



Recognition of Human Face by Face Recognition System using 3D

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ABSTRACT

In this paper, we briefly define the meaning of face recognition system, human face features that use to identify the face, face recognition types including two-dimensional system (2D) and three-dimensional system (3D), explanation of three-dimensional recognition procedures: they are (detection, alignment, measurement, representation, matching and verification or identification process). We also explained our new idea for recognizing the human face. This new procedure done by face feature extraction, drawing (x,y) axes in the face, eyes and mouth extraction and finally the angle drawing. At the end of this document, we mention the parameters of verification in images of the human face.

1. INTRODUCTION

Nowadays with the network world, the way for crime is become easier than before. Because of this reason, network security has become one of the biggest concerns facing today's IT departments. We heard a lot about hackers and crackers ways to steal any password or pin code, crimes of ID cards or credit cards fraud or security breaches in any important building and then reach any information or important data from any organization or company. These problems allow us to know the need of strong technology to secure our important data.

This technology is based in a field called "biometrics".

Biometric is a form of bioinformatics that uses biological properties to identify people. Since biometric systems identify a person by biological characteristics, they are difficult to forge. Examples of biometrics are fingerprinting, iris scanning, signature authentication, voice recognition and hand geometry.

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Face recognition is one example of biometric [1, 3] and it is use the character of the face to identify a person.

Face recognition has drawn attention in computer vision at 1970 and the rst time the system of face recognition used was at 2001 for the purpose of reducing the crimes but this system fails to recognize the clear picture of any thief because the thieves were wearing a mask.

1.1 Reason of Choosing Face Recognition System

There is multiple reasons that make us choose Face Recognition System from all the kinds of biometric, we will summary them in these points:

1. It doesn't need any Physical interaction from the user.
2. It is very accurate and more secure.
3. We can use any cameras or image capture device.

1.2 Usage

In any case, there are now more uses of this technology in banks, airports and will increase the use and speared, the more developed this technique and reduce the cost of it.

In the worth mentioning, that is currently experience of this system in program called "Registered Traveler". This program allows to the traveler to speed up inspection procedures, and pass through security barriers through allocation of special tracks with those people enrolled in the program, where they are identified through special cameras installed on these tracks by face recognition system.

Also, possible applications include a recognition system in ATM (Automated Teller Machine) to withdraw money in banks, where the programs verify the cline before he/she ejects the money. It is possible to be dispensed card to withdraw money and content to stand in front of machine that will identify the person then open the bank account to perform a withdraw or deposit.

Additionally, some companies and corporations have developed face recognition programs used to identify faces in controlling the presence and departure of stu or workers.

1.3 Research Paper Contents

Finally, in this research paper we will talk about the face recognition system denition, what types of measurements face recognition system need, two types of face recognition system and then we talk about 3D System, how face recognition system work in this led, After that we will explain our new idea for recognize the face and how the feature is extracting and nally we will mention some variation in images of human faces The remainder of the paper is structured as follows. Section 2 explores the core of the contribution including face measure, face recognition type, 3D face recognition, new Ideas for recognize the face etc. Finally, Section 3 provides the conclusions and identities directions of future work.

2 Body

2.1 Denition

As we all know that almost the security system in the airports, huge hotel and especially in the police led depend on the use of advanced protection system that based on the computer programs. Theses program verifying people present and also thieves. This system is based database for pictures of people criminals, thieves and others with picture captured by a surveillance camera. So a facial recognition system is a computer application for automatically identifying a person digital image that its source is already sorted in the

database. Actually, it works by comparing the selected facial features from the image and a facial database.

2.2 Face Measure

Every human face has many distinctive features are in a various meandering on the face. The program is based on these parameters nodal points. Each face has approximately 80 nodal points. Almost facial recognition programs analyze the relative position, size, and/or shape of the eyes, nose, cheek boons and jaw. The most famous features of the face measured by a program are:

1. The distance between the eyes.
2. The depth of the eye.
3. Nasal breadth.
4. The form of the cheek boon.
5. Along the jaw line.

The parameters measured by the program and then translated into digital codes called the ngerprint and face print used to represent the face in the database.

2.3 Face Recognition Types

2D System In the past [4], facial recognition programs depended on twodimension (2D) picture to compare it with the image sorted in the data base, but these programs did not succeed only if the person is looking just to the camera. Of course anyone suspect will be warned that he/she will see a cam era in place, and here lies the problem where this fails by depending on the 2D system. Beside, the additional changes in the environment surrounding the person, such as light will produce images the computer cannot nd them in the corresponding memory, also the changes in the same person like that might not be dressing her/his hair or palace , all of these cause a system failure in face recognition [5, 6].

3D System Modern system for face recognition based on the pattern of three-dimensional (3D) [8], where the special cameras will captured images of three-dimensional views of the suspected person, and using the special main features of each face that are not changed signicantly with time , such as eye hole, the distance between the eyes, nose shape and others mentioned above. These features are a source of information for a facial recognition system as the changes in the lighting or surrounding environmental conditions do not aect these measurements, for example: can operate these systems in any lighting conditions even if the place was dark and even if the person is not in the face of camera.

