

HUMAN FACE RECOGNITION SYSTEM

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Bachelor of Mechatronics Engineering

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I hereby declare that I have read through this report entitle “Human Face Recognition System” and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Mechatronics Engineering.

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HUMAN FACE RECOGNITION SYSTEM

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**A report submitted in partial fulfillment of the requirement for the degree of Bachelor of
Mechatronics Engineering**

Faculty of Electrical Engineering

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I declare that this report entitle “title of the project” is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of candidature of any other degree.

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Date :

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ABSTRACT

This proposal is projected to develop Human Face Recognition System. The purpose of this proposal is to design and develop a system that can be used to classify and recognize human face. Actually, it is a computer application used to automatically identify or verify a person from a digital image. Algorithms will be used to develop system to classify the given input image. This project will process the 2D image as input data and process it. Project will be built up using MATLAB and Graphical User Interface (GUI) so that the system is user friendly.

ABSTRAK

Projek ini dilaksanakan untuk membangunkan sebuah perisian yang dapat mengecam muka manusia. Tujuan projek ini dibangunkan adalah untuk mengklasifikasi serta mengecam muka manusia. Sebenarnya, ini merupakan sebuah aplikasi komputer yang bergerak secara automatik untuk mengenal imej seseorang manusia dalam bentuk digital. “Algorithms” akan digunakan untuk membolehkan sistem ini untuk mengklasifikasi imej yang diproses. Projek ini akan memproses imej yang berbentuk 2D sebagai data masukan seterusnya memproseskannya. Projek ini akan dibangunkan melalui penggunaan perisian MATLAB dan “Graphical User Interface” supaya ini lebih mudah digunakan.

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CHAPTER I

INTRODUCTION

1.1 Project Background

Human face recognition system is a security system which will be developed to classify and recognize human face as a password to get access to the system. It is system where an organization can use it as security system to their authority room access. This system only requires a wireless camera and workstation which installed with MATLAB software to operate it. This wireless camera will be used to capture human faces. Then, the receiver of this camera which connected to a workstation will transmit the data from the camera to workstation.

The workstation will run Graphical User Interface (GUI) application to deal with the captured image. The MATLAB will be used to process the image captured and recognize the human face through the available human faces at data set. The GUI developed using MATLAB also so that source code can easily and efficiently communicate the data within the software. Because, communicating the two software may results in clash of software.

1.2 Problem Statement

Identification card checking to recognize human is become less secure. A lot of fraudulence methods are used to create duplicate cards to breakthrough authority checking. A biometric authentication will help solve the problem. Therefore, proposed project is to develop the human face recognition system that is able to classify and recognize human face securely compared using identification card.

Although it is more secure, there are lot problems in implementing this system. In order to test and train the system, data set contains number of human faces are needed. The main problem is data set which will be created using wireless camera will not surely satisfy the standard orientation of the system needs. Let says the face captured is not at center of the camera, there will be difficulty in processing that particular image.

In addition, the environment of the wireless camera also will increase the difficulty of image processing. High illumination around the wireless camera will complicate the process of distinguish foreground (human face) with background of the image. Next, algorithms will be developed not surely suit for everyone with different facial expression. Because, different reference values (eigenvectors and eigenvalues) will be created for same person if they give pose with different facial expression.

1.3 Objectives

The objective of this project is to:

- i. Develop algorithm to detect human face and classify it by computing its eigenvectors and eigenvalues
- ii. Develop algorithm to recognize human face and its Class
- iii. Create Training Set Data for the Face Recognition System
- iv. Build up a Graphical User Interface (GUI) for the Face Recognition System
- v. Build up a face Recognition System using any Integrated Development Environment (IDE)

1.4 Scope

The face recognition system algorithm will be developed by analyze the famous algorithms from pattern recognition algorithms. The computational approach algorithm was identified give satisfactory results. This type of algorithms approach will extract out eigenvalues and eigenvectors from the image. This will need spaces to store the data. So, the MATLAB workspace will be utilized by create appropriate algorithms.

