FACIAL RECOGNITION USING THEORY OF BIOMETRICS

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ABSTRACT *While people have had the inborn ability to identify and compare different faces for millions of years, computers are just now captivating this. In this paper, the techniques of how computers are shaping your face into computer code are compared to millions of other faces are illustrated. How facial recognition software is being used in criminal investigations, elections and to protect your personal computer.*
A facial recognition system is a computer application for automatically recognizing or verifying a human from a digital image or a video frame from videos. This can be done by distinguishing selected facial features from the image and a facial database. It is widely used in security systems and can be compared to other biometrics such as fingerprint or eye iris recognition systems.
3-D facial recognition system and biometric facial recognition system is focussed. This paper also illustrates future scope of enhancement of facial recognition system in India.

Keyword:-*3D facial recognition, biometrics facial recognition, alignment,identification.*

1.INTRODUCTION

Humans have a wonderful ability to identify and memorize large number of faces. While people have had the inborn ability to identify and compare different faces for millions of years, computers are just now captivating this. In this paper, the techniques of how computers are shaping your face into computer code so it can be compared to millions of other faces are illustrated. How facial recognition software is being used in criminal investigations, elections and to protect your personal computer. Biometrics is assigned as a natural way of recognisation, since the ability to differentiate among human appearances is given to individuals. Facial scan systems can vary from software-only solutions that evaluate images processed through prevailing closed-circuit television cameras and processing systems. With facial recognition technology, a digital video camera image is used to identify facial features such as the distance between eyes, nose or mouth. These dimensions are stored in a database and used to distinguish with a subject standing before a camera. Facial-scan technology works on the principle of standard biometrics sequence of image acquisition, image processing distinctive characteristic location, image acquisition, templates creations, and matching. A favorable image is captured through a high resolution camera, with moderate lighting and users directly facing a camera. The enrollment images illustrates the facial features which are be used in all future verifications. So a high quality enrollment is important for challenges like acquisition and lighting. Distance from the camera diminishes facial size and thus image resolution.

2. FACIAL TECHNOLOGY AT GLANCE

Identix, a company based in Minnesota, is one of many developers of facial recognition technology. Its software, FaceIt, can capture someone's face out of a crowd, draw the face from the rest of the scene and distinguish it to the database of previous stored images. In order to work for this software, it must know how to distinguish between a basic face and other background. Facial recognition software is based on the ability to identify a face and then

evaluate the different features of the faces. Face recognition has been taken in various securities related applications such as surveillance, e-passport and access control.

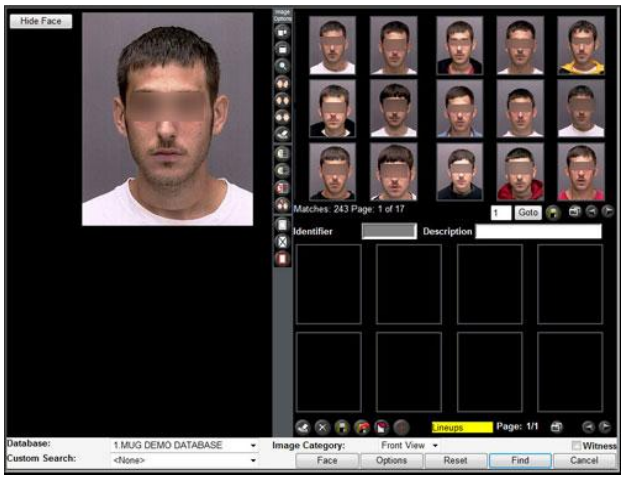

Fig1: Face IT software compares the face print with other images in the database.

Every face has numerous, different landmarks, the distinguishable peaks and valleys that make up facial characteristics. FaceIt explains these landmarks as nodal points. Each human face has approximately 80 nodal points. Few of these evaluated by the software are:

• Distance between the eyes.
• Width of the nose.
• Depth of the eye sockets.
• The shape of the cheekbones.
• The length of the jaw line.

These nodal points are calculated by creating a numerical code, called a face print, depicting the face in the database. To be precise and true, the image picked needs to be of a face that was viewing almost straight at the camera, with small variance of light or facial expression from the image in the database. This resulted in a problem. In most cases the images were not captured in a controlled environment. Even the little changes in light or orientation could minimize the performance of the system, so they wouldn't be matched to any face in the database, resulting to a high rate of failure. In the next section, we will find the alternatives to correct the problem.

