BIOMETICS : FACE RECOGNITION SYSTEM & APPLICATIONS

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Abstract: The human face plays an important role in our social interaction, conveying people's identity. Using the human face as a key to security, face recognition technology has received significant attention in the past several years and is a great challenge. Face recognition has the potential to be the non intrusive form of biometric identification.
In this paper we shall see different techniques for face recognition followed by these technologies, their advantages, disadvantages and solutions to resolve the problems, applications.

Keywords: Biometrics, Facial recognition technology, person identification.

INTRODUCTION:

Humans often use faces to recognize individuals and advancements in computing capability over the past few decades now enable similar recognitions automatically. Early face recognition algorithms used simple geometric models, but the recognition process has now matured into a science of sophisticated mathematical representations and matching processes. Major advancements and initiatives in the past ten to fifteen years have propelled this technology into the spotlight.
This technology can be used for both verification and identification. Face recognition is a fascinating problem with important commercial applications such as mug shot matching, crowd surveillance & witness face reconstruction.
The system can be represented in block diagram as:

1.1. Biometric:

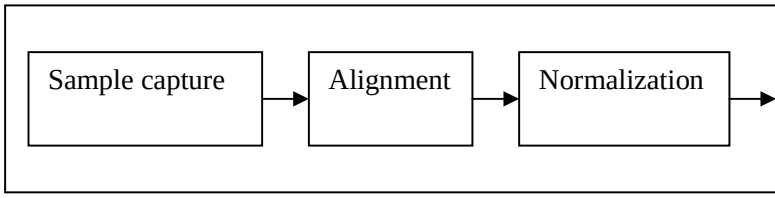
A biometric is a unique, measureable characteristic of a human being that can be used to automatically recognize an individual or verify an individual's identity. This feature can measure both physiological and behavioral characteristics. A biometric system refers to the integrated hardware and software used to conduct biometric identification and verification.This technique can further be divided into physiological and behavioral biometrics.
The Physiological Biometrics is based on measurements and data derived from direct measurement of a part of human.It includes: finger scan, facial recognition, iris scan, retina scan, Hand scan.

The Behavioral Biometrics is based on measurements and data derived from an action .This includes: Voice scan, signature scan, keystrokes scan.

1.2. Face Recognition System:

Face recognition system turns human face to computer code so that it can be compared with thousands of faces. In order for face recognition system to work it has to know what a basic face looks like. It is based on ability to first recognize faces, which is a technological feat in itself and then measure the various features of each face. This technique is more beneficial to use for facial authentication than for identification purposes, as it is too easy to alter face, features with a disguise or mask, etc. Each human has some distinguishable part landmarks which are known as nodal points. There are about 80 nodal points on human faces like distance between eyes, width of nose, depth of eye sockets, cheekbones, jaw line, chin etc. These nodal points are used to create numerical code, a string of numbers that represents the face in database.

2.1. Facial Scanning: There are mainly five steps or part of facial scanning. These are: sample capture, alignment, normalization, representation, matching.



Sample capture - When the system is attached to a video surveillance system, the recognition software searches the field of view of a video camera for faces. If there is a face in the view, it is detected within a fraction of a second. The system switches to a high-resolution search only after a head-like shape is detected.

Alignment - Once a face is detected, the system determines the head's position, size and pose. A face needs to be turned at least 35 degrees toward the camera for the system to register it.

Normalization -The image of the head is scaled and rotated so that it can be registered and mapped into an

appropriate size and pose. This is performed regardless of the head's location and distance from the camera. Light does not impact the normalization process.

Representation - The system translates the facial data into a unique code also called as template. This coding process allows for easier comparison of the newly acquired facial data to stored facial data the template is much smaller than the image from which it is drawn whereas quality facial images generally require 150-300 kb, the templates are approx. 1300 bytes or less than 1/100th of original.

Matching - The newly acquired facial data is compared to the stored data and (ideally) linked to at least one stored facial representation.