2.4 3D Face Recognition

How 3D Procedure isWork The use of depth and focus of the face that does not aect the change in lighting is known as three-dimensional face recognition system. The software system that relay on three-dimensional technique with a series of steps to eventually be able to perform a face recognition procedure. We can divide the whole process by the following steps. Figure 1 also shows these steps:

Detection: Capture a digital image by a two-dimensional digital camera or even using a video camera.

Alignment: After capturing the image, the system will determine a head position, size and its direction. The three-dimensional system can do this step even if the picture is diagonal taken. This will create an angle of 90 degrees with the camera lens, while the two-dimensional system cannot perform this step only if the person is looking directly at the

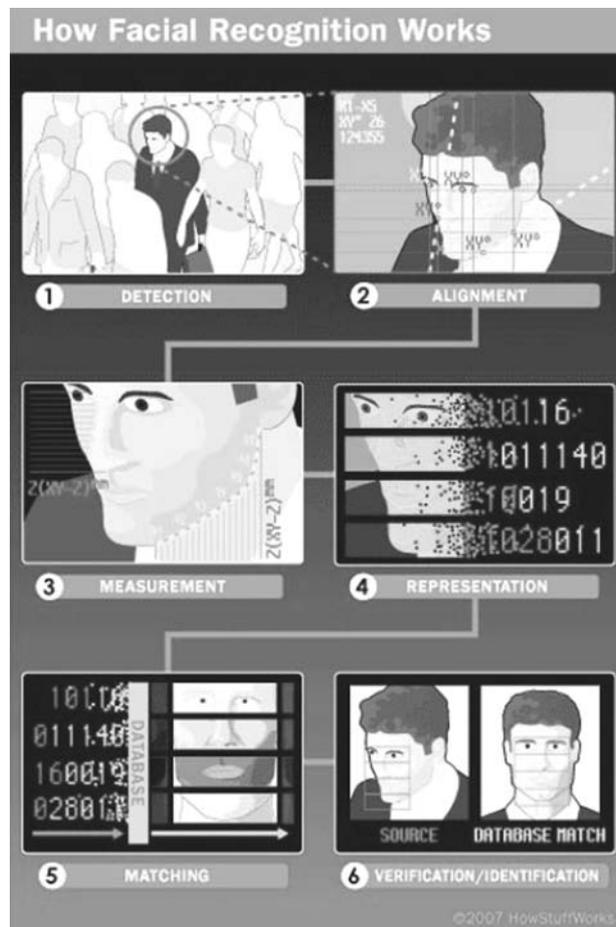
camera or in its direction as not to increase the angle between the person's face and camera lens of 35 degree.

Measurement: The software (specic program) will calculate the curves and meanders on the face to an accuracy of part OS the millimeter. Then the program ready to convert that information to establish a face model or pattern.

Representation: In this step, the system will translate the model and form a specic code. The code for each model is unique and consists of a set of numbers.

Matching: In the case that the picture is three-dimensional and corresponding to the three-dimensional images that stored in the database, the comparisons between the images are immediately. But the challenge facing these systems is that most of the images stored in database are in two-dimensional. So, how can be compared with a vivid picture of a person moves his head in front of camera and pick up his/here three-dimensional image with the millions of two-dimensional images

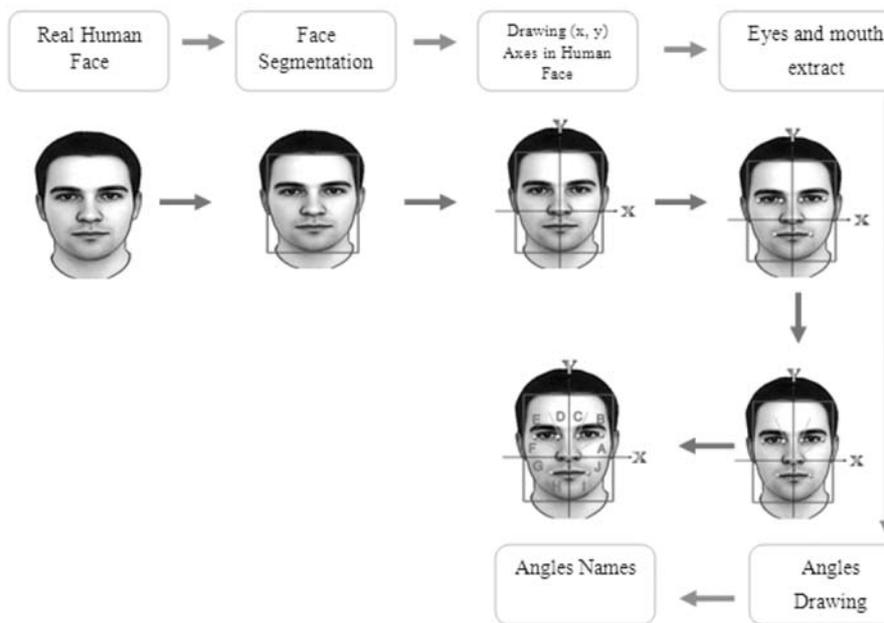
Fig. 1
the steps of 3D face recognition system.



