Study of Face-Recognition Parameters and its finding using DSP Software

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ABSTRACT

As one of the most successful applications of image analysis and understanding, face recognition has recently received significant attention, especially during the past several years. Recently face recognition is attracting much attention in the society of network multimedia information access. This paper presents a algorithm for rapid and accurate face-detection, extraction & recognition. The algorithm can be transferred from a PC to embedded devices, such as a Digital Signal Processing platform using MATLAB software. This system-level implementing ability brings great potential to customized and reusable applications as well as miniature systems.

Keywords: Face Recognition; Biometric Identification; Network Security and Surveillance.

INTRODUCTION

Going on the assumption that facial recognition is a reference to the FaceIt, it is a software program that is used to identify persons whose facial ID's are stored in a databank. At least two reasons account for the need of facial recognition technology in our daily lives: the first is the wide range of commercial and law enforcement applications, and the second is the availability of technologies after 30 years of research. Even though current machine recognition systems have reached a certain level of maturity, their success is limited by the conditions imposed by many real applications. For example, recognition of face images acquired in an outdoor environment with changes in illumination and/or pose remains a largely unsolved problem. In other words, current systems are still far away from the capability of the human perception system.

As shown in fig 1 for a face recognition system the face is extracted from the rest of the scene and compared to a database of stored images. In order for this software to work, it has to know how to differentiate between a basic face and the rest of the background. Facial recognition software is based on the ability to recognize a face and then measure the various features of the face. Every face has numerous, distinguishable landmarks, the different peaks and valleys that make up facial features. FaceIt defines these landmarks as nodal points.

Each human face has approximately 80 nodal points. Some of these measured by the software are:

- Distance between the eyes
- Width of the nose,
- Depth of the eye sockets
- The shape of the cheekbones
- The length of the jaw line

These nodal points are measured creating a numerical code, called a face print, representing the face in the database .In the past, facial recognition software has relied on a 2D image to compare or identify another 2D image from the database. To be effective and accurate, the image captured needed to be of a face that was looking almost directly at the camera, with little variance of light or facial expression from the image .Now 3D image comparison is done with help of new technology.

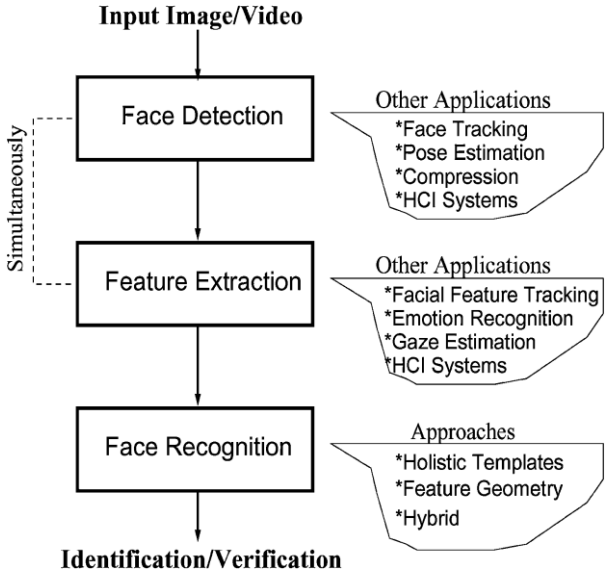

Fig.1 Configuration of face recognition system.

THEORY

Color information helps extract features of skin color and hair from a complex background. The flowchart of the proposed algorithm is shown as Figure 2. The algorithm can be transferred from a PC to embedded devices, such as a Digital Signal Processing platform using MATLAB software. This system-level implementing ability brings great potential to customized and reusable applications as well as miniature systems.

Detailed descriptions of each module are as follows:

Face detection algorithm

Color information helps extract features of skin color and hair from a complex background.

The flowchart of the proposed algorithm is shown as Figure includes five main modules-- (A)Skin Detection: Using color information to detect possible skin color in an image (B)Hair Detection: Utilizing brightness information to find out where hair probably is (C)Skin Quantization: Quantizing skin color pixels and identifying blocks of the skin (D)Hair Quantization: Quantizing hair color pixels and identifying blocks of the hair (E) Get the Fusion of Features: Determining whether the detected skin area is a part of a human face according to the relative positions between skin and hair regions.

