

Motioned Facial Recognition from Live Feed for Surveillance Solutions

Sarah Bal, Anmol Kalra, Rishi Kumar

Abstract— The paper focuses on how face recognition can be done on live video stream (using a webcam-inbuilt or USB attached). The live video is checked for any human face. If a human face is detected, a rectangular box is formed around the face. If nothing is found for the face detection method, a text box showing the error is presented in front of the user. If the face is detected this face is then matched with the already saved database which was priorly created having images of different faces. This is the training database which is then matched with the face image extracted from the live video stream. Initially the project shows the process of face detection and matching procedure from images and then proceeds to face recognition and matching through a live video streaming. The live video here considered is the webcam, the face is detected through the webcam and if any match is found from the train database previously stored in the computer or the device is found then both the detected image and the current image are displayed on the graphical user interface. The GUI being made consists of three axes windows, one showing the continuous live streaming of video, the second shows the screenshot or singular frame of the face detected in the live stream and the third has the image got from the database that somewhat matches to the current image being displayed. The two databases are there, one the train database where the images of different faces of people are stored which would then be used for matching from live video stream for the purpose of security and authentication. The test database consists of the images that are being received from the live video stream, the video stream as soon as it detects the face of human, takes the snapshot of the frame and saves it to the test database, these images are then checked for authentication by matching them with the images in the train database.

I. INTRODUCTION

The aim of video surveillance system is the safety of public, to detect and deter criminal activities. [1] These systems are being installed everywhere (in elevators, hallways, shops etc). [2] Detecting objects and recognizing faces from a live video stream is the major step in video analysis. [1] Detection of the motion is generally an algorithm that is software aligned that orders the surveillance camera for starting the motion finding events-be it a face or any object.[2] The video captured by the camera is processed by Matlab.[2]

The research on the video based recognition and detection of faces or objects are contemplated as continuation and extension of recognition in still images that has been researched upon widely and many good results have been obtained too.[3]

II. FACIAL RECOGNITION

Face recognition either from video or from face has been quite popular in biometric research. It has played a wide role in

surveillance systems for security purpose.

It has been acknowledged widely because it does not need any object's cooperation. It is widely recognized over other techniques because of its unique nature and is also accepted everywhere. [12] Face matching networks that would be getting huge awareness from the private sector and from the pattern finding grounds. [3] There are two reasons accounting for the same: First is the vast range of commercial uses while other being practicable technique. The strong need of secure systems to keep our assets safe and to protect personal identity in sea of numbers is much needed. [10] For recognizing people one usually sees the face of person as faces differ one person from another. Face recognition methods usually record the spatial orientation of different attributes for person's profile. The major focus is at the main characters of profile of person. These methods are put for use in detecting and finding criminals, terrorists and others for law enforcement causes. [11]

Most of the work in face recognition is focused mainly on detecting face features like eyes, nose, mouth, head outline and the relationship among these given features. [13] Face recognition is always known to be a very challenging task. On one side the applications are quite purposeful in self-level of checking- matching but otherwise can prove to be difficult as the human face can be found in various different situations. [11] A lot of work has been implemented on face recognition from images. The face of the person is recognized from a given image by matching it with the present database. There are a lot of methods incorporated to do the same. The face recognition is done by feature extraction methods where the features like eyes, nose and mouth are considered. Feature extraction algorithms can be further of two types namely: geometrical character extrication, statistical character extrication. Statistical feature extraction is basically algebraic, method. For geometric method the profile will get shown as edifice calculations and special face attributes such as the distance and angles between the two eyes, nose. The mouth or face one like the nose width, nose position of mouth and chin kind. All such attributes were then checked for recognition of the unidentified profile by checking it with the closest neighbor from storage that has been stored previously. [14] The statistical features are calculated by methods that involve algebraic methods. The methods used for the same are Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA) etc. They check for a link within original face features places onto lesser dimension character place. [14] With terms of recognition of any individual, a folk generally sees the profiles of facial things, that differs an individual with other. Face recognition which has been widely put into use to searching for photos with similar attributes [5]. Eye of human basically tell in regards of who that individual could be, and regarding the individual's emotions and feelings [1].

