BIMODAL RECOGNITION BASED ON THUMBPRINT AND THUMB IMAGE USING BAYESIAN CLASSIFIER

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Dedicated to my family for their support and love

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ABSTRACT

The purpose of this project is to develop a Thumb image classification module which able to predict the gender from the image input. This module can be integrated into the current thumb print recognition system to form a bi-modal biometric system. With this add in module, the performance of the recognition system will significantly increase since the database search time is reduce into almost half when only the gender matched is considered. The development of this module is based on the Bayesian Classifier method by having input of the textural analysis, thumb area consumption and the thumb width size. The textural analysis is using the GLCM (Gray Level Co-occurrence Matrix) with its properties of contrast, correlation, energy and homogeneity. The thumb area and size calculation is based on a cropped image which has the thumb over a certain boundary. Due to the usage model of searching the database, the training set and the verification set is coming from the same data sets. The Bayesian Classifier algorithm is implemented in the MATLAB code. Few GLCM pixel distance analysis was done to evaluate the module performance. With the distance pixel of 2, it had shown the best accuracy among the result of other pixel combination. Result for male matching 82.35% and female matching is 81.82%.

ABSTRAK

Projek ini bertujuan untuk membina satu modul klasifikasi ibu jari yang mampu meramal jantina daripada imej ibu jari. Modul tersebut boleh diintegrasikan dengan sistem pengenalpastian imej ibu jari untuk membentuk satu sistem biometric dwi-modal. Dengan adanya modul ini, prestasi sistem pengenalpastian dapat ditingkatkan kerana masa untuk menaksir and membanding hanya perlu dilakukan kepada jantina yang berpadan sahaja. Pembinaan modul ini berdasarkan kepada klasifikasi Bayesian dengan ciri-ciri tekstur, kawasan ibu jari dan saiz ibu jari. Analisis ciri-ciri tekstur adalah berdasarkan matrix sama kejadian paras kelabu (GLCM) dengan sifat-sifat seperti kontras, kolerasi, tenaga dan kehomogenan. Pengiraan terhadap kawasan dan saiz ibu jari adalah berdasarkan imej yang dipotong dengan batasan mengandungi ibu jari. Kumpulan data latihan and kumpulan data pengesahan adalah daripada kumpulan data yang sama oleh sebab penggunaan modul ini adalah untuk memadan imej dalam database sahaja. Algoritma Bayesian klasifikasi ditulis dalam kod MATLAB. Beberapa analisis terhadap jarak GLCM piksel telah dijalankan untuk menilai prestasi modul ini. Dengan menggunakan jarak piksel 2, keputusan ketepatan adalah terbaik member ketepatan 82.35% bagi golongan lelaki dan 81.82% bagi golongan perempuan.

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LIST OF ABBREVIATIONS

ASM - Angular Second-Moment

GLCM - Gray Level Co-Occurrence Matrix

IPT - Image Processing Toolbox

MATLAB - Matrix Laboratory

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CHAPTER 1

INTRODUCTION

This project implement a thumb top view classification module using the Bayesian classifier based on the texture, thumb area and size analysis. The Bayesian classification is developed and implemented using the MATLAB software. With the addition of thumb area and size analysis from previous research, it is target to hit higher accuracy of the classification system. In the first chapter, overview of the project background is presented followed by the discussion on the problem statement, project objectives and the scope of work. The organization of this report is presented at the end of the chapter.

1.1 Project Background

Bio recognition system is getting popular nowadays especially on the thumb print recognition since most of the high end laptop is integrated with the thumb print recognition device. With the cheaper cost of implementing the thumb print recognition system compared to the 90's, the government agency such as National Registration Department (Jabatan Pendaftaran Negara) started to record the resident's

thumbprint for their record. Besides that, the bank as well implemented the thumbprint record upon the registration of a new account. With this implementation, the huge database will takes time to retrieve the data when bank or the government wants to retrieve the customer information upon verification process.

Thus to improve the verification process throughput time, bi-modal thumbprint recognition is suggested where the thumbprint recognition is integrated with the gender recognition using the Bayesian classification method. This can be done with a camera capturing the top-view of the thumb image while the user is providing the thumbprint through the thumb print scanning device. From the top-view image captured, it is feed into the MATLAB code to differentiate the male and female while the thumbprint captured is used to get the actual identity recognition. It will help to reduce the database query time since the query can just limit to the male or female category only.

In this project, a thumb classification module based on the Bayesian classification technique will be developed to classify the top-view image captured to male and female category. A few parameters will be extracted from the image to feed into the Bayesian classifier such as the space occupied of the thumb in a pre-defined area, texture feature like contrast, hue, homogeneity and the size of the thumb skin. The algorithmic detail will for these implementations will be discussed in Chapter 2. The main focus on this project would be to increase the accuracy of differentiating the image to be male of female compared to previous project and integration with the thumb print recognition.

1.2 Objective

The main objective of this project is to develop a thumb classification module that can integrate with thumb print recognition system to differentiate between male and female in order to reduce the database searching time. The target achievements are as below:

1) To develop a thumb classification module based on the Bayesian classifier technique using the data from top-view captured image.

2) To able to integrate the thumb classification module with the thumb print recognition system.

1.3 Scope of Work

The scope of work can be divided into the following:

I. Understand the Bayesian classifier based on the texture, shape, and size analysis of the thumb.
II. Analysis will be done on the thumb in grayscale and on a cropped region of the thumb images.
III. Develop the MATLAB code that will differentiate male and female based on the thumb texture, shape and size based on the offline data.
IV. All programming coding will be done in MATLAB.

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