International Journal of Scientific Research in Computer Science, Engineering and Information Technology

ISSN : 2456-3307 OPEN ACCESS

Available Online at :www.ijsrcseit.com

doi : https://doi.org/10.32628/IJSRCSEIT

Survey Paper on 3-D Hand Geometry Based Recognition System for User Authentication Using Image Processing

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ARTICLEINFO

Article History:

Accepted: 10 Oct 2023

Published: 30 Oc t2023

Publication Issue

Volume 9, Issue 10

September-October-2023

Page Number

10-17

ABSTRACT

User authentication is a critical aspect of modern security systems, ranging from personal devices to secure facilities. Traditional authentication methods often rely on passwords, PINs, or biometric features like fingerprints or facial recognition. However, these methods can be vulnerable to unauthorized access or spoofing. This paper presents a novel approach to user authentication using 3D hand geometry-based recognition, leveraging image processing techniques. A Palm print, biometric characteristics, was mostly found in civil and commercial applications for security system because it has more reliable and easy to capture by low resolution devices. This research focuses on the development of hand identification and hand geometry using hand features, including the length of the hand, length and width of each finger, size of palm. We use radius distance methods to find the position of the fingertip and the concave of the finger from the hand contour. The radius distance method is highly flexible, accurately detecting the curves of fingertip and concave of finger. We use these reference points to identify the characteristics of individual hands. The sample images are acquired from the simple and low-cost acquisition system. The experimental results demonstrate the efficiency of the proposed method. 3D shape reconstruction from multiple hand-drawn sketches is an intriguing way to 3D shape modelling. Currently, state-of-the-art methods employ neural networks to learn a mapping from multiple sketches from arbitrary view angles to a 3D voxel grid. Because of the cubic complexity of 3D voxel grids, however, neural networks are hard to train and limited to low resolution reconstructions, which leads to a lack of geometric detail and low accuracy. To resolve this issue, we propose to reconstruct 3D shapes from multiple sketches using direct shape optimization (DSO), which does not involve deep learning models for direct voxel-based 3D shape generation. Specifically, we first leverage a conditional generative adversarial network (CGAN) to translate each sketch into an attenuance image that captures the predicted geometry from a given viewpoint. Then, DSO minimizes a project-and-compare loss to reconstruct the 3D shape such that it matches the predicted attenuance images from the view

angles of all input sketches. Based on this, we further propose a progressive update approach to handle inconsistencies among a few hand-drawn sketches for the same 3D shape. Our experimental results show that our method significantly outperforms the state-of-the-art methods under widely used benchmarks and produces intuitive results in an interactive application.

Keywords: - Hand geometry, hand features, radius distance methods, computational intelligence, hand biometrics, palm geometry analysis, palm equations.

I. INTRODUCTION

Biometric characteristics such as palmprint [1], hand and finger geometry [2], finger-print [3], Iris [4], etc. are mostly popular used in security systems over the traditional secure measures, password or ID cards. The biometric systems are more reliable be-cause they cannot easily be lost, stolen, shared and duplicated. Palmprint features have advantages compared with other features. For example, palmprint has more information than fingerprint and it can be captured by low resolution devices such as digital camera, video camera. Furthermore, iris capture devices are more expensive than palm print capture devices. The Principal lines and wrinkles are normally features extracted from palm print image. The most researchers usually used them for identification process. The palm print alignment which is the crucial pre-processing steps prior to the identification steps in the palm print recognition system [5]. The previous works almost used three approaches for palm print alignment. At the first approach, tangent-based approach [6] is a tangent calculation between two boundaries to find the key points for further used in palm print alignment. A bisector-based approach [7, 8] is constructed the lines from the centre of gravity of a finger boundary to find the key points. The last approach is a finger-based approach [9]. This method used a wavelet to detect the fingertips to assign the key points. Most of the previous approaches usually used hand acquisition devices with guidance pegs [2, 6, 8, 9] to fix the hand position to avoid the scaling, translation and rotation problems for correctly palm print image alignment. But this mechanism makes some user feel uncomfortable and the palm must becontacted to image capture device during acquisition process so it is not hygiene for the user. In this paper, we proposed a new contactless palm print image alignment method and further used in the person identification We find the robust reference point in the middle of palm using distance map applied on the binaries hand image. We use radius distance methods to find the position of the fingertip and the concave of the finger from the hand contour which are served as fiducially points used to estimate the affine transformation matrix. The reference palm print image can then be aligned against the query palm print image. The distance map error can be computed and used for person identification. A pixel form can be used for palm print image [10].Author presented an algorithm for detecting and preventing Node isolation attack where attacker become the sole MPR of victim and isolated the victim from the rest of the network[11].9