Manuscript Received on May, 2014.

Sarah Bal, Amity School of Engineering and Technology, Amity University Uttar Pradesh, New Delhi, India.

Anmol Kalra, Amity Institute of Aerospace Engineering, Amity University Uttar Pradesh, New Delhi, India.

Facial checking networks spatial orientation on exclusive characteristics of human profile. The major focus of the task is on the characteristics of the face. These techniques are used for the identification of criminals, terrorist or any of the petty thieves. These are mostly preferred for the law enforcement purposes. Facial recognition is one of the cheaper and advancing technologies. In the process of facial recognition the two dimensional recognition method is altered by any kind of change is lighting, age of the person, hair, glasses if or not worn by the person, low resolution of images etc. [5] Camera is required as a tool for the identification of the user and thus it might be a problem for this technique to gain popularity as for that all the personal computers shall be equipped with camera as the standard device.

United States of America uses the same kind of technologies for the prevention of its citizens from acquiring wrong tokens of checking and driver's cards. This method proved as demanding job to researchers. The application in one end proves to as of utmost use for the personal use whereas on the other hand, it has always been very difficult in its implementation work because of all different phases in which a human face could be seen (the different emotions, face movements etc). Facial recognition can be termed as the way of computer vision which makes the use of faces for attempting to find a person or verification of an individual's proposed identity. Facial recognition has the following five steps for the same.

Step number 1: ACQUISITION OF IMAGE: there are two ways by which image can be acquired, these are: 1) Digital method for obtaining the picture; 2) get the real picture of the object.

Step number 2: LOCATING PICTURE OF PERSON: Application could be put to use for finding the individual profiles which are got from any of the two methods.

Step number 3: ANALYSING THE FACIAL IMAGE: Face is quantified through its peaks and valleys; focuses on the "golden triangle" which is the area of eyes and nose or area between these two.

Step number 4: CONTRAST OF TWO PICTURES: The copy made by the application was contrasted to other ones that were saved in the storage. [17]

A. Concept of eigenfaces:

Eigenfaces can be defined to be the character modules which could be used as the variations in the facial photos, these are the eigenvectors that are put to use for field of vision for the task of recognition. The location of each image furnish eigenvector such as the eigenvectors could be exhibited as a blurred image known as the eigen-face. The photo of an eigenface looks very little like a face. Each face is depicted as linear combinations of eigenvectors. [15][14]

The notion of using eigenfaces was extracted Sirovich and Kirby in the year of 1987 and Kirby and Sirovich (1990) for effective representation in individuals with PCA. Those had debated upon the fact such as any group of photos could roughly remade with saving minute amount of weights with all the photos also a minute extraction of photos. Weights that described the image was got with the marking the photo into every eigen picture. [15]

Before we start with the process of recognition, we firstly need a database of images with which the image would be matched.

Thus this eigenface approach of this has the initial moves as:

- [1]. Obtain basic pictures (face images). These images should have been taken under the same lightening conditions and same camera conditions for better results. The resolutions must be matched too.
- [2]. Compute the eigenfaces as of character group, putting just pictures that have been corresponding to maximum eigen-values. Here the average face is calculated. Each face difference is then calculated from the average face.
- [3]. These images now define the facespace. The eigenfaces were to be further reconstructed.
- [4]. Compute dimensional weight pace distribution for each of the individuals by marking photo into face space.[15][14]

Once the initialization is done the steps given are used for recognition:

- [1]. Compute the attribute group on basis of photos, eigen-faces with marking the initial photo till eigen-face.
- [2]. Check for presence of any face in the picture.
- [3]. Photo found forface, categorize method to be of stored face else of not stored face.
- [4]. Update the method as well as the eigen face. If there is an unknown face coming up several times, incorporate its weight into the other total weight along with other images.[15]

Eigenfaces show basic attributes in the group. Being urgent and crucial for easing out the checking method. Initially consider the average subtracted photo at storage then send to face gap. Going by logic, the profiles having same individual could be linked bounded closely with other for the face gap. Matching can be said as finding the closest image. [14]

