

**Ministry of Higher Education
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University of Diyala
College of Science
Department of Computer Science**



Contactless Palmprint Images Recognition System under Uncontrolled Conditions

**A Thesis Submitted to the Department of Computer Science/
College of Science/ University of Diyala
In Partial Fulfilment of the Requirements for the Degree of
Master in Computer Science**

By

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

﴿ قُلِ الرُّوحُ مِنْ أَمْرِ رَبِّي وَمَا أُوتِيتُمْ مِنْ

الْعِلْمِ إِلَّا قَلِيلًا ﴾

صدق الله العظيم

سورة الاسراء

الاية (85)

Acknowledgments

*First of all, praise is to **Allah** the lord of the whole creation, on all the blessing was the help in achieving this research to its end.*

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Dedication

To ...

Dear mom

And to my dear wife, brothers, and sisters,

To all my friends

All our distinguished teachers who paved the way for our

knowledge and knowledge



Salam Jabbar Abdulkadhim

Supervisor's Certification

We certify that this research entitled "Contactless Palmprint Images Recognition System under Uncontrolled Conditions" was prepared by **Salam Jabbar Abdulkadhm** under our supervision at the Department of Computer Science College of Science University of Diyala, as partial fulfillment of the requirement needed to award the degree of Master of Science in Computer Science.

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Abstract

In the past years, interest in biometric identification systems has increased. This interest has given rise to many biometric-based applications. These systems have spread in many facilities of life and have been used in many important applications such as people identification, check-in and attendance and departure systems. Contactless palm prints are an important part of biometric identification systems because they play an important role in identifying people through contactless palm prints. The aim of this message is to classify and distinguish contactless palm print to detect people by contactless palm print to solve many problems. Examples of problem solving include identifying criminals through a palm print, as well as identifying criminals who cover their faces, and if a database is available, people can be identified through a search and matching process. Another problem nowadays is the spread of communicable diseases by contact, so it has become necessary to establish a system known as the non-contact biometrics system to ensure that diseases are not transmitted. Therefore, the other problem is overcoming the problems of the contact palm print, which suffers from slow and technical malfunctions that may affect the palm print scanner. Contactless palm print identification can be used in biometric systems. A contactless palm print recognition system is proposed using the Convolution Neural Network algorithm with two preprocessing methods. The first method in preprocessing was using normalization, and the second method was by adding a CLAHE filter to the images in the preprocessing stage. The three dataset IITD, collected and mixed was divided as follows: 80% for training, 20% for testing, 70% for training, 30% for testing, 60% for training, 40% for testing. After training and testing, the results were obtained with an acceptable accuracy compared to the previous works, as the results were obtained using the proposed model 99.95, 100, 99.93, 97.70, 97.06, 95.5.

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List of Abbreviations

Abbreviations	Meaning
CASIA	Chinese Academy of Sciences' Institute of Automation
CLAHE	Contrast Limited Adaptive Histogram Equalization
CNN	Convolutional Neural Networks
DCNN	Deep Convolutional Neural Networks
DDR	Deep Discriminative Representation
DNA	Deoxyribonucleic acid
DWT	Discrete Wavelet Transforms
FC	Fully Connected
FIKEN	Fixed Key points Number
IITD	Indian Institute of Technology Delhi
JCLSR	Joint Constrained Least-Square Regression
KNN	K-Nearest Neighbors
LSR	Least-Squares Regression
NN	Neural Network
ReLU	Rectified Linear Unit
ROI	Region Of Interest
SURF	Speeded-Up Robust Features
SVM	Support Vector Machine

CHAPTER ONE

General Introduction

A decorative graphic consisting of several parallel, slightly curved lines in a light blue-grey color, extending diagonally from the bottom-left towards the top-right of the page, passing behind the text.

1.1 Introduction

Biometrics are measurements and calculations of body characteristics used in computer science as a form of identification, biological or behavioral characteristics or biometric features such as palm print, DNA, iris, sound, hand, and vein engineering, these studies have been the subject of research for more than five decades where these biometrics are directly related to the individual, so they have been used to identify people in most applications. Need to identify people such as access to private places or private accounts or identification of suspects or criminals etc. [1]

The person identification system works through a device that recognizes one of the vital things of the person and records and processes the data to the required representation of the system and is stored in a database where these systems achieve very high accuracy in terms of security and commercial where proven efficiency through biometrics to identify suspects, so the purpose of the biometric identification systems is to decide the identity of the person or who that person is[2].

So, the environment subject to conditions the image is more accurate and reaches high results because the user cooperates with the device to capture while in this user or person is uncooperative and not subject to conditions and control therefore the image is not good in terms of accuracy and distance. These images must be worked on with low accuracy and in different positions, and here lies the difficulty of distinguishing the palm of the hand, so the system must be designed to work on uncontrolled environments and work on low quality samples where this system can be used in criminal applications and search for suspects to identify criminals by the palm where the system can also work to detect terrorists or criminals by palmprints.

Because they often hide their faces to avoid identification, but the palm of the hand remains prominent and waving their hands while speaking, such as giving speeches or referring to a particular thing. so that the palm is identified and processed to connect to the palm print and is matched in the database available in the system. Hooligans can also be detected because high-resolution photographs of them are taken by journalists when their faces are covered with masks. Today, due to technological development and rapid development. The need a lot of mechanisms and systems to detect people due to population momentum and increased riots and terrorism and detection mechanisms and increase in accuracy [3].

