ANALYSIS OF LOCAL BINARY PATTERN BY USING UNIFORM BINS AS PALM VEIN PATTERN DESCRIPTOR

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BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : ANALYSIS OF LOCAL BINARY PATTERN BY USING UNIFORM BINS AS PALM VEIN PATTERN DESCRIPTOR

Sesi Pengajian : 2018/2019

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I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Bachelor of Electronic Engineering with Honours.

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This report is submitted in partial fulfillment of the requirements for the degree of Bachelor of Electronic Engineering with Honours

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2019

DEDICATION

I dedicate this thesis to my beloved father, Mohd Hayat Bin Jalal, and to my beloved mother, Sadiah Binti Manaf, who have made me into who I am. You will always be remembered.

ABSTRACT

Palm vein authentication technologies which reads the features of palm vein have been spread out in recent years as it offers a high accuracy identification and difficult to be forged and impersonated. However, palm vein images that were used in palm vein recognition systems were not always clear as sometimes show irregular shadings and highly saturated regions that can slow the processing time. To overcome this problem, palm vein recognition system using Uniform Local Binary Pattern (LBP) was demonstrated in this project. In this project, Spyder software with Python language and R software was implied. Python software is implemented for contrast enhancement, noise reduction and LBP implementation while R software were used for classifying palm vein pattern in K-Nearest Neighbour classifier. The sample that employed comes from two samples which are 15 sets of Chinese Academy Science Association (CASIA) and 15 sets of Rasberry Pi analysis or also called as Self dataset. The outcome were the extracted vein features from palm image and classified palm vein pattern based on subjects and their accuracy based on each dataset. For both dataset, there were two elements that were taken for the final result which were all uniform bins and selected uniform bins. The uniform bins were bin 0 to bin 25 while the selected uniform bins consist from bin 16 to bin 24. The

result of the accuracy for all uniform bins and selected uniform bins from Self dataset are 87% and 53% respectively. For CASIA dataset, the percentages for all uniform bins were 60% and for selected uniform bins were 27%.

ABSTRAK

Teknologi pengesahan vena telapak tangan yang membaca ciri-ciri vena telapak tangan telah tersebar dalam beberapa tahun ini kerana ia menawarkan pengenalan ketepatan yang tinggi dan sukar untuk dipalsukan dan disamar. Walau bagaimanapun, imej vena telapak tangan yang digunakan dalam sistem pengenalan urat telapak tangan tidak selalu jelas tetapi kadang-kadang menunjukkan penyinaran tidak teratur dan kawasan yang sangat tepu yang boleh melambatkan masa pemprosesan. Untuk mengatasi masalah ini, sistem pengenalan urat telapak tangan yang menggunakan Corak Perduaan Tempatan (LBP) telah dicadangkan dalam projek ini. Dalam projek ini, perisian Spyder yang menggunakan bahasa python dan perisian R akan digunakan. Perisian Spyder akan digunakan untuk peningkatan kontras, pengurangan bunyi dan pelaksanaan LBP. Manakala perisian R akan digunakan untuk mengklasifikasikan corak urat telapak tangan dalam pengelas K-terdekat Neighbor (KNN). Sampel yang digunakan terdiri daripada dua sampel iaitu 15 set Persatuan Sains Akademi Cina (CASIA) dan 15 set analisis Rasberry Pi atau juga dikenali sebagai dataset Sendiri. Hasilnya ialah corak vena telapak tangan yang telah diekstrak dan dikelaskan berdasarkan subjek dan ketepatannya berdasarkan setiap dataset. Untuk kedua-dua dataset, terdapat dua elemen yang diambil untuk

hasil akhir iaitu semua bin seragam dan bin seragam terpilih. Semua bin seragam adalah bin 0 hingga bin 25 manakala bin seragam yang dipilih terdiri daripada bin 16 hingga bin 24. Hasil ketepatan untuk semua bin seragam dan bin seragam terpilih dari dataset Sendiri masing-masing adalah 87% dan 53%. Untuk dataset CASIA, peratusan bagi semua bin seragam adalah 60% manakala untuk bin seragam terpilih adalah 27%.

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to all those who involves in completing this report. A special appreciation I give to my supervisor, Ms Zarina Binti Mohd Noh, whom contributes in stimulating wonderful ideas and encouragement, helped me to systematize my project especially in writing this report.

Besides, a special thanks to my panel, Dr Masrullizam Bin Mat Ibrahim whom contributing more beneficial ideas and useful comments which will advantages me in the future. Also, I would like to acknowledge with much appreciation to Dr. Nurhidayah Binti Mohd Yatim for the permission to present this project.

Last but not least, many thanks to all my friends who always invented their full effort in providing help for me to finish this project. Without them, I might not be able to put an end to this project.