The development of a new technology support the use of three different points to get to know any face sorted in database. Some of these points are outside of the eyes, inside the eyes and the tip of the nose. The conduct of the system will carry out these measurements on the dimensions between these points of three-dimensional picture and begin to be converted to two-dimensional images through the application of complex mathematical algorithms. After the conversion process, of this part, the system begins to work of comparison.

Verification or Identification: In the step of recognition, the program will compared the images and match them with pictures of the database sorted by the system in the previous step. But if the goal is verify the result of the previous step, the system compares the image with all images in the database and then matching results are displayed in percentages [3].

Fig. 2
Feature Extraction Process.



Note: Could not be above steps sufficient to identify the personal or verified it by 100%. Because of that, some companies developed new products, which these computer programs help to raise the proportion of verification. This program depends on the skin tag distinctive relief of the face surface [5, 6].

2.5 New Idea for recognize the face

Feature Extraction For face recognition there are several steps as mention before used to recognize the person face. The first step is to divide the human face into some region to reduce the search region for detect purpose. In this part we will show in more details how this procedure is done. Figure 2 below show the overall feature extraction process.

Face Segmentation mentioned before the first step in face recognition system is detecting the face and locate the face area from a given facial scan. The segmented face area starts from the forehead until the chin as shown in gure 2. The subsequent feature point extraction is conducted within the segmented face area.

Drawing (x, y) Axes in human face For drawing (x, y) axes in human face we have first to set the center first. A nose is a special point in human face and also holds the maximum height of the face. Sometimes other factors can affect the nose extract as beard, hair, other objects in the field of view, sensor noise, and so on. Figure 3 below gives 2 examples.

Fig. 3

In A the beard will be detected as a maximum height and in B the hair.



(a)



(b)

For this problem we developed a robust nose tip extraction scheme. We look for the shape of the nose to locate it in the map. The range image is represented as $h(r; c)$, where h is the height value, r for the row indices and c for the column indices. By using the face segmentation extraction as mentioned in part a, we will have the part of the person face only. Then we will find the position of maximum h by searching vertically and then draw the row in where h is highest. After the row of the highest value of h is being known and drawn, we will start searching horizontally and then draw the column in where h is holding the maximum value. This process is shown in figure 4. As you can see (x, y) axes have been drawn in the human face, and the nose is being in the centre.

Eyes and mouth extract Depending on other scientists research the position of the eyes and mouth of personal face will be set. Figure 5 shows these positions.

Angles Drawing After (x, y) axes is drawing in human face as in part b, we will start to make the angles. We will have to divide the face into 10 parts each part will have an angle. These angles will be calculated and then used to recognize the person face. By using the eyes and nose positions we will draw the angles as following:

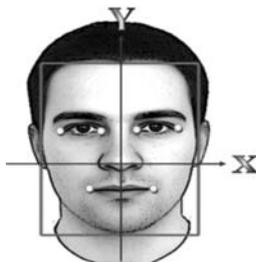
- For the part of the right eye we will have A, B and C angles by drawing two lines in the two edges of the right eye. This will construct the first quarter.
- For the part of the left eye we will have D, E and F angles. This will construct the second quarter.
- The mouth will be dividing in two parts according to y axes. For the part in the left side, we will have angle G and H. This will construct the third quarter.
- For the part in the right side, we will have angle I and J. This will construct the fourth quarter.

All these steps are clearly shown in figure 6.

Fig. 4
Feature Extraction Process.



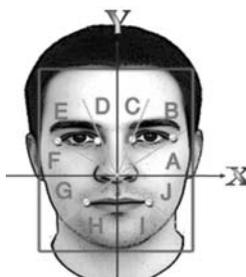
Fig. 5
Eyes and Mouth segmentation.



Parameters of Variation in Images of Human Faces \Human faces differ in shape and texture, and additionally each individual face by itself can generate a variety of different images [3, 5]. This huge diversity in the appearance of face images makes the analysis difficult. Besides the general differences between individual faces, the appearance variations in images of a single face can be separated into the following four sources [4]. These four sources are:

- Pose change can show different views of the face.
- Light changes can affect the appearance of the human face.
- Facial expressions also play a big role on changing the human face (smiley face look different of angry face).
- The face can change when people get old, changing hairstyle, according to makeup or men making their beard growing up. These are the four major sources of appearance variations in images of a single face. We just want to mention it for the reader information.

Fig. 6
Angles Drawing.



3. CONCLUSIONS

As you can see, face recognition system is very important in our daily life. It possesses a really great advantage. Among the whole types of biometric, face recognition system is the most accurate. In this research paper, we have given an introduction of face recognition system and its advantage, then we mention its types and explain the procedure that done by 3D face recognition. After that we start to explain our new idea of detect and recognize the human face and we explain its process (face segmentation, drawing (x, y) axes, eyes and mouth extract and angles drawing). Then we end the research paper by mention the parameters of variation in images of human faces. We have presented small examples to justify our ideas which are more feasible for the recognition system.

As a future work, we would like to explore this research area more deeply.

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