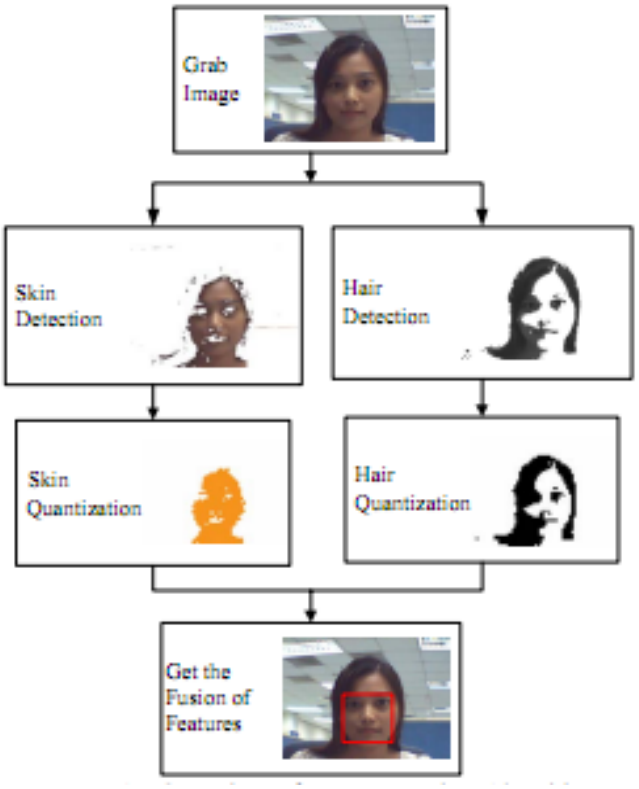

Fig.2 Face detection algorithm

Skin detection

Many studies have been involved in defining the range of skin color in an image. Extracting skin color from the Normalized RGB color model [10] was found to be effective since the RGB model without normalization was sensitive to variations of light. The RGB model was therefore transformed to the Normalized RGB model. The formulas for the transformation are listed as equation 1 and 2:

$$r = \frac{R}{R+G+B}$$ ----------Equation 1

$$g = \frac{G}{R+G+B}$$

---------- Equation 2

Equation 1 represents the normalization of a red pixel while equation 2 stands for that of a green pixel. The distribution of skin color is observably concentrated in the correlation chart of r with respect to g, as indicated in Figure

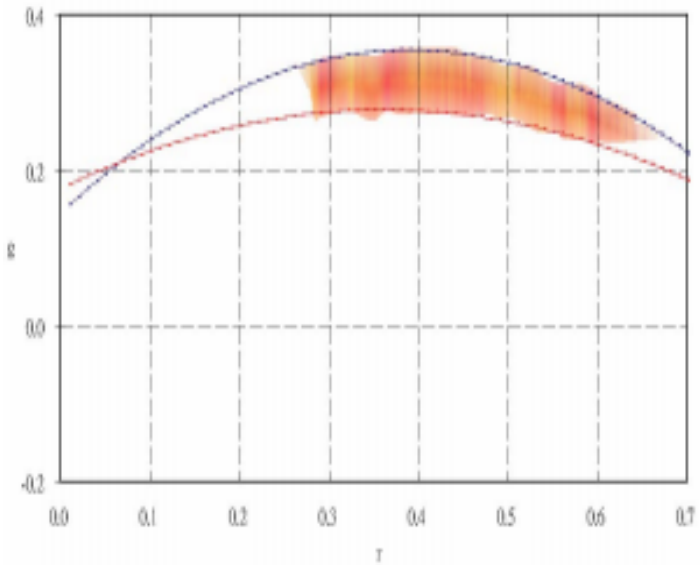

Chart 1. Statistical chart of skin color

Hair detection

The intensity element of HSI color model is employed for detecting the hair color. The relation between the intensity element and RGB elements is as follows:

$$I = \frac{1}{3}(R+G+B)$$

--------Equation 3

Skin quantization

This module quantizes skin color pixels and uses a 5x5 pixel square to express whether or not a region included pixels of skin color. The quantization lowers the image resolution; nonetheless, the following calculation of the geometric locations of pixels is speeded up. The number of black pixels

Within 25 pixels is counted and these 25 pixels regarded as non-skin color blocks if the number is beyond a threshold value 12. The rest are viewed as skin color blocks. Figure 3 demonstrates the image of Skin Quantization.