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LIST OF SYMBOLS AND ABBREVIATIONS

CLAHE	:	Contrast Limited Adaptive Histogram Equalization
CSV	:	Commas Separated Value
HOG	:	Histogram of Oriented Gradient
KNN	:	K-Nearest Neighbour
LBP	:	Local Binary Pattern
NIR	:	Near Infrared
ROI	:	Region of Interest
SBC	:	Single Board Computer
SIFT	:	Scale Invariant Feature Transform
SURF	:	Speeded Up Robust Features
SVM	:	Support Vector Machine

CHAPTER 1

INTRODUCTION

The project was first started with the introduction of the project which highlighted the background, problem statement, project objective, project scope and the report outline.

1.1 Background of Project

Palm vein recognition is one of the most advantages among all the biometric system as it provides a great level of accuracy. The palm contains a complex vein pattern that cause the recognition becomes more secure against spoof attack. Furthermore, vein patterns of palm image also advantageous in term of stability that

it can be beneficial over a long period of time. Besides, there is no hygiene issues as contactless design has been introduced [1]. This project is mainly focus on the uniform bins of local binary pattern operator that is used to describe the palm vein pattern from human's palm. This is because besides this operator and method, there are another several different method that was used in extracting palm vein, but with their own advantages and disadvantages. With this method, some disadvantages that appear from the other method could be reduced, thus will make the process of biometric identification using palm vein easier.

1.2 Problem Statement

Palm vein image of human's hand can only be recognized by human itself. However, the biometrics system cannot read the vein pattern easily as it has to be interpreted in different method. Palm vein images were not always clear as irregular shadings and highly saturated regions may occur. Sometimes, segmentation errors can occur during the feature extraction process due to the low quality of palm vein images. If this problem keeps happening, the process of palm vein extraction will affect the accuracy of palm vein biometrics identification. Hence, extra processing is needed in extracting palm vein pattern. Thus, this project aims to recognize and extract human palm vein pattern using uniform LBP algorithm so it can be used as biometrics data.

1.3 Project Objective

- To extract vein features from palm image using uniform LBP algorithm.
- To classify palm vein pattern extracted based on uniform LBP bins using KNN classifier.

1.4 Scope of Project

Main focus of this project is to analyze Local Binary Pattern (LBP) using uniform bins as Palm Vein descriptor. This project scope was in research and analysis by using software. In order to achieve the expected result in analyzing the LBP operator, the Spyder environment Figure 1.1, is used for Python programming. The dataset of sample image of the palm is obtained from the use of near infrared (NIR) spectrum illumination. The palm image will be captured by the system to capture the image formed by the NIR spectrum [2]. Figure 1.2 shows the illustration of the process to capture palm image by using the system of NIR spectrum. To classify the extracted palm vein, KNN classifier is done by using R Software, as shown in Figure 1.3.

Figure 1.1: Spyder Environment

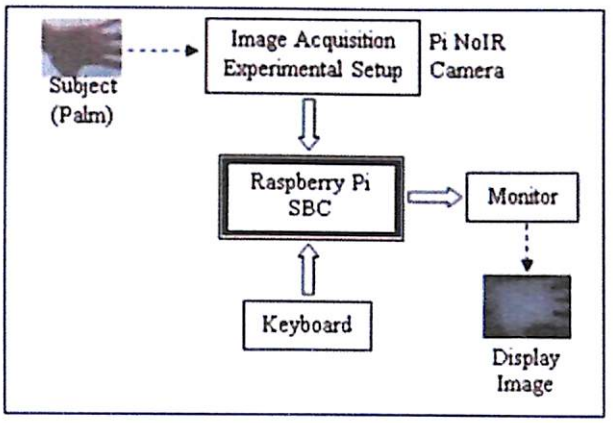

Figure 1.2: : Illustration of the Process to Capture Palm Image [2]

Figure 1.3: R Software

1.5 Report Outline

This report is organized into five chapters to cover the research work that was related to the analysis of Local Binary Pattern (LBP) operator. It also includes the uniform bins that were chosen in order to obtain the palm vein identification. The outline of the report was described as follows:

Chapter 2 present the literature review of the entire process and step that involved in extracting and identifying palm vein from human's hand which are image enhancement, noise reduction, palm extraction by using Uniform LBP, and also identifying palm vein image by K-Nearest Neighbor (KNN) algorithm. Here, all the process that involved were retrieved thoroughly.

Chapter 3 is the research methodology on how the project was implemented. Here, the flowchart was done to enlighten the flow of the work progress for this project.

Chapter 4 mainly focused on the analysis and the discussion on the result of the outcome in extracting palm vein pattern by using LBP operator. In this chapter, all of the data and result obtained were shown.

Last but not least, the content of chapter 5 was the discussion and future works that were planned as the result has been obtained.