The algorithms will form certain file which will save the data in matrix format either in two or three dimensions. Since the MATLAB used as platform for the system operation, the graphical user interface (GUI) for the system will use MATLAB function to increase time efficient (reduce time taken for connect GUI with MATLAB).But, the system have some limitation such lighting conditions, head orientation, image quality, facial expression, and partial occlusion.

1.5 Expected Output

These face recognition system will detect human faces and categorize it by computing the eigenvectors and eigenvalues. Different reference value (eigenvectors and eigenvalues) will be created for each person and stored it for further process. Then, algorithms will be developed to recognize human face and figure it out from the data set. The algorithms consist of mathematical calculation and programming will be used to process the input image.

Next, data set will be built for face recognition system will consists group of human faces which collected to test and train the system. In addition, Graphical User Interface (GUI) also will be developed. GUI is developed to easier the user to discover the system process such as image being processed and result of the process. The face recognition system is a complicated process. So, MATLAB software will be used as platform to develop this system.

1.6 Conclusion

In conclusion, this system is considered as a good project to be developed where it make the security system of the user is more secure and advance than normal security system which using identity cards. In addition, this biometric authentication is become more popular since its data required is easily obtained and readily available. The next chapter is about literature review of famous and reliable techniques.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

Biometrics refers to methods for uniquely recognizing humans based upon one or more intrinsic physical or behavioral traits. Biometric characteristics can be divided in two main classes that are physiological and behavioral. Physiological are related to the shape of the body but are not limited to fingerprint, face recognition, DNA, hand and palm geometry, iris recognition, which has largely replaced retina, and odor/scent. Behavioral are related to the behavior of a person but are not limited to typing rhythm, gait, and voice. Some researchers have coined the term behaviometrics for this class of biometrics.

Biometric authentication normally used in national ID cards, airport security, surveillance, site access and so on. But, face recognition offers several advantages over other biometrics as listed below:-

- i. Covert operation or can be used without subjects knowledge
- ii. Human readable media
- iii. Public acceptance or no association with crime, as fingerprints
- iv. Data required is easily obtained and readily available

Actually, this biometric face recognition system is divided into two major parts that is "Face Identification" and "Face Recognition". But, only recognition part only will be covered. Below are some typical approaches which used in face recognition. [1]

