A Review Paper on Age Invariant Face Recognition

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Abstract— Face Recognition is used for real time application. So reliability is the more important matter for security. Face biometrics is useful for authentication that recognizes face. A facial recognition system is a computer application for automatically identifying or verifying a person from a digital image or a video frame from a video source. It is typically used in security systems and can be compared to other biometrics such as fingerprint or eye iris recognition systems. Recently face recognition is attracting much attention in the society of network multimedia information access. Areas such as network security, content indexing and retrieval, and video compression benefits from face recognition technology because "people" are the center of attention in a lot of video. In this paper we focus on 3-D facial recognition system and biometric facial recognition system. Aging directly affects those physiological and behavioral traits which are characterized in biometric.

Key words: Face Recognition, Image Processing,

GENERAL TERMS

Image Processing

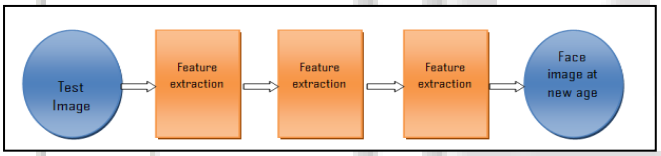

Fig. 1 Image Processing

I. INTRODUCTION

The human face plays an important role in our social interaction, conveying people's identity Using the human face as a key to security, machine recognition of faces is emerging as an active research area spanning several disciplines such as image processing, pattern recognition, computer vision and neural networks, Biometric face recognition technology has received significant attention both from neuroscientists and from computer vision scientists in the past several years due to its potential for a wide variety of applications in both law enforcement and non-law enforcement such as passports, credit cards, photo IDs, drivers' licenses, and mug shots to real time matching of surveillance video images. As compared with other biometrics systems using fingerprint palm print and iris, face recognition has distinct advantages because of its non-contact process Face images can be captured from a distance without touching the person being identified, and the identification does not require interacting with the person.

Research interest in face recognition has grown significantly in recent years as a result of the following facts:

1) The increase in emphasis on civilian /commercial research projects.
2) The increasing need for surveillance related applications due to drug trafficking, terrorist activities. etc.
3) The re-emergence of neural network classifiers with emphasis on real time computation and adaptation.
4) The availability of real time hardware.

Facial biometric matching is used to verify the identity of individuals attempting access for various border management and access control applications. Facial matching algorithms make use of digital photographs of the face stored in a database or on an ID card. These digital images are captured upon registration into the system, and then compared to a live photo of the individual upon an access attempt in a process called "matching".

Face recognition is an easy task for humans Experiments, three day old babies are able to distinguish between known faces. Facial recognition utilizes distinctive features of the face including the upper outlines, the eye sockets, the areas surrounding the cheekbones, the sides of the mouth, and the location of the nose and eyes to perform verification and identification. Most technologies are somewhat resistant to moderate changes in hairstyle, as they do not utilize areas of the face located near the hairline.

When used in identification mode, facial recognition technology generally returns candidate lists of close matches as opposed to returning a single definitive match (as do fingerprint and iris-scan technologies The performance of facial recognition technology is very closely tied to the quality of the facial image. Low-quality images are much more likely to result in enrolment and matching errors than high-quality images. For example, many photograph databases associated with drivers' licenses or passports contain photographs of marginal quality, such that importing these files and executing matches may lead to reduced accuracy. Similarly well-known problems exist with surveillance deployments. If facial images for enrolment and matching can be acquired from live subjects with high-quality equipment, system performance increases substantially. For facial recognition at slightly greater-than-normal distances, there is a strong correlation between camera quality and system capabilities.

Various approaches for 2D face recognition

It can be classified into three categories:

1) Analytic (feature based) methods:- analytic approaches compare the salient facial features or components detected from the face
2) Holistic (global) methods:- holistic approaches make use of the information derived from the whole face pattern.
3) Hybrid methods:- By combining both local and global features hybrid methods attempt to produce a more complete representation of facial images.

One of the first automated face recognition systems was described; marker points such as: Position of eyes, ears

and nose were used to build a feature vector (distance between the points, angle between them, the recognition was performed by calculating the Euclidean distance between feature vectors of a probe and reference image. Such a method is robust against changes in illumination by its nature, but has a huge drawback: the accurate registration of the maker points is complicated, even with state of the art algorithms. Some the week on geometric recognition was carried out in. The eigen faces method described took a holistic approach to face recognition: A facial image a point a high dimensional image space and a lower representation is notation becomes easy.