Now, considering the situation where a new image is entered into the system, it can be recognized by three ways. First is by checking if it is a known image that is the image is previously present at storage, secondly photo was face or of some unmatched identity, and thirdly picture was nothing like a profile. [14]

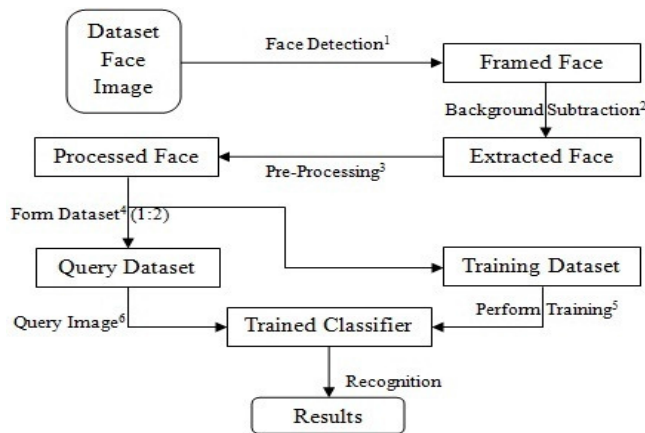
Being one of the widely spread and successful application, facial recognition has received a lot of appreciation. The reason behind the same is the large number of applications that are used in law enforcement or for commercial purposes too. The second reason is the scope of the workable technologies after many years of research being conducted. At present in all the fields a large number of security measures are needed like PIN for ATM, password for computers and million other things for the internet access. Fingerprint and retina recognition method are reliable biometric methods but they work only on the collaboration of the person or the worker. A personal identification system like face recognition does not need any of the worker's cooperation for the identification or any of the authentication methods.

The applications of face recognition are mentioned in the following table

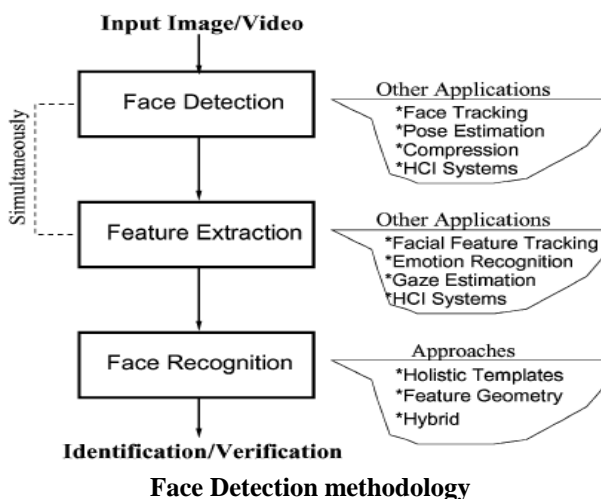
Applications of face matching

Areas	Applications
Entertainment	Video game, virtual reality, human robot interaction, training programming etc
Information Security	Personal device login, parental control, intranet security, file security, security for trading terminals, internet access.
Law Enforcement	CCTV cameras, portal control, suspected criminal tracking and further investigation
Smart Cards	Welfare fraud, driver's license, passports, voter cards

Face checking being the crucial thing in the living being's group, hence being a continuous process. [10]



Method for extraction



Face Detection methodology

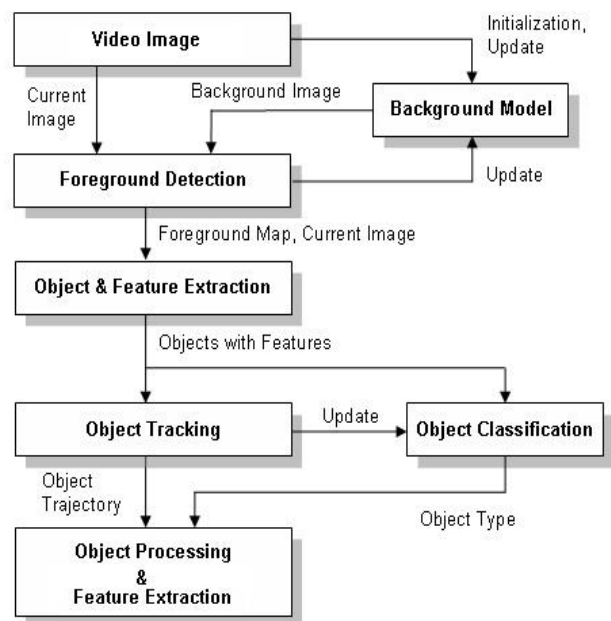
III. DESIGN AND IMPLEMENTATION SOFTWARE USED