Fig.3 Skin Quantization

Hair quantization

This module, similar to the Skin Quantization, quantizes hair color pixels and uses a 5x5 pixel square to express whether or not a region included pixels of hair color. The number of white pixels within 25 pixels is counted and these 25 pixels considered as non-hair color blocks if the number is beyond a threshold value 12. The rest are treated as hair color blocks. Fig4. Show the Hair Quantization.

Fig. 4 Hair Quantization

Facial recognition

Algorithm

Principal Components Analysis is used in computer vision, first showing how images are usually represented, and then showing what PCA can allow us to do with those images. The information in this section regarding facial recognition comes from "Face Recognition: Eigenface, Elastic Matching, and Neural Nets" High-level functioning principle of the eigenface-based facial recognition algorithm show the actual face recognition technique .on the basis of this principle the information regarding facial recognition is stored in database then biometric is compared with extracted image difference of stored biometric & extracted biometric is zero then the image is recognize.

MATLAB provides a comprehensive suite of reference-standard algorithms and graphical tools for image analysis tasks such as statistical analysis, feature extraction, and property measurement. By using various methods on face matrix, the individual face can be recognize an indexing is an alternative to sorting a vector. With indexing, the vector is left in its original order. An index vector is used to point to the values in the original vector in the desired.

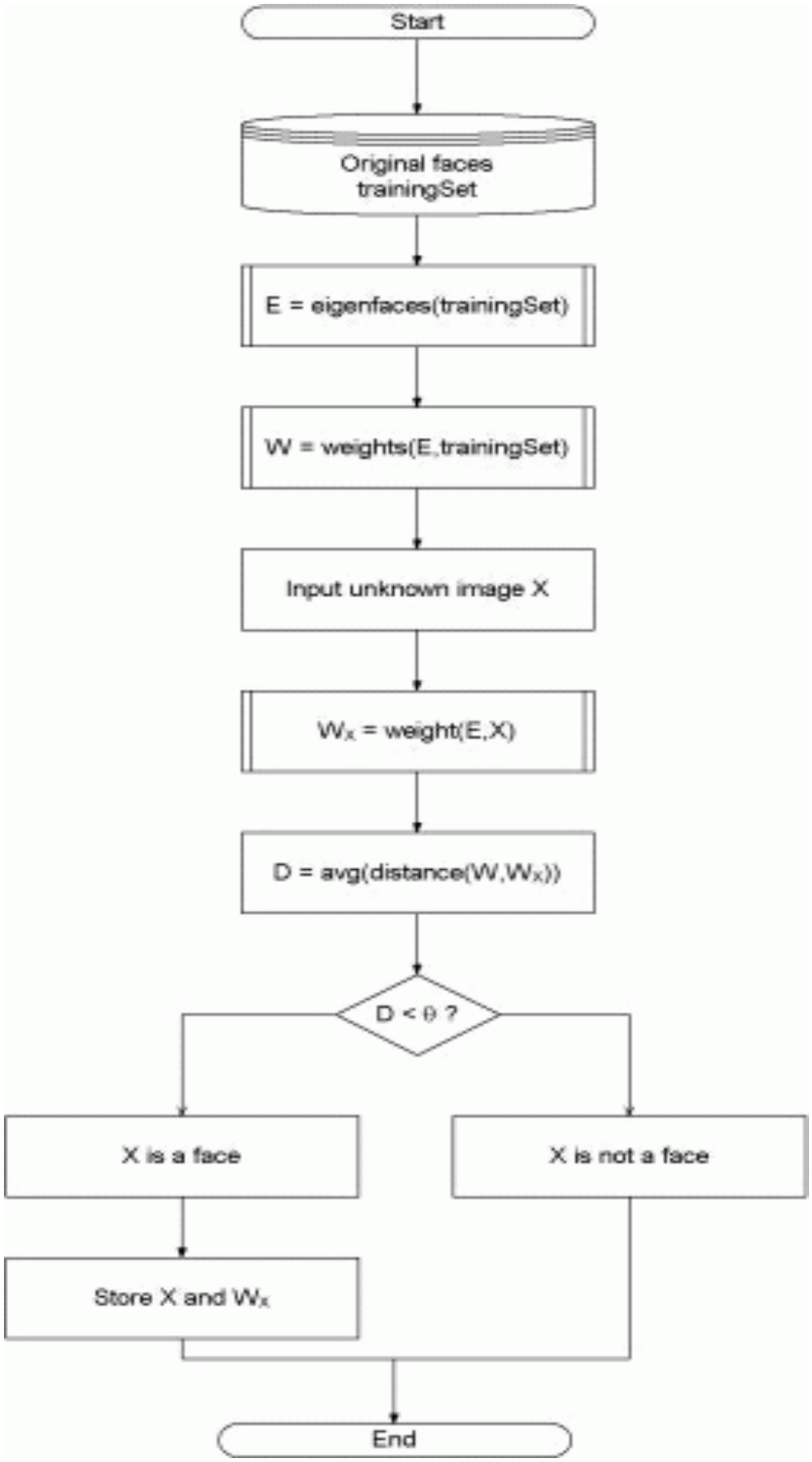

Fig. 5 Algorithm showing face recognition steps

Future FR model

The performance of pattern recognition systems that use statistical features depends on a specific feature extraction technique. This technique is used to represent an image by a set of features and to reduce the dimension of the image space by removing redundant data.

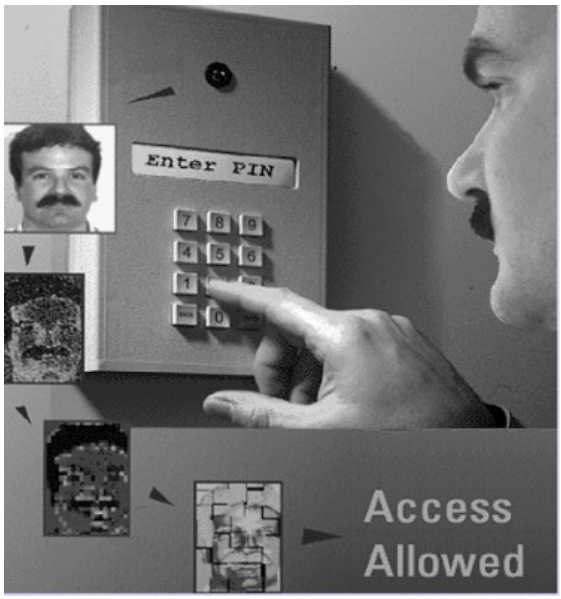

Fig.6 Miniature Systems

The ability to recognize people by their facial characteristics. The most advanced technology is based on the Eigenface algorithm, which maps the characteristics of a person's face into a multidimensional face space. Computers can conduct facial database searches and/or perform live, one-to-one or one-to-many verifications with unprecedented accuracy and split-second processing. Users can be granted secure access to their computer, mobile devices, or for online e-commerce, simply by looking into their Web camera.