A. 3D Facial Recognition

A recent trend in facial recognition software uses a 3D model, which demands to give more accuracy. Capturing a real-time 3-D image of a person's facial surface, 3D facial recognition uses typical characteristics of the face -- where rigid tissue and bone is most evident, such as the curves of the eye socket, nose and chin -- to recognize the subject. These areas are all unique and do not vary with time. Using depth and an axis of measurement that is not changed by lighting, 3D facial recognition can be used in darkness and has the capability to identify a subject at different view angles with the ability to evaluate up to 90 degrees (a face in profile).Using the 3D software, the system covers a number of steps to verify the selfhood of a person.

a) Detection:- Capturing an image can be completed by digitally scanning a previous photograph (2D) or by using a video image to acquire a live view of a subject (3D).

b) Alignment:- When the face is detected , the system measures the head's position, pose and size. As stated earlier, the subject has the capability to be recognized up to 90 degrees. While with 2-D, the head should be turned at least 35 degrees towards the camera.

c) Measurement:- The system then determines the curves of the face on a sub-millimeter (or microwave) scale and forms a template.

d) Representation:- The system changes the template into a unique code. This coding provides each template a set of numbers to depict the characteristics on a subject's face[1].

e) Matching:- If the image is 3D and the database contains 3D images, then matching will take place without any alterations being made to the image. However, there is a conflict currently facing databases that are still in 2D images. 3D provides a live, mobile variable subject being different from a flat, stable image. New technology is addressing this challenge. When a 3D image is captured, various points (usually three) are determined. For example, the outside of an eye, the inside of an eye and the tip of the nose will be pulled out and measured.

Once those dimensions are in place, an algorithm will be carried out to the image to convert it to a 2D image. After conversion, the software will then make comparisons with the 2D images in the database to find a perfect match.

f) Verification or Identification: - In verification, an image is compared with only one image in the database (1:1). For example, an image taken of a subject may be matched to an image in the Department of Motor Vehicles database to verify the subject is who he is as he says. If identification is the motive, then the image is evaluated to all images in the database resulting in a score for each capable match (1: N). In this example, we will take an image and evaluate it to the database of mug shots to verify who the subject is. Next, we'll see how skin biometrics help in verifying matches[2].

