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FURROW AND CRYPT DETECTION USING MODIFIED ANT COLONY OPTIMIZATION FOR IRIS RECOGNITION

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ABSTRACT

Iris recognition has been widely recognized as one of the most performing biometric system. The accuracy performance of iris recognition system is measured by FAR (False Accept Rate) and FRR (False Reject Rate). FRR measures the genuine that is incorrectly denied by the system due to the changes in iris features (such as aging and health condition) and external factors that affected the iris image to be high in noise rate. The external factors such as technical fault, occlusion, and source of lighting caused the image acquisition which produce distorted iris images problem hence incorrectly rejected by the system. The current way of reducing FRR are wavelets and Gabor filters, cascaded classifiers, ordinal measure, multiple biometric modality and selection of unique iris features. Iris structure consists of unique features such as crypts, furrows, collarette, pigment blotches, freckles and pupil that are distinguishable among human. Previous research has been done in selecting the unique iris features however it shows low accuracy performance. As a solution, to improve the accuracy performance, this research proposes a new approach called as Modified Ant Colony Optimization that uses ant colony algorithm which search for crypts and radial furrow. The method consists of two tasks in obtaining the crypt and radial furrow features from the iris texture. The first task is the artificial ants that scan the pixel values according to the range of selected crypt or radial furrow. Then, the scanned pixels value is searched based on degree of angle (0^o, 45^o, 90^o and 135^o). The second task produces the confusion matrix and the blob of iris feature image is marked and indexed before stored into the database. In order to evaluate the performance of the proposed approach, FAR and FRR are measured with Chinese Academy of Sciences' Institute of Automation (CASIA) database for high quality images and Noisy Visible Wavelength Iris Image Databases (UBIRIS) database for noisy iris. By using CASIA version 3 image databases, the crypt feature shows that the result of FRR is 18.05% and radial furrow gives 81.5% when FAR at 0.1%. For UBIRIS version 1 database, the crypt feature indicates that the value FRR is 46.93% meanwhile the radial furrow shows the values of FRR 33.87% when FAR at 0.1%. To evaluate Modified Ant Colony Optimization, the genuine acceptance value (GAR) is measured to recognize iris features detection in low quality image environment. The experiment finding indicates that by using the Modified Ant Colony Optimization, radial furrow is able to be detected in distorted iris images with 84.62% since its own characteristics is obviously revealed. Moreover, the intersaction between FAR and FRR produces the Equal Error Rate (EER) with 0.21%, which indicated that equal error rate is lower than the previous standard value, which is 0.3%. Therefore, the advantages of using Modified Ant Colony Optimization are it has the capability to adapt with unique iris features in robust manner and use small amount of information in unique micro-characteristics of iris features to determine the user. The outcome of this new approach is to reduce the EER rates since lower EER rates indicates better accuracy performance. As a conclusion, the contribution of Modified Ant Colony Optimization extraction approach brings an innovation at the extraction process in the biometric technology and provides benefits to the communities.

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CHAPTER ONE

INTRODUCTION

1.1 OVERVIEW OF IRIS RECOGNITION

Biometrics has been used worldwide as a reliable source of identification system for many applications such as restricted area access control, database access, computer login, building entry, airport security, forensic application systems and automatic teller machine (ATM). Compared to existing identification system (i.e.: smartcard and RFID), biometrics offers higher accuracy, security, efficiency, availability, uniqueness and superior performance. In most application, biometric recognition system scan a person's body parts, extract unique features and stored them in a secured database as biometric template. Then, later, when the system is invoked again by a user (e.g. a user scans his/her body parts to gain access), the system compares the database with the existing biometric template and provides indication whether the scanned images matches any of the existing iris template. If it matches, then the system allows the user to gain access, else, the system will deny access.

In biometrics, various modalities such as facial shape, fingerprint, handwriting, and iris have been used for human identification and access control. Iris recognition stands out as a promising method for obtaining automated, secure, reliable, fast and high in accuracy for user identification which typically achieve 99% accuracy rate with equal error rates of less than 1% [1].

Iris recognition is an autonomous system that uses complex mathematical pattern recognition, image processing and machine learning techniques for measuring the iris [2]. Inside the human iris, there are many unique features such as crypts, radial furrows, concentric furrows, collarette, freckles, pupil and pigment blotches which distinguish the genuine characteristics of a person, thus making it suitable for recognition purposes. However, the demand for higher accuracy and high speed recognition in biometric system leads to continuous proposals of new iris recognition