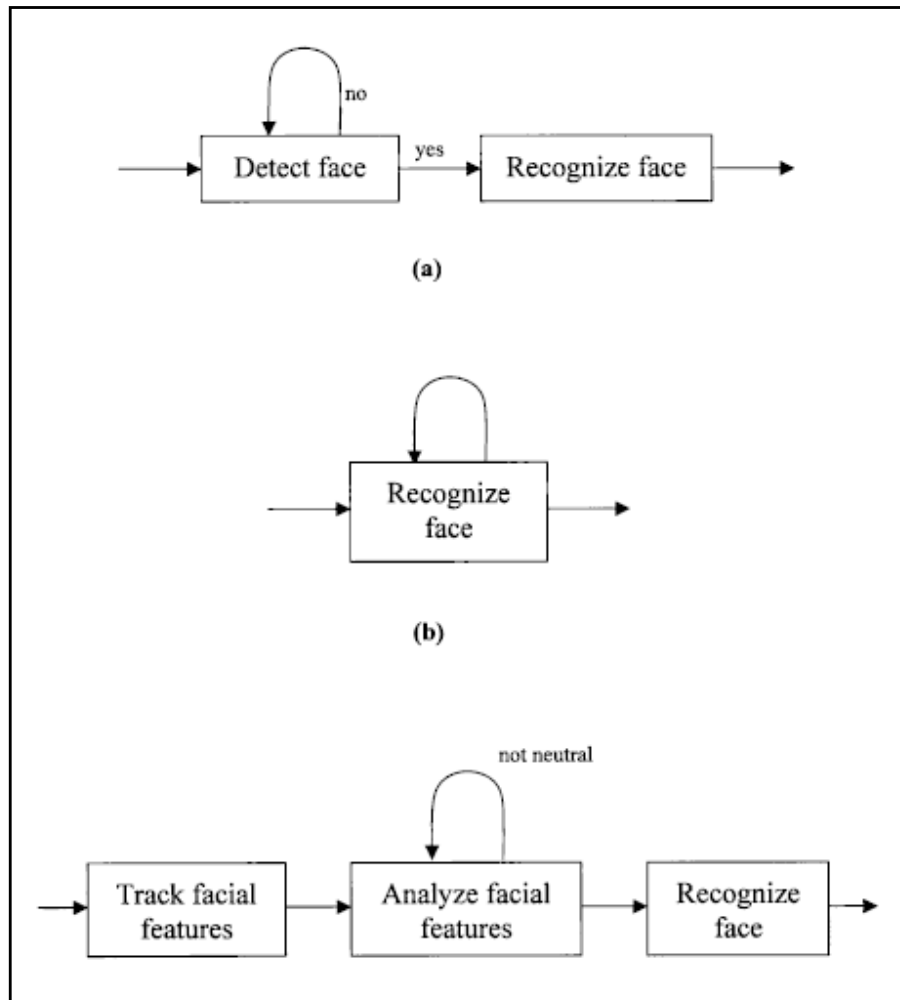


Figure 2.1: Typical approaches to face recognition

Figure 2.1 shows there are three typical approaches used in face recognition system. Some of famous inventors in Computer Vision and Pattern Recognition field conclude the detection and recognition of human faces as a single operation.

2.2 Face Recognition Approaches

There are several techniques famously used by worldwide experts for commercial and R&D purpose. The commercialization of face recognition still fewer compare other biometric security system such as iris and thumb scanning. But, at R&D are actively searching new face recognition technology since it believed have tendency to develop near future. [1]

There are several methods which famously discussed under research. There are Direct Correlation, Eigenfaces and Fisherfaces. Every of them seem using almost same way in development of techniques but actually it's not. Because their way of stored the image into database may seems same. But, the ways it recognize the new image are vary via different methods. They have their own advantages and disadvantages as described in following section.

2.2.1 Direct Correlation

Correlation is a robust and general technique for pattern recognition and is used in many applications, such as automatic target recognition, biometric recognition and optical character recognition. The design, analysis, and use of correlation pattern recognition algorithms require background information, including linear systems theory, random variables and processes, matrix/vector methods, detection and estimation theory, digital signal processing, and optical processing.

2.2.2 Eigenfaces

Eigenfaces are a set of eigenvectors used in computer vision problem of human face recognition. The approaches of using eigenfaces for recognition was developed and used in face pattern classification. These eigenvectors are derived from the covariance matrix of the probability distribution of the high-dimensional vector space of possible faces of human beings. To generate a set of eigenfaces, a large set of digitized images of human faces are taken under the same lighting conditions and normalized to line up the eyes and mouths. Mathematical tool as Principal Component Analysis (PCA) is used to extract out the image data. [2]

2.2.3 Fisherfaces

Fisherfaces is a similar method such as eigenface approach but it able to account for variations between multiple images of the same person. Additionally, it utilizes a larger training set containing multiple images of each person compared to the other methods. It also attempt to maximize the between class scatter, while minimizing the within class scatter. In other words, fisherfaces moves images of the same face closer together, while moving images of difference faces further apart.

2.3 Analysis

According to study on related topics, limitations are discovered for face recognition system. The limitation are depends on environment of the image captured and developed algorithms. Then, comparisons of effectiveness are done within explained face recognition approaches.

2.3.1 Limitation

Developed face recognition system effectiveness is highly dependent on image capture. But there are some limitations for the system. Variations of lighting condition are highly effect the brightness of the image and different lighting condition for enrolment and query. This will cause the image saturation which difficult to differentiate the face from the background. Then, the pose of head orientation should be standardized. The 2D feature distances appear to distort if angle of head turning vary much since we need to calculate Euclidian distance.