The project is done in MATLAB2012b. **MATLAB** (matrix laboratory). It is a multi-archtype algebraic enumeration surrounding the 4rth generation computable language. MATLAB was built by Math Works. MATLAB lets matrix changes, organization of the information and variables,

executing codes, making GUI's and linking along with other compatible languages of computers like fortran, java etc. MATLAB was made initially with the intensions for algebraic enumerations the regular toolbox makes use of the MuPAD representative engine letting the grants to the representative enumerations potentials. It also adds the Graphical many fields of simulating the model based design(MBD) i.e extra part for the implanted groups or networks.

A.Video Surveillance

The appearance of a vastly improved image processing technologies and increase in the network bandwidth has escorted the rapid development of the video surveillance. The video surveillance systems have been used widely for the security monitoring purposes. It is crucial distinguishing one object from the other for the purpose of tracking and analyzing the actions of these objects. The two of the approaches: shape type, motion type ways. The first methodology utilizes the 2-Dimesional spatial details while the latter takes the temporary characteristics for things grouping results. [1] The CCTV camera's need the continuous monitoring whereas the modern surveillance systems automatically detect the faces of humans, object and even animals and check for their authenticity too. In general the video surveillance systems do the monitoring of the various activities like detection and authentication of threat posing objects by analyzing a recorded video, but this turns out to be a very tiring task for the people doing the same. Surveillance systems now a days are used for the management and monitoring of public places for the obvious reasons of security and safety. For video surveillance continuous checking proves a risk which rose suspicion to users. Notion behind this ,being the construction of objects that corresponds to object parts between consecutive video frames. Tracking provides temporal data regarding the mobile objects which may increase the lower level processing like segmentation or may even enable recognition. [1]



Video Surveillance Methodology

Motioned Facial Recognition from Live Feed for Surveillance Solutions

The given figure shows the methods to be followed while doing the video surveillance process. [1] In general the framework of the system begins with the acquisition of images from a live video stream (screenshot or frame extraction) by the use of camera and preprocessing may or may not be done on them for the enhancement procedure.

B. Face Recognition

Face recognition either from video or from face has been quite popular in biometric research. It has played a wide role in surveillance systems for security purpose. It has been acknowledged widely because it does not need any object's cooperation. It is widely recognized over other techniques because of its unique nature and is also accepted everywhere. [12] Face matching networks that would be getting huge awareness from the private sector and from the pattern finding grounds. [3] There are two reasons accounting for the same: First is the vast range of commercial uses while other being practicable technique. The strong need of secure systems to keep our assets safe and to protect personal identity in sea of numbers is much needed. [10] For recognizing people one usually sees the face of person as faces differ one person from another. Face recognition methods usually record the spatial orientation of different attributes for person's profile. The major focus is at the main characters of profile of person. These methods are put for use in detecting and finding criminals, terrorists and others for law enforcement causes. [11]

Most of the work in face recognition is focused mainly on detecting face features like eyes, nose, mouth, head outline and the relationship among these given features. [13]

Face recognition is always known to be a very challenging task. On one side the applications are quite purposeful in self-level of checking- matching but otherwise can prove to be difficult as the human face can be found in various different situations. [11]

A lot of work has been implemented on face recognition from images. The face of the person is recognized from a given image by matching it with the present database. There are a lot of methods incorporated to do the same.

The face recognition is done by feature extraction methods where the features like eyes, nose and mouth are considered. Feature extraction algorithms can be further of two types namely: geometrical character extrication, statistical character extrication. Statistical feature extraction is basically algebraic, method. For geometric method the profile will get shown as edifice calculations and special face attributes such as the distance and angles between the two eyes, nose. The mouth or face one like the nose width, nose position of mouth and chin kind. All such attributes were then checked for recognition of the unidentified profile by checking it with the closest neighbor from storage that has been stored previously. [14]

The statistical features are calculated by methods that involve algebraic methods. The methods used for the same are Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA) etc. They check for a link within original face features places onto lesser dimension character place. [14]

Facial recognition can be broadly done in five steps (image or video):

Step1: Image acquisition: The image of an individual can be acquired in two ways, one by digitally scanning an existing picture or by taking a live picture of the individual.

