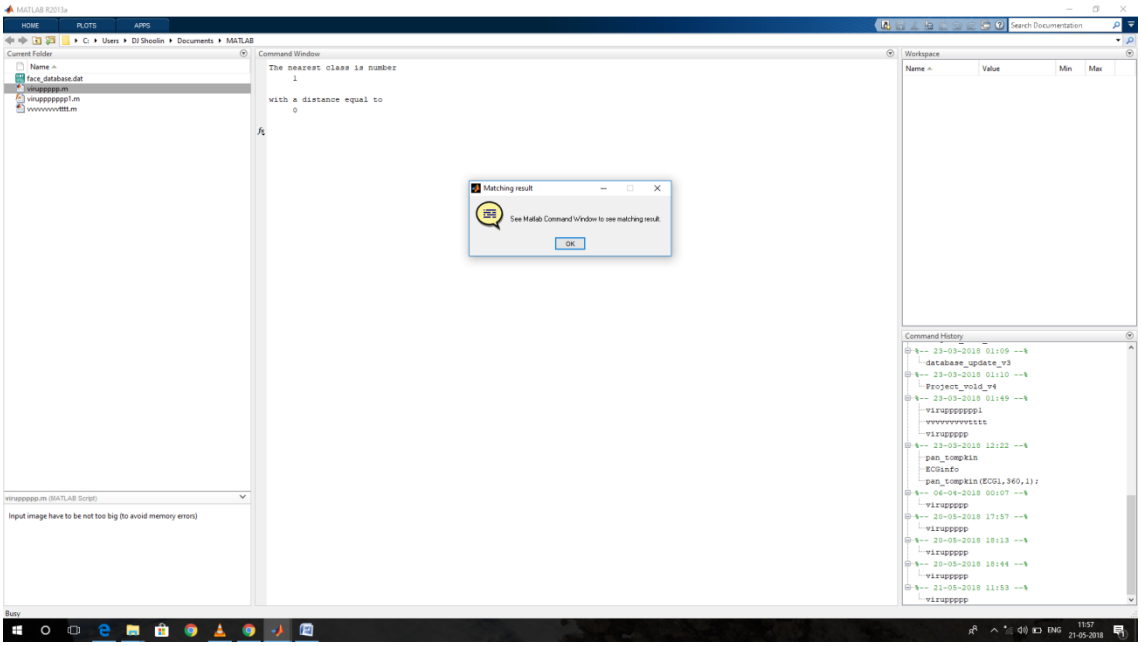


IMAGE 6.6

CHAPTER 7

SCOPES AND APPLICATIONS

7.1 SURVEILENCE SYSTEM:

The system can be used as a personal security system. This can be popular with students who can't afford insurance. Students are constantly the victims of burglary as found by the crime statistics report15. The system is available for free of cost (see section 11). Students can leave the system running when they leave the room. If the burglar enters the room the system will start doing its job. Even if the burglar steals the PC running the system an email will be sent. If the student sees the e-mail he can directly call the police and the burglar may be caught. Also, the system as we see at least provides some sort of information which then can be passed to the police as evidence.

7.2 SHOPLIFTER ALARM:

The system can be used at the entrance of supermarkets. Most of them have a database of known shoplifters. It's the duty of the security personal to keep checking that none of those persons have entered the premises and if they have they are being monitored. This is not practical as most of the times the shop lifters change their appearances by wearing glasses, caps etc. (This problem was found by conducting a meeting with the regional managers of Sainsbury's). The system can compare all the customers entering the premises with that database automatically. If a shop lifter is detected the security can be informed by the method described in section 6.3. The only issue is that the camera has to be facing the customers as they walk in so that it can approximate capture profile view of their faces.

7.3 SMART ROOMS:

Currently most of the smart homes16 rely on user input. When the user enters the room and if the system is running the room can be personalized automatically according to user's preference rather than waiting for the user to input. Personalization can be defined as the room's temperature, lighting color, dimmer settings, curtain settings, music being played, photos being displayed on digital photo frames etc. If two users are detected then the algorithm may be complex enough to set the room's ambience which takes equal elements from both of the users likings. The information containing who is in the room can be extracted from our system by another function.

CHAPTER 8

CONCLUSION

INTRODUCTION: In our study we have found that our algorithm performed well with different types of images .We were Working on this algorithm and how we can come with the better and the modified version. We finally did it using Fisherman Faces algorithm . Ye can also use this algorithm in different applications described below:

1 Automatic attendance management system: In this we have to install 1 camera in the classroom then when the class will start the camera will take picture of all the students and after that those images will be processed by our algorithm and by the output of our algorithm will tell us the whole attendance.

2 Random reorganization: Our algorithm can also be used as to recognize any person in randomness. When sometimes detection is needed of a particular thing.

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