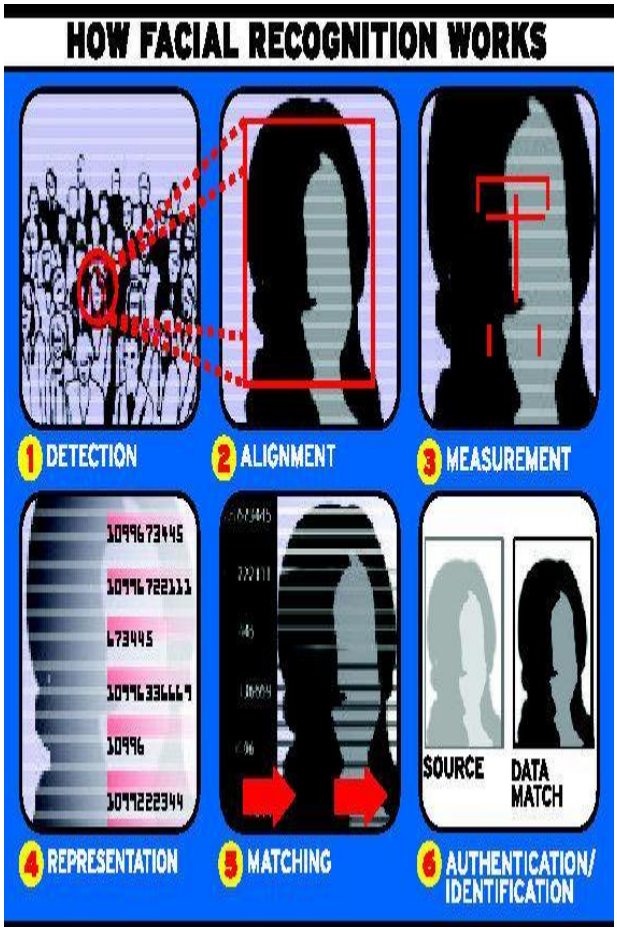

Fig2: Steps of face recognition

B. Biometric facial Recognition

The image may not always be verified or recognized in facial recognition alone. Identix has developed a new product to help with precision. The development of FaceIt®Argus uses skin biometrics, the uniqueness of skin texture, to bring even more precise outputs. The process, called Surface Texture Analysis, works in the same way as facial recognition does. An image is taken of a patch of skin, called a skin print. That patch is then split up into smaller blocks. Using algorithms to bring the patch into a mathematical, measurable space, the computer will then differentiate any lines, the actual skin texture and pores. It can evaluate dissimilarities between identical twins, which is not yet developed using facial recognition software alone. According to Identix, by combining facial recognition with surface texture analysis, accurate identification could maximize by 20 to 25 percent.

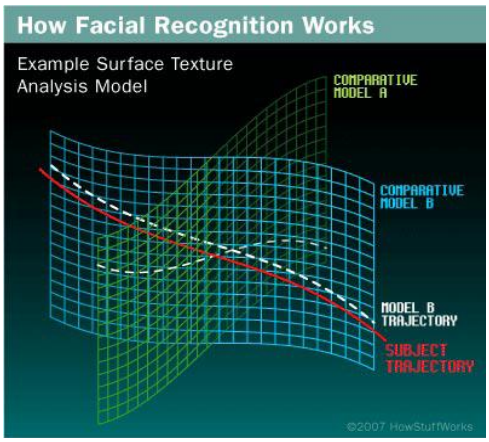

Fig3: Working of facial recognisation by surface texture analysis model

3.FUTURE DEVELOPMENT

An expected future application for facial recognition Systems lies in retailing. A retail store may have cash registers with cameras; the cameras would be focused at the faces of humans, so that images of people could be captured. The camera would be the primary means of recognizing the customer, and if visual identification failed, the customer could finish the purchase with the help of a PIN (personal identification number). After the cash register had estimated the total sale, the face recognition system would match the selfhood of the customer and the total amount of the sale would be minimized from the

customer's bank account. Hence, face-based retailing would provide means for retail customers, since they could go shopping simply by displaying their faces, and there would be no need to bring debit cards, or any other financial media. Wide-reaching applications of face-based retailing are possible, including retail stores, car rental companies, airports restaurants, movie theaters, hotels etc. For instance, Swiss European surveillance: facial recognition and vehicle make, model, color and license plate reader. The scopes of face recognition system in India are as follows:

1. In order to stop the frauds of ATM in India, it is recommended to set up the database of all ATM customers with the banks in India & deployment of high resolution camera and face
recognition software at all ATMs. Therefore, when users will enter in ATM his picture would be obtained to allow the access after it is being verified with stored photograph from the database.

2. Duplicate voter are being found in India. To stop this, a database of all voters, and, of all constituencies, is suggested to be prepared. At the time of voting the resolution camera and face recognition equipped of voting site will approve a subject face 100% and results the recognition for voting if match is found [3].

3. Visa verification and passport can also be exercised using face recognition technology as explained above [4].

4. In defense ministry and all other important places the face technology can be deployed for better security

5. To recognize and evaluate terrorists at airports, railway stations and malls, the face recognition technology will be the perfect choice in India as compared with other biometric technologies since other technologies cannot be helpful in clumsy areas.

6. Driving license verification can also be done using face recognition technology as mentioned earlier.

7. This technology can also be used efficiently in various important examinations such as SSC, HSC, Medical, Engineering, MCA, MBA, B- Pharmacy, Nursing courses etc. The examinee can be identified and verified using Face Recognition Technique.

8. In all government and private offices this system can be recommended for identification, verification and attendance.

9. It can also be deployed in police station to recognize and verify the criminals.

10. It can also be deployed lockers and vaults in banks for access control verification and identification of authentic users.

4.CONCLUSION

Face recognition technologies have been linked generally with very costly top secure application. Today the core technologies have grown and the cost of equipments is decreasing drastically due to the integration and the increasing processing power. Certain applications of face recognition technology are now cost effective, highly accurate and reliable. Though there are some weaknesses of facial recognition system, there is a great scope in India. This system can be effectively used in ATM's, identifying duplicate voters, passport and visa verification, in defense, competitive and other exams, in governments and private sectors driving license verification. Government and NGOs should focus and enhance applications of facial recognition system in India in various fields by giving economical support.

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