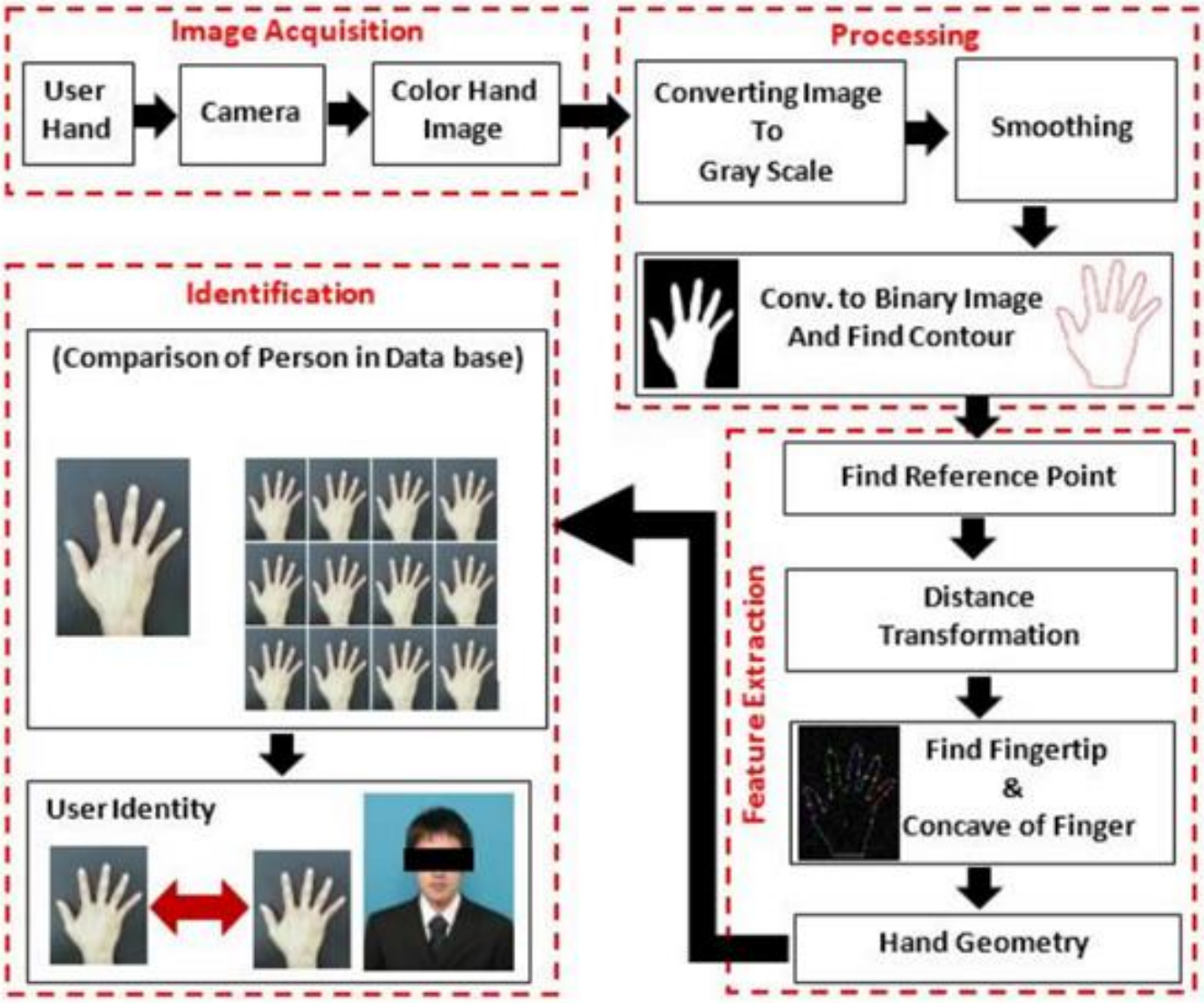

Fig. 1 Reference–Proposed contactless person identification using palm print.