The process of distinguishing the contactless palm print is of high accuracy because of the features it contains. Previous researchers indicated important results through deep learning and distinguishing inherent features by inserting filters on the data [4]. The process of palm print recognition is by (CNN) algorithm in the proposed system. It is possible to increase the security of personal information due to the results it has achieved and its high accuracy, and it can be used instead of other biometric techniques and in many applications that depend on identifying people through biometric technology. The proposed system it can classify and distinguish the contactless palm print using the CNN algorithm and detect people who cover their faces and identify them by the palm print. through the database people can be identified by the search and matching process for identification through palm print. The methods used for pretreatment were normalization and the second method was adding a CLAHE filter. The models were trained by dividing the data into 80% for training, 20% for testing, 70% for training, 30% for testing, 60% for training and 40% for testing. The results were that the system achieved high accuracy compared to some previous works, and the results were as follows 99.95,100, 99.93, 98.70, 96.06, 95.5.

1.2 Related Works

Many previous works on recognition and classification systems for contactless palm print using multiple mechanisms and algorithms by many authors. The present survey includes previous work related to this thesis:

- Raouia Mokni, Monji Kherallah in 2016 [5] In their research, the researchers presented a method for identifying people for use in forensic medicine. The method of the three descriptors was used to extract the palm print, which are radius of mass, methods of intersection and counting box. This method was performed on two types of standard databases: IITD database and the CASIA database. The algorithms used to apply the three descriptors method were randomization, forest classification, SVM, and KNN. This method, which was performed on databases, achieved results that were 96.35 % for the first dataset CASIA and 95.98 for the second dataset IITD.
- Bilal Attallah, Amina Serir and Youssef Chahir in (2017) [6] A method has been used by researchers for palm print recognition based on generating ultra-informative features to increase accuracy. The proposed method has been applied to enhance the performance through three stages, which is first, the application of the DWT of the image; secondly, the extraction of the feature code from the merged graph; and third, matching and determining the similarity in the palm print feature maps. Three standard databases were used for this method: IITD, MSPolyU, and PolyU Palmprint. From IITD 2300 images were used from the database with a size of 150 x 150 pixels using the PCA algorithm achieving an accuracy 98.17%.
- Zhou, Kaijun; Zhou and Xiancheng in 2019 [7] A double transform network method has been proposed. This method is biologically inspired. This method works by building convolution layers twice. The first time to

wrap is to extract the image edge file. The second time, it builds two convolution layers to measure spatial frequency to improve feature maps. This method was tested on several databases, which are: IITD, CASIA, PolyU, and COEP. This method achieved the performance of palm print recognition using the CNN algorithm, and through the proposed method, the system using the IITD database was able to obtain an accurate 94.79%.

- Zhao, Shuping, Zhang and Bob in (2020) [8] The researchers propose a method to identify a contactless palm print called deep discriminative representation (DDR). This method is based on the extraction of multiple deep features, after which the deep features are recombined to produce the best performance for palm print identification using the DCNN algorithm. Two databases were used: CASIA and IITD. Experiments were carried out in the DDR proposed method on these databases, and despite the presence of noise, the proposed method achieved wide appeal for high security applications. Results have been found in the CASIA database accuracy was 99.41% , and the results have been found in the IITD database accuracy was 98.70%.
- Zhao, Shuping, Zhang and Bob in 2020 [9] This method was presented to identify the palm print by way of extracting features from multiple regions of the palm print of the same image. The multiple regions that are taken are transformed into matrices to exploit the commonalities between the matrices. This is for the proposed method called joint constrained least-square regression (JCLSR). One of the advantages of this method that is solved the problem of classifying a small number in palm print recognition Experiments were performed on databases CASIA, PolyU, IITD, and noisy IITD. Suggested method (JCLSR) using the(DCNNs) algorithm, this method achieved on the standard database IITD an accuracy 93.43%.

- Anca IgnatIoan , Păvăloi in 2021 [10] In this work, (FIKEN) algorithm was used. This method has been compared with other methods, of recognizing the palm prints. This method with another algorithm SURF The techniques in the preprocessing that I used are LSR, LS, Norm. This method depends on the points that are selected in the palm print, and the training is done based on those selected points. One of the problems with this method that it generates points with many points. Some points did not used, and this method also computationally expensive. Several standard databases were used in this system, namely: CPDS, IITD, and CASIA. After testing operations on databases, the proposed method achieved accurate results of 99.12%, This result was used the IITD database.

1.3 Problem Statement

The problem that will be addressed was the discovery of a contactless palm print in several ways and algorithms. to take advantage of it in identifying people for many applications, including the lack of a palm print database in our city to detect criminals. The second problem the inability of the police to detect criminals from a distance who cover their faces while photographing themselves. Solving the problem of contact palm print that suffers from technical problems such as sudden stop, dust, dirt of the device, and slow recognition. The problem of non-contact with biometric identification systems can be solved in the presence of communicable diseases.

1.4 Aim of Thesis

Classifying the contactless palm print based on a standard database and classifying the contactless palm print based by on another database that was collected. Establishment of a system for the recognition of a contactless palm print.

1.5 Contribution

The most important contributions that have supported this thesis will be presented

- Create a database that is collected from students at the university and is trained and tested through the proposed system.
- Create a merge database that includes the collected data base and a standard database of 50 percent of each database and fill it in the proposed system.
- The method used to solve the problem is the first of its kind in Iraq.

1.6 Layout of Thesis

The other chapters in this thesis are as follows:

- Chapter Two, **“Theoretical Background”** presents a general overview of the methods used in this dissertation.
- Chapter Three, **“The Proposed System”** This chapter presents a study on palm print identification and the proposed system with databases through the proposed algorithms.
- Chapter Four, **“Results and Tests”**, presents the outcome of subjective and objective measures of the proposed algorithms and therefore the time consuming for every processing step.
- Chapter five, **“Conclusions and suggestion for Future Works”**, present the conclusions and suggestions for future expansion and development.