The lower dimensional subspace is found with principal Component Analysis, which identifies the axes with maximum variance. While this kind of transformation is optimal nom a reconstruction standpoint, it doesn't take any class labels into account. Imagine a situation where the variance is generated from external sources, let it be light. The axes with maximum variance do not necessarily contain any discriminative information at all; hence a classification becomes impossible so a class-specific projection with Linear Discriminate Analysis was applied to race recognition in. The basic idea is to minimize the variance within a class, while maximizing the variance between the classes at the same time. Recently various methods for a local feature extraction emerged. To avoid the high-dimensionality or the input data only local regions of an image are described. The extracted features are (hopefully) more robust against partial occlusion, illumination and small sample size. Algorithms used for a local feature extraction are Gabor Wavelets lol, Discrete Cosines Transform m and Local Binary Patterns. It's still an open research question how to preserve spatial information when applying a local feature extraction, because spatial information is potentially useful information as with all biometrics, the four steps sample capture, feature extraction, template comparison, and matching define the process flow of facial scan technology. Enrolment generally consists of a 20-30 second enrolment process whereby several pictures are taken of one's face. Ideally, the series of pictures will incorporate slightly different angles and facial expressions, to allow for more accurate matching. After enrolment, distinctive features are extracted (or global reference images are generated), resulting in the creation of a template. The template is much smaller than the image from which it is derived: facial images can require 15 30kb templates range from 84 bytes to 3000 bytes. The smaller templates are normally used for 1: N matching.

II. 3D FACIAL RECOGNITION

A newly-emerging trend in facial recognition software uses a 3D model, which claims to provide more accuracy. Capturing a real-time 3-D image of a person's facial surface, 3D facial recognition uses distinctive features of the face -- where rigid tissue and bone is most apparent, such as the curves of the eye socket, nose and chin -- to identify the subject. These areas are all unique and don't change over time. Using depth and an axis of measurement that is not affected by lighting, 3D facial recognition can even be used in darkness and has the ability to recognize a subject at different view angles with the potential to recognize up to 90 degrees (a face in profile). Using the 3D software, the system goes through a series of steps to verify the identity of an individual.

1) Detection:-Acquiring an image can be accomplished by digitally scanning an existing photograph (2D) or by using a video image to acquire a live picture of a subject (3D).
2) Alignment:- Once it detects a face, the system determines the head's position, size and pose. As stated earlier, the subject has the potential to be recognized up to 90 degrees. While with 2-D the head must be turned at least 35 degrees toward the camera.
3) Measurement:-The system then measures the curves of the face on a sub-millimeter (or microwave) scale and creates a template.
4) Representation:-The system translates the template into a unique code. This coding gives each template a set of numbers to represent the features on a subject's face.
5) Matching:- If the image is 3D and the database contains 3D images, then matching will take place without any changes being made to the image. However, there is a challenge currently facing databases that are still in 2D images. 3D provides a live, moving variable subject being compared to a flat, stable image. New technology is addressing this challenge. When a 3D image is taken, different points (usually three) are identified. For example, the outside of the eye, the inside of the eye and the tip of the nose will be pulled out and measured
6) Verification or Identification:- In verification, an image is matched to 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 says he is. If identification is the goal, then the image is compared to all images in the database resulting in a score for each potential match (1:N). In this instance, you may take an image and compare it to a database of mug shots to identify who the subject is. Next, we'll look at how skin biometrics can help verify matches.