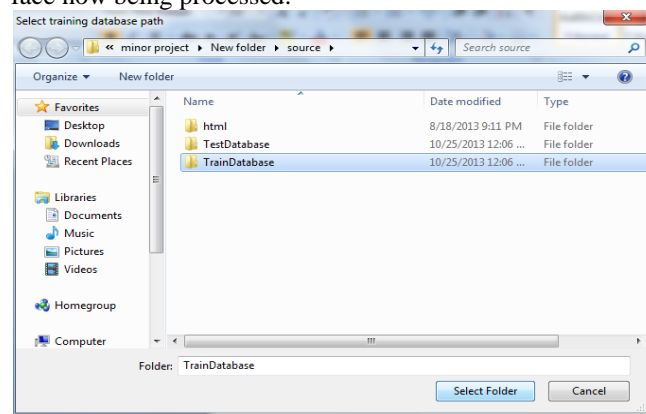
Step 2: Locate the face (if the image is of whole body, then the face of the person is located and all other things including the background are ignored)

Step 3: Analyzing the facial image obtained: The face is measured according to the peaks and valleys present in the face, the features are mainly extracted by using the 'golden triangle'.

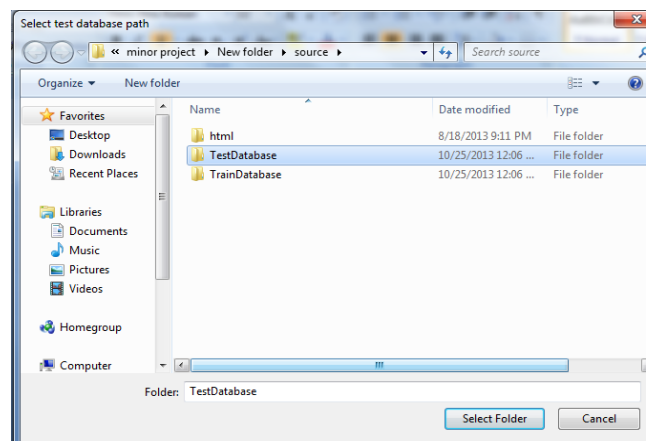
Step 4: Comparison : The image so obtained is now matched with the images present in the database to get the nearest match.

Step 5: Checking for match or not a match: Result for whether match will be there or not is done here. [11]

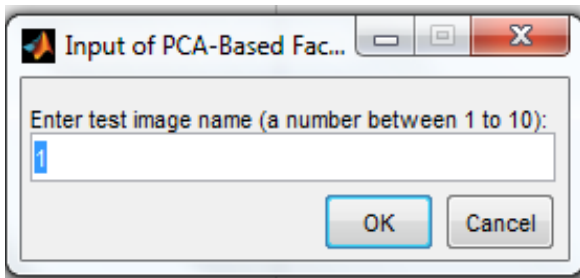
The face recognition process when done on the still images gave the result as follows. The first figure shows the train database which consist of the images of the people. It is a pre created database having a number of pictures of different people's faces. The test database is then matched with the images of this train database, if the images are found in the train database only then the match is said to be correct else an error is displayed. The test database consists of the newly added image that needs to be checked or matched for the identification and authentication purpose. The third figure shows the image from the test database that has to be selected for the matching purpose. The final image shows the screenshot of the matched images. The two images, one that was located in train database which is the stored or pre saved database of the computer and the other is the test database in which new image is taken and it finds the nearest match of the face now being processed.