2.2. Technologies used for Facial Recognition:

There are various methods by which facial scan technology recognizes people. All these technologies share certain commonalities such as emphasizing those sections of the face, which are less susceptible to alteration, including the upper outlines of the eye sockets; areas surrounding ones cheek bones and side of mouth. All primary technologies are designed to be robust enough to conduct one to many searches i.e. to locate single face out of a database of thousands of faces. These technologies are mainly categorized into:

2.2.1 Traditional:

Some facial recognition algorithms identify facial features by extracting landmarks, or features, from an image of the subject's face. For example, an algorithm may analyze the relative position, size, and/or shape of the eyes, nose, cheekbones, and jaw. These features are then used to search for other images with matching features. Other algorithms normalize a gallery of face images and then compress the face data, only saving the data in the image that is useful for face recognition. A probe image is then compared with the face data. Recognition algorithms can be divided into two main approaches, geometric, which look at distinguishing features, or photometric, which is a statistical approach that distills an image into values and compares the values with templates to eliminate variances. Popular recognition algorithms include Principal Component Analysis using eigenfaces, Linear Discriminate Analysis, Elastic Bunch Graph Matching using the Fisherface algorithm, the Hidden Markov model, the Multilinear Subspace Learning using tensor representation, and the neuronal motivated dynamic link matching.

2.2.2 3-Dimensional recognition:

A newly emerging trend, claimed to achieve improved accuracies, is three-dimensional face recognition. This technique uses 3D sensors to capture information about the shape of a face. This information is then used to identify distinctive features on the surface of a face, such as the contour of the eye sockets, nose, and chin. One advantage of 3D facial recognition is that it is not affected by changes in lighting like other techniques. It can also identify a face from a range of viewing angles, including a profile view. Three-dimensional data points from a face vastly improve the precision of facial recognition. 3D research is enhanced by the development of sophisticated sensors that do a better job of capturing 3D face imagery. The sensors work by projecting structured light onto the face.

2.2.3 Skin texture analysis

Another emerging trend uses the visual details of the skin, as captured in standard digital or scanned images. This technique, called skin texture analysis, turns the unique lines, patterns, and spots apparent in a person’s skin into a mathematical space.

3 APPLICATIONS OF FACE RECOGNISATION SYSTEM

3.1 Law enforcement and justice solutions:

The law enforcement agencies are looking for innovative technologies to help them stay one step ahead of the world's ever-advancing criminals.As such; FRS is committed to developing technologies that can make the jobs of the law enforcement officer easier. This includes acclaimed CABS-computerized arrest and booking system and the child base protection, a software solution for global law enforcement agencies to help protect and recover missing and sexually exploited children, particularly as it relates to child pornography.

3.2 Identification solutions:

The use of face recognition for identification programs has several advantages over other biometric technologies.It optimises the existing identification infrastructure. This includes, using existing photo databases and the existing enrollment technology.It also helps in integrating the terrorist watch lists including regional, national, and international most-wanted databases.

3.3 Homeland defense:

Since the terrorist events of September 11, 2001, the world has paid much more attention to the idea of

Homeland Defense, and both governments and private industries alike are committed to the cause of national defense.This includes everything from preventing terrorists from boarding aircraft, to protecting critical infrastructure from attack or tampering (e.g. dams, bridges, water resevoirs, energy plants, etc.) to the identification of known terrorists.

3.4 Airport security:

Airport and other transportation terminal security is very essential.The use of biometric identification, can enhance security efforts already underway at most airports and other major transportation hubs (seaports, train stations, etc.).This includes the identification of known terrorists before they get onto an airplane or into a secure location.

3.5 Immigration:

Most countries do not want to be perceived as being a weak link when it comes to accepting immigrants and refugees, particularly if that individual uses the new country as a staging ground for multi-national criminal and terrorist activities. Consequently, governments around the world are examining their immigration policies and procedures.Biometric technology, particularly face recognition software, can enhance the effectiveness of immigration and customs personnel.

3.6 Financial services:

The financial industry revolves around the concept of security. Yet the security within the industry is limited to a simple personal identification number (PIN) or password.Biometrics, particularly face recognition software, can improve the security of the financial services industry, saving the institution time and money both through a reduction of fraud cases and the administration expenses of dealing with forgotten passwords.The use of biometrics can also ensure that confidential information remains confidential while deterring identity theft, particularly as it relates to ATM terminals and card-not-present e-commerce transactions

3.7 Scene analysis and surveillance solutions:

This includes the ability to extract, categorize, and search non-facial imagery. For example, within the law enforcement application it allows you to capture, archive, and retrieve such identifying characteristics as tattoos, marks, or scars.It can also analyze scenes from either streaming or archived video, looking for out of the ordinary occurrences, the presence of certain vehicles, specific faces, etc.

4. CONCLUSION

Face detection is currently a very active research area and the technology has come a long way. This paper presents facial recognition system and its various technologies. 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, and then we have mentioned different types of technologies used for facial recognition. At the end we have briefly described the applications of facial recognition in our daily life.

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