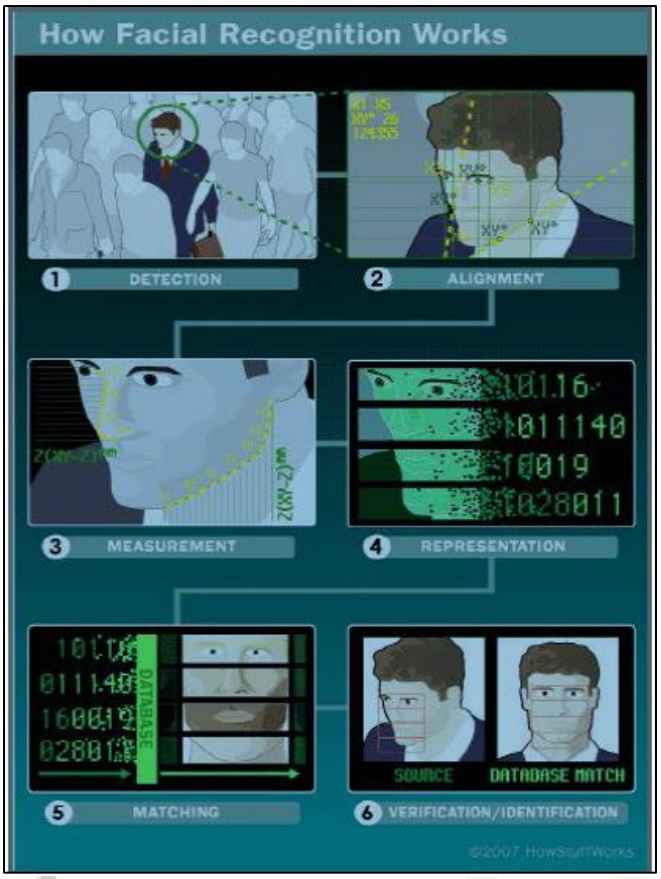

Fig. 2: Facial Recognition

A. Working of Facial Recognition (Surface Texture Analysis Model)

The process, called Surface Texture Analysis, works much the same way facial recognition does. A picture is taken of a patch of skin, called a skin print. That patch is then broken up into smaller blocks. Using algorithms to turn the patch into a mathematical, measurable space. It can identify differences between identical twins, which is not yet possible using facial recognition software alone. According to Identix, by combining facial recognition with surface texture analysis, accurate identification can increase by 20 to 25 percent Face It currently uses three different templates to confirm or identify the subject: vector, local feature analysis and surface texture analysis. The vector template is very small and is used for rapid searching over the entire database primarily for one to- many searching.

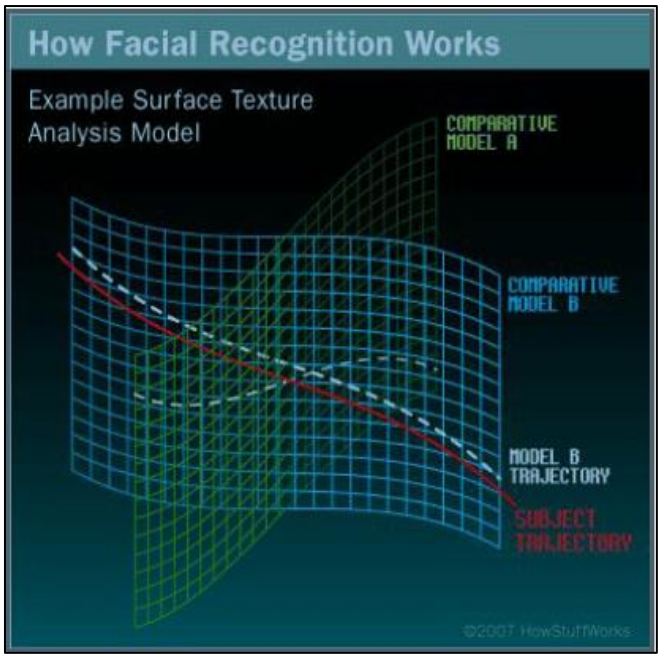

Fig. 3: Working of facial recognition (Surface texture analysis model)

1) Local Feature Analysis (LFA) template performs a secondary search of ordered matches following the vector template.
2) Surface Texture Analysis (STA) is the largest of the three. It performs a final pass after the LFA template search relying on the skin features in the image, which contains the most detailed information.

By combining all three templates, Face it has an advantage over other systems. It is relatively insensitive to changes in expression, including blinking, frowning or smiling and has the ability to compensate for mustache or beard growth and the appearance of eyeglasses. The system is also uniform with respect to race and gender. Among the different biometric techniques facial recognition may not be the most reliable and efficient but its great advantage is that it does not require aid from the test subject. Properly designed systems installed in airports, multiplexes, and other public places can identify individuals among the crowd. Other biometrics like fingerprints, iris, and speech recognition cannot perform this kind of mass scanning. However, questions have been raised on the effectiveness of facial recognition software in cases of railway and airport security.

III. CRITICISM

A. Weaknesses

Face recognition is not perfect and struggles to perform under certain conditions. Ralph Gross, a researcher at the Carnegie Mellon Robotics Institute, describes one obstacle related to the viewing angle of the face: "Face recognition has been getting pretty good at full frontal faces and 20 degrees off, but as soon as you go towards profile, there've been problems." Other conditions where face recognition does not work well include poor lighting, sunglasses, long hair, or other objects partially covering the subject's face, and low resolution images. Another serious disadvantage is that many systems are less effective if facial expressions vary. Even a big smile can render in the system less

effective. For instance: Canada now allows only neutral facial expressions in passport photos.

IV. CONCLUSION

This paper has attempted to review a significant number of papers to cover the recent development in face recognition field. Present study exposes that face recognition algorithm can be enhanced using hybrid methods for better performance. The list of references to provide more detailed understanding of the approaches described is enlisted. We apologize to researchers whose important contributions may have been overlooked. In future scope, one can implement hybrid method to get better result of face recognition.

Face recognition is a both challenging and important recognition technique. Among all the biometric techniques, face recognition approach possesses one great advantage, which is its user-friendliness (or non-intrusiveness). In this paper, we have given an introductory survey for the face recognition technology. We hope this paper can provide the readers a better understanding about face recognition.

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