The image quality is quite affecting the recognition process. The quality of CCTV and web-cam are offen not good enough. Some more, the expression of face are important too. The feature location and shape changes even for same person if a person long smiles or raising eyebrows. Next, the partial occlusion also will hide the some important feature of faces. So, the part of face which covered by Hats, scarves, glasses are often changes the image being processed.

Even the best algorithms is developed, the factors such as shown above are always reduce performance of the system. So, in order to increase the accuracy of the developed face recognition system controlled environment such as under steady lighting condition, fixed head orientation and face expression when posing should be carried out. [5]

2.3.2 Comparisons

The effectiveness of the system is technically defined by measure the False Accept Rate (FAR) and False Reject Rate (FRR). FAR is probability of system incorrectly matches the input pattern with incorrect template in the testing database. FRR is probability of system failure in matches the input pattern with a matching template in the testing database. Both of these rates are measured in percentage. Below are graph which showing the results of rate for using 3 different types of face recognition approaches.

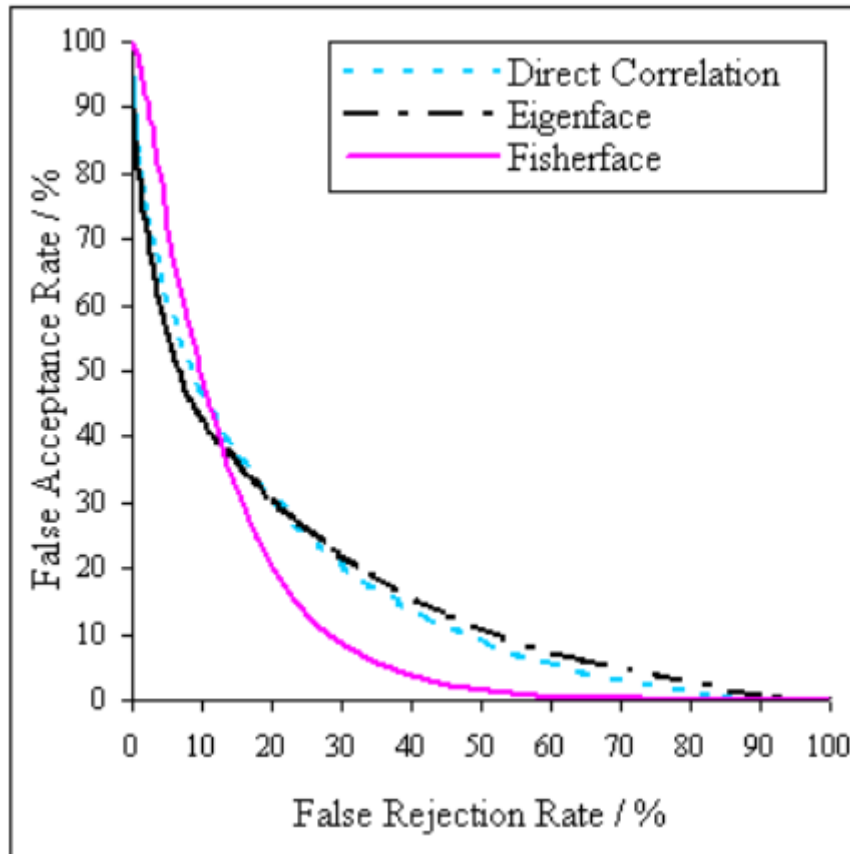


Figure 2.2: Comparison performance based on approaches

Figure 2.2 shows that fisherface method is give minimum rate of errors compared to the other two methods. During the Phase A, Eigenface method gives better performance compare to Direct Correlation and Fisherface methods. During the phase B, the fisherface method gives greater performance compare to the other methods. Overall, Direct Correlation and Eigenface method gives steady performance.

[3]