Train database for face recognition



Test Database for face recognition



Test image number



Result for recognition

Now, considering the situation where a new image is entered into the system, it can be recognized by three ways. First is by checking if it is a known image that is the image is previously present at storage, secondly photo is profile that of not known individual, and thirdly photo wasn't any face or similar thing. [14]

IV. THE GUI -GRAPHICAL USER INTERFACE

It is also called as GUI is graphical manifestation at either one or more windows having components that are the controls. These components allow the person in performing participative jobs. The worker on the GUI shall not have to make a script or write any of the command line for completing the work. In GUI the user or the worker need not be bothered about comprehension of the detailing of the jobs being executed. The GUI parts can have the menus, toolbars, radio and push buttons, sliders and list boxes etc. The GUI which is made using MATLAB tools can also fulfill any kind of calculation, read and write information files and interact with the other graphical user interfaces and exhibit information as plots or any kind of tabular form.

The graphical user interface may include the axes component, a pop up menu having three datasets which are peak, membrane and sinc, it can also have a static text component for labeling the pop up menu and three button show different kinds of plots, surfaces, mesh or contour.

A MATLAB graphical user interface is a template window that allows one to add the user working components. One can do the selection, size and positioning of the parts as one wants. Using the callbacks one can form the parts do what one wants them to do and when the user makes a click on these or handle the parts by keystrokes.

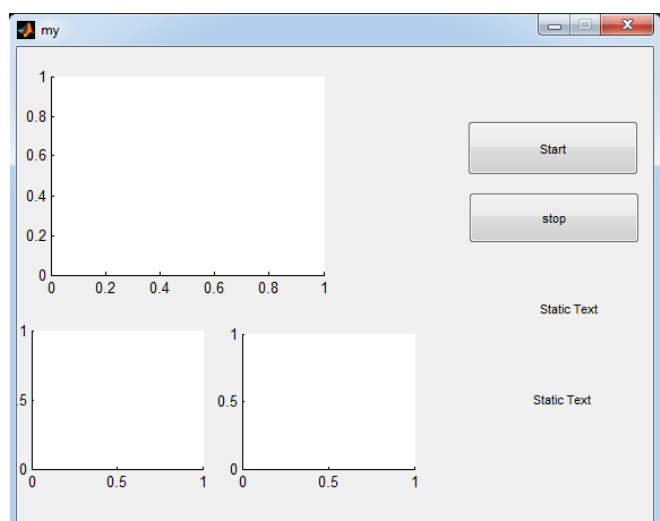
GUI can be made with GUIDE and then could be advanced using different programs. Moreover, if once a GUI has been created using the programs then it cannot be modified with GUIDE. The GUI making methods chosen depend entirely on one person's practice and skills, on the person's choices and the type of application one needs for the GUI to work.

There are four types of graphical user interface as shown in the table:

Types of GUI

Type of GUI	Techniques used
Dialog Box	The MATLAB software gives the feature of selecting dialog box that can be introduced using singular functional call.
Graphical user interface having only a few components	Building GUI's where the number of components are low is easier for programming, here each of the component of the GUI can be explained and defined properly.
Moderately complex interface	GUIDE can be used for making the moderate complex GUI's easier and simpler.
Complex GUI having many components or any GUI that needs to interact with other GUI's	Making such graphical user interfaces programs enable the user or the programmer to have a control of the exact placement of the components.

The GUI for the current project is as shown in the figure given below, the GUI consists of two push buttons: start and stop, the start push button is used for initializing the webcam and for making the webcam capture the face of a person. The start and the stop push buttons contain the respective coding for initializing and ending the webcam for the purpose of performing the surveillance. The start button will initiate the camera for the purpose of surveillance and it will continue for streaming till the push button stop is pressed which then closes the program and live streaming of the video is stopped immediately. The text boxes mentioned show the text id the image detected is a match or not, these text boxes show whether the match of the face shown in the live streaming matches with the ones saved in the database or not. The text boxes also give the alerts for the non-matched faces of people in the video streaming, these faces then could either be added into the database of computer that has been made and saved previously or could be held as an alert for future works.



