ALIYU BELLO

FACE RECOGNITION TECHNIQUES: 3D AND THERMAL

ABSTRACT:

In image analysis and computer vision, face recognition is a captivating technology. Due to its numerous applications in different fields, it has sparked much interest in recent years. Although there are a variety of biometric approaches available, the most effective and extensively utilized is face recognition. Through the years, it has been developed with numerous techniques and algorithms. The main goal of this paper is to describe some of the well-known techniques; 3D face recognition and Facial thermography. After extensive research on both; A highlight, discussion, and comparison were presented, also a reflection and conclusion.

KEYWORDS: 3D face recognition, Facial thermography

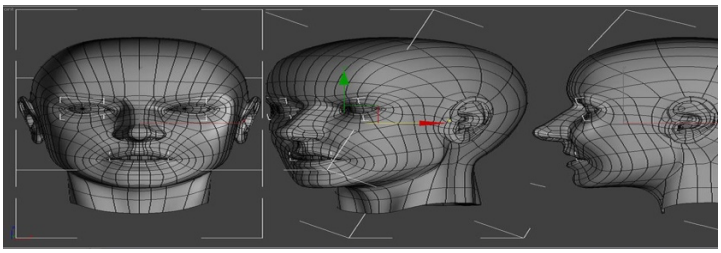
INTRODUCTION:

Biometric-based technologies have to do with identifying and verifying unique physiological features. Face recognition is a technique of identifying a person's identity using their face. The feature frameworks can recognize individuals in real-time, photographs, videos on devices and gadgets. In comparison to other biometrics, face recognition looks to have several advantages. The face recognition algorithms are important components that enable high efficiency and performance. This paper takes a broad look into 3D face recognition and facial thermography, with a general review and visualizations.

3D FACE RECOGNITION:

3D face recognition technique could accurately identify human faces considerably in low lights. The 3D scan has to do with sensors that capture the exact geometry face with higher accuracy. By analyzing the geometry of rigid characteristics on the face, 3D facial recognition has been intensively investigated by the scientific community to overcome unsolved challenges

in 2D facial recognition and achieve much-improved accuracy. As a result, various new systems based on 3D data have been developed recently.



In order to illuminate the target human face, the active capture systems emit non-visible light, such as infrared laser beams. The systems then use the reflection to determine the target face's form features. According to Avast (2021) It is mainly considered to go through these six steps; It is mainly considered to go through these six steps; Detection, alignment, measurement, representation, matching, and verification. Below are the performance matrices according to Song Zhou & Sheng Xiao.

$$Accuracy = \frac{TP + TN}{TP + FN + FP + TN}$$

Error rate is the opposite of accuracy rate.

$$Error = \frac{FN + FP}{TP + FN + FP + TN} = 1 - accuracy$$

- TP—the number of samples for the prediction of the positive class as the positive class.
- FN—the number of samples of positive class is predicted to be negative class.
- FP—the number of samples whose negative class is predicted as positive class.
- TN—the number of samples of negative class is predicted to be negative class.

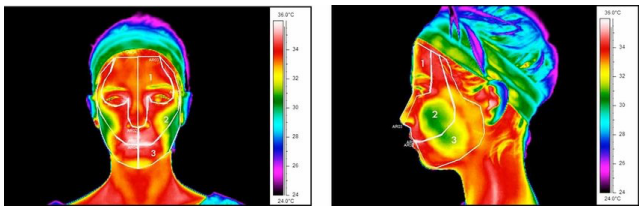
Among them, True and False indicate correct and wrong classification, Positive and Negative samples.

Face recognition is substantially improved by using three-dimensional data points from a face. Advanced sensors that beam structured light onto the face have enabled 3D-dimensional face recognition studies.

FACIAL THERMOGRAPHY:

Thermography is a type of infrared imaging technology that involves utilizing a thermal camera to capture and construct an image of an object using infrared radiation emitted by the object. Francine J. Prokoski, a scientist, established in the mid-1990s that facial thermograms are unique to each individual. Face identification using thermal infrared technology can

identify faces that are not visible in the light and can also recognize facial blood vessel anatomy.



A thermal imaging camera is capable of performing algorithms to interpret that data and build an image. Thermography of the face detects heat patterns formed by the branching of blood vessels released by the skin. Thermograms are a type of pattern that is extremely rare. As a result, identical twins' thermograms are different.

COMPARISON AND REFLECTION:

PROS

3D FACE RECOGNITION	**FACIAL THERMOGRAPHY**
-High reading accuracy is a feature of 3D technique**.** -3D face recognition is yet a functioning examination field, offering several organizations commercial solution	- It has higher response to facial expressions and emotions - Even in low-light and nighttime settings, thermal cameras can capture face imagery without a flash.

CONS

3D FACE RECOGNITION	**FACIAL THERMOGRAPHY**
- When it comes to personality recognition, the distinction between twins is almost non-existent. - 3D requires expensive devices and professionalism.	- Exposure to infrared radiation for longer periods may experience health issues - It damages the skin and tissues as radiation waves are like heat waves

REFLECTION:

Based on research when these strategies are compared, it becomes clear that they are more effective and efficient than failures. When thermal face recognition is compared to 3D technique, the method is more resilient when there are less features. Since their reveal, these strategies have been refined over time. This makes them useful in numerous aspects, like security, businesses, and devices.

CONCLUTION:

In image analysis and computer vision, face recognition is a captivating technology. Due to its numerous applications in different fields, it has sparked much interest in recent years. One of the most notable findings of this study was that the recognition accuracy of all approaches had improved with time. Even with its current capability, the 3D face recognition remains a tough but potentially promising research subject. With the technique of thermal face recognition, its ability to capture in dark under low visibility is its top advantage.

REFERRENCES:

https://www.mdpi.com/1424-8220/20/2/342

https://www.researchgate.net/publication/329202680_3D_face_recognition_a_survey

https://hcis-journal.springeropen.com/articles/10.1186/s13673-018-0157-2

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8021210/

https://www.researchgate.net/figure/Facial-thermograms-frontal-and-lateral-views-with-the-trigeminal-ROIs-proposed-by-the_fig3_314243052

https://sciencing.com/uses-infrared-light-5454589.html

https://www.biometricupdate.com/201308/explainer-facial-thermography