

3D Face Recognition

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Abstract - 3D face recognition is one of the novel ways of having a security feature. This could be considered much more safer than a finger print scanner as it uses the crests and troughs on the face to accurately map every centimeter of the face, now because of his technology the machine cannot be fooled by showing a photo of the person because it won't be able to detect the crests and troughs on the face. In order to cheat the machine, one would have to make a 3D model of the face with exact depths at every centimeter which is very difficult. PCA algorithms, resulting in improved recognition performance, both individually and in combination. We have also examined the effect of depth resolution on performance of 3D recognition which is very accurate.

Keywords: 3D face recognition, security, crests and troughs, PCA algorithm, depth resolution, performance.

1. INTRODUCTION

A Face recognition technology is basically a computer application for identifying a person through an image or a video. This is usually achieved by comparing selected facial features from the image and a face database. It is mainly used in security systems and can be compared to other biometrics such as fingerprint or eye iris recognition.

3D Face recognition is an enhancement of the facial recognition technology wherein, the three-dimensional geometry of the human face is used. 3D face recognition technology is more accurate than 2D recognition (i.e. fingerprint recognition). The accuracy is mainly improved by measuring the geometry of rigid features of the face. The drawbacks of 2D recognition change in lighting, different facial expressions, make-up and head orientation can be avoided by using 3D face recognition.

This technique uses 3D sensors to capture the information about the shape of the face. This information is further used to identify different features of a face, such as the eyes, nose, etc. This helps in identifying the face from a wide range of viewing angles.

3D Face Recognition Technology has many benefits. One of the top benefits of biometric face technology over other forms of face recognition is that it has a non-contact process. Instead of requiring the person to offer their fingerprint or asking them to submit their iris scanner. Facial characteristics can be videoed or captured easily without requiring any contact at all. For many purposes, like crime deterrent or security purposes becomes easily due to this feature.

Secondly, 3D Face Recognition provides fast and accurate results. Users enjoy high recognition rates and short

processing time, these systems an effective option. Most of these systems provide the ability to recognize anyone's face regardless of facial changes, which may include different expressions, the addition of a beard, or even glasses.

The 3D Face recognition technology provide reliable matching. The software can be easily integrated in to various types of video monitoring systems. 3D Face recognition technology is non intrusive.

This technology can be used in security camera and for other security purposes. Since, it takes information from the geometry of an individual's face, it is accurate in identifying the person.

3D face recognition can be achieved by using sophisticated sensors for 3D face imagery. The sensors work by projecting structured light onto face. A number of image sensors can be placed on the same CMOS chip- each sensor captures a different part of the spectrum.

Another method is to introduce a way to a capture a 3D picture by using three tracking cameras that point at different angles; one camera will be pointing at the front of the subject, second one to the side, and third one at an angle. All these cameras will work together so it can track a subject's face in real time and be able to detect and recognize. This technology has helped to improve privacy as well. With advancement in technology for security purposes now, biometric recognition is being used. For example, in our mobile phones initially where passwords were now biometric recognition like fingerprint sensors, iris scanner and now 3D face recognition is being which shows 34% more security as compared to other biometric recognition technology.

The accuracy of this technology depends on the quality of an image. The basic recommendations for facial recognition are :

Cameras and Images

Cameras with similar quality should be used for both enrolment and identification. The minimum recommended distance between the eyes for a face on an image must be 50 pixels for performing face template extraction and 75 pixels is ideal for good face recognition without resizing the image. Webcams with lower resolution is not recommended as optical distortions might appear and spoil the facial template quality.

Lighting

While recording the face for recognition and for proper biometric geometry of the face the lighting should be controlled in the following manner. Firstly, there should be direct frontal or diffused light which allows equal lighting distribution on the entire face (on each side and from top to bottom) with no shadows in the face region. Secondly, there should not be any glares on the face or any kind of glasses that are produced by some illumination.

Facial expression

Neutral face expression during enrolment is recommended, as any other expression may affect the accuracy of recognition. Expressions like broad smile, raised eyebrows, closed eyes, Eyes looking away from camera are not recommended during enrolment of the face.

Glasses, Makeup, Hair, Beard and Moustache

If an individual wears glasses he should make separate enrolments, with or without glasses for higher accuracy. During enrolment of the face heavy makeup is not recommended as it may cause facial distortions and reduce the accuracy of the technique.

Now, we will discuss how does the scanners find the faces in the images or the videos. When the 3D recognition scanner is given with an image it examines the image or video and classifies it as a "face" or "not face". There is a fixed scale for each face say maybe 50x50 pixels. The faces might be smaller or larger than the scale, so the scanner re-examines the image several times. Usually, these systems extract certain features from face image and then match these features to the given face. Google's Picasa digital image organizer has built a facial recognition system. This software mainly associates

faces with people. Apple has come up with its latest iPhone X which uses the 3D Face recognition technology for unlocking the phone. The company is one of the first to implement this technology. The company claims that it is more reliable than any other biometric technology and provides more security.

REFERENCES

- [1] A Review paper on Biometrics: Facial Recognition by Sakshi Goel, Akhil Kaushik, Kritika Goel
- [2] https://en.wikipedia.org/wiki/Facial_recognition_system#3-dimensional_recognition
- [3] en.m.wikipedia.org
- [4] Image-based Face Detection and Recognition by Faizan Ahmad, Aalma Najam, and Zeeshan Ahmed
- [5] Face Recognition : a summary of 1995-1997 by Thomas Fromherz