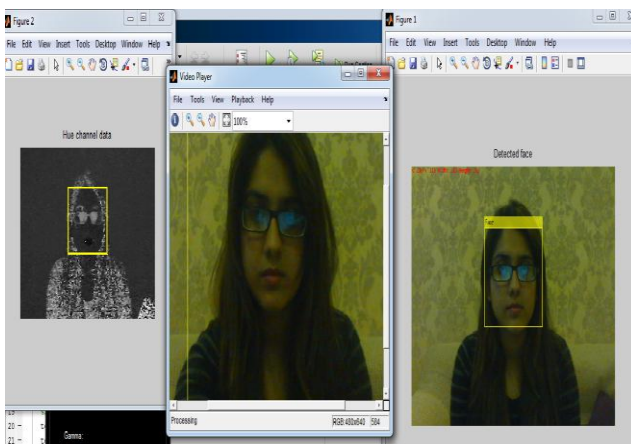
The GUI for Surveillance

Motioned Facial Recognition from Live Feed for Surveillance Solutions

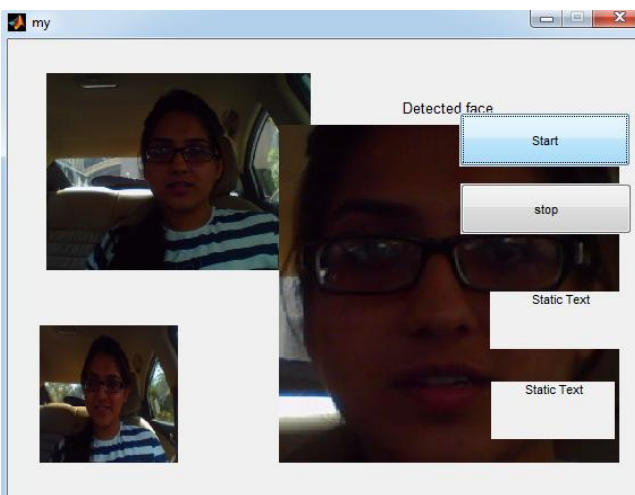
The start button captures the image of the person. The axes on the left shows the continuous live streaming of the video, here the video streaming is done through the webcam of the computer. The bottom left axes shows the matched image with the captured one. The captured image from the first frame is the largest of all the images as shown in the figure. The matching is done with the images that have been previously stored in the database.

The recognition method in a video is done by creating an application in which first the face is detected by creating a cascaded detector. The inbuilt function 'cascadeobjectDetector' is used which detects the face. The input device used is the webcam. When a person sits in front of the camera, the application looks for a human face. If a face like structure is detected by the application then the program goes forward else the message that no face was confronted is shown.

The next step is to form a rectangular box on the face detected. The coordinates of the tracked face are found. The hue and saturation for the image are also calculated. The skin tone of the person is considered for the same. The skin tone for rgb and hvq are measured from the nose. These images thus obtained are then saved in a database for further use and detection.



Detection of face



Matching of face

The figures show the detection of face from a live video stream using the webcam. The first image shows the hue channel data, the second segment of figure 1 shows the live streaming and the third segment (image) of figure 3.8 shows the detected face, with a rectangular box highlighting the face.

The program detects only the face by measuring the facial features like eyes nose and mouth. If some other object except face is shown, the program does not run.

The current application works on the principle of Cascade Face Detection method where the inbuilt function CascadeObjectDetector() is used. Here three modules of cascade face detection is presented. [3]

These removes images, background noises, back at heads and not the profile item (i.e. objects that are not human face). The images that contain just the frontal face of human are sent to the engine that does the task of recognition. The threshold can be set in the threshold modules and this can further help in better face detection. In one way it can be said that the video based detection is a continuation of still photo detection. [3]

V. CONCLUSION

In conclusion it could be deduced from the project that today the need is for the authentication systems. The project consists of facial recognition which in the future can be integrated with other biometric techniques as well to get a stronger authentication system. This program on a larger scale can be incorporated by defense forces in order to identify threat posing objects such as missile detection or enemy warfare. Moreover, for places where guarding of something valuable is required, these authentication techniques are very useful but due to non-availability of any Indian development firm the use of this technique is vague. This project could be deployed and enhanced even more for betterment of results.