The computer can distinguish the same person with different appearances; for example, with or without glasses, change of hair style and seasonal skin color changes. Neural networks were used for earlier face recognition systems, but with Eigenface, the computer cannot be easily fooled by photographs or by someone else with a similar appearance. A face is digitized and matched against the face database to determine if the person is authorized to enter a facility or use a system.

Advantages

A facial recognition system is a computer application or device that can identify individuals based on their unique facial characteristics. Unlike many other identification methods (e.g., fingerprints, voiceprint, signature), this can be advantageous in clean environments, for surveillance or tracking, and in automation systems. Because the system keeps a reference model of the individual, and captures their image for identification, there may be concerns about how the system is perceived by its users. They may also be more error-prone when

identifying individuals, due to the fairly recent development of the technology. In addition, it is used for security purposes. Some Applications are given below-

- Just look attendance.
- Anti Terrorist Activities.
- Prevention of fraud in the markets.
- Law Enforcement.
- Prevention of child molestation.
- Rapid progression through customs.
- Residential Security.
- Voter Verification.
- Banking.
- Identity verification in the field and intelligence gathering,
- Crime prevention and investigation.

Disadvantages

Disadvantages of other identification methods e.g., fingerprints, voiceprint, signature are as follows:

- The finger print of those people working in chemical industries is often affected. Therefore these companies should not use the finger print mode of authentication.
- It is found that with age, the voice of a person differs. Also when the person has flu or throat infection the voice changes or if there are too much noise in the environment this method may not authenticate correctly. Therefore this method of verification is not workable all the time
- For people affected with diabetes, the eyes get affected resulting in differences.

CONCLUSION

We have presented an extensive survey of image & video-based face recognition of human faces and a brief review of related studies. We have categorized the methods used for each type, and discussed their characteristics and their pros and cons. In addition to a detailed review of representative work, we have provided summaries of current developments using Digital Signal Processing (MATLAB Software). We have also identified two important issues in practical face recognition systems: the illumination problem and the pose problem. At last, we have categorized proposed methods of solving these problems.

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