REFERENCES

1. Study of Moving Object Detection and Tracking for Video Surveillance, International Journal of Advanced Research in Computer Science and Software Engineering
2. Real Time Motion Detection in Surveillance Camera Using MATLAB, International Journal of Advanced Research in Computer Science and Software Engineering, Iraqi National Cancer Research Center ,Baghdad University, Iraq
3. A Video-based Face Detection and Recognition System using Cascade Face Verification Modules, Ping Zhang, Department of Mathematics and Computer Science, Alcorn State University, USA
4. A Surveillance System based on Audio and Video Sensory Agent cooperating with a Mobile Robot, The University of Padua, Italy
5. Face Recognition using Eigenfaces, Mathew.A.Turk and Alex.P.Pentland, Vision and Modeling Group, The Media Laboratory, Massachusetts Institute of Technology
6. Performance evaluation of object detection algorithms for video surveillance, Jacinto Nascimento*, Member, IEEE and Jorge Marques
7. Face recognition using multiple eigenface subspaces, P.Aishwarya and Karnan Marcus, Journal of Engineering and Technology Research Vol. 2(8), pp. 139-143, August 2010
8. Development of a real-time face recognition system for access control, Desmond E. van Wyk, James Connan, Department of Computer Science, University of Western Cape, South Africa
9. Face Recognition and Retrieval in Video, Caifeng Shan
10. Image-based Face Detection and Recognition: "State of the Art", Faizan Ahmad , Aaima Najam and Zeeshan Ahmed
11. OBJCUT for Face Detection, Jonathan Rihan, Pushmeet Kohli, and Philip H.S. Torr, Oxford Brookes University, UK
12. Design Of Efficient Face Recognition Based On Principle Component Analysis Using Eigenfaces Method, Mr.A.R.Sejani
13. Eigenfaces for Recognition, Alex Pentland and Mathew Turk, MIT
14. An Improved Face Detection Method in Low-resolution Video, Chih-Chung Hsu and Hsuan T. Chang* Photonics and Information Laboratory Department of Electrical Engineering National Yunlin University of Science & Technology Douliu Yunlin, 64045 Taiwan ROC

15. Biometrics and Face Recognition Techniques, International Journal of Advanced Research in Computer Science and Software Engineering, Renu Bhatia
16. Biometrics- Fingerprint Recognition, International Journal of Information & Computation Technology, Sarah Bal and Anmol Kalra
17. Face Detection and Tracking in a Video by Propagating Detection Probabilities, IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, VOL. 25, NO. 10, OCTOBER 2003, Ragini Choudhury Verma, Cordelia Schmid, and Krystian Mikolajczyk

AUTHORS PROFILE



Sarah Bal is currently pursuing her final year of Bachelor's degree from Amity University Uttar Pradesh in the field of Computer Science Engineering. She has done her schooling from Bal Bharti Public School, New Delhi. One of her recent publications was in 2nd International Conference on Advancement in computing sciences, information techniques and emerging E-learning technologies on the topic Biometrics-Fingerprint Recognition. She is an active member of Amity Human Values Quarter

which aims to spread awareness amongst fellow humans about ethics and trying to promote better living for those in need. She is also associated with Uday Foundation (an organization working for patients with congenital defects and rare blood groups). Furthermore, she is a diploma holder in Six Sigma-Green Belt certified by British Standards Institution.



Anmol Kalra is currently pursuing his final year of Bachelor's degree from Amity University Uttar Pradesh in the field of Aerospace Engineering. He has done his schooling from Delhi Public School, Noida. One of his recent publications was in 1st International Conference on Flight Simulation Using Graphic User Interface, Advances in Aerospace Science and Applications, ISSN 2277-3223 Volume 4,

Number 1 (2014), pp. 85-90. He is an active member of Amity Human Values Quarter which aims to spread awareness amongst fellow humans about ethics and trying to promote better living for those in need. He is also associated with Krishi Sanskriti (an NGO providing education and shelter for orphans). Furthermore, he is a diploma holder in Six Sigma-Green Belt certified by British Standards Institution.



Rishi Kumar completed M.Tech (I.T.) from IIT Allahabad, India. His research area is image processing & pattern recognition. He has published papers in International journals & presented paper in several conferences of well repute. At present, he is associated with Amity Univeristy, Noida Campus as a Assistant Professor in the department of Computer Science

& Engineering.