II. LITERATURE SURVEY

Sr.No.	Topic Name	Author Name	Year of Publication	Problem solved in this paper : Existing Problem Statement	Technique used to solve problem : Existing Problem Solution	What will be future work : Future Scope
11 1.	Identity Verification Using Geometry of Human hands	Markus Mu¨ller, Georg Poier	2021	Hand geometrybased authentication systems need to be accurate and reliable in	Collect a sufficient number of hand images or scans from the individuals who	Using the geometry of human hands for identity verification has promising

				recognizing individuals.	will be using the system.	future scope in various fields, particularly in security and authentication systems.
2 2.	Reconstructing 3D Shapes From Multiple Sketches Using Direct Shape Optimization	Zhizhong Han,Baorui Ma	2020	Given a set of 2D sketches from different viewpoints, the goal is to reconstruct a coherent and accurate 3D shape that best represents the underlying object.	The problem of reconstructing 3D shapes from multiple sketches using direct shape optimization can be approached using a combination of techniques from computer vision.	Machine learning techniques, particularly deep learning, could be integrated into the reconstruction process.
33 3.	3D Shape Reconstruction from Free-Hand Sketches	Jiayun Wang, Jierui Lin,	2022	Hand-drawn sketches can be ambiguous, lacking precise measurements and details required for accurate 3D reconstruction.	Gather a diverse dataset of hand-drawn sketches paired with their corresponding 3D models.	Future research can focus on improving the accuracy and realism of the reconstructed 3D shapes.
4.	Human Palm Geometry Modelling for Biometric Security Systems	Johnson I Agbinya	2019	The problem is to develop an accurate and reliable biometric security system based on human palm geometry modelling.	The proposed solution involves a multi-step approach to address the challenges modelling for biometric security systems.	As technology advances, the accuracy and reliability of palm geometry recognition systems are likely to improve.
5 5.	Biometric identity Authentication System Using Hand Geometry	Hesham Hashim Mohammed , Shatha	2020	Design and develop a robust biometric identity authentication	Developing a biometric identity authentication system using	Future research could focus on improving the accuracy of hand geometry

	Measurements	A. Baker		system utilizing hand geometry measurements.	hand geometry measurements involves several steps and considerations.	measurements for authentication.
6 6.	BIOMETRIC VERIFICATION OF HUMANS BY MEANS OF HAND GEOMETRY1	Marcos Faundez -Zanuy	2019	Biometric verification systems are crucial for ensuring secure access control and identity verification.	The proposed solution involves utilizing hand geometry as a biometric identifier for human verification.	Hand geometry biometrics could enable personalized user experiences in various industries.
7 7.	Hand Pose Estimation in Object-Interaction based on Deep Learning for Virtual Reality Applications	Min-Yu Wua , Pai-Wen Tinga	2020	In virtual reality (VR) applications, realistic object interaction is crucial for creating immersive experiences.	To address the challenge of hand pose estimation for object interaction in VR applications, a deep learning-based approach can be employed.	Hand pose estimation in object-interaction based on deep learning has significant potential for future developments in virtual reality applications.
8 8.	BIOMETRIC VERIFICATION OF HUMANS BY MEANS OF HAND GEOMETRY'	Marcos Faundez -Zanuy	2020	Hand geometry refers to the physical measurements and features of a person's hand, including the size and shape and the overall hand structure.	Utilize specialized hardware, such as hand scanners or cameras, to capture high-resolution images or 3D models of individuals' hands.	Research on techniques for securely storing and transmitting hand geometry templates to prevent unauthorized access or misuse.
9 9.	Human Palm Geometry Modelling for Biometric Security System	Johnson I Agbinya	2019	The problem revolves around capturing, processing to establish a secure	Gather high-quality palm images using specialized scanners,	Combine palm geometry with other biometric modalities like fingerprint,

				and convenient biometric identification method.	cameras, or sensors.	facial recognition, or iris scanning to enhance accuracy and security.
10 10.	Usinga Variable-Friction Robot Hand to Determine Proprioceptive Features for Object Classification during Within-Hand-Manipulation	Krishnan Srinivasa	2019	In the realm of robotic manipulation, a significant challenge arises when a robot attempts to manipulate objects within its own hand.	This dataset will include proprioceptive sensor readings and ground truth object labels for each manipulation scenario.	Exploring how the VFRH can collaborate with humans in tasks requiring delicate manipulation, suchas medical procedures or intricate assembly tasks.

III. LIMITATIONS OF EXISTING SYSTEM

- Performance of 3D Hand geometry systems can be affected by the medical conditions of the hand like swelling, injuries, arthritis that obscure or changes the basic structure of the hand and cause recognition difficulties.
- The geometric structure of the hand is affected with respect to weight and aging and thus affects 3D Hand Geometry recognition.
- 3D Hand Geometry systems require re-enrollment once or twice for the users who are under growth and thus possess hindrance in verification.
- Hand geometry can be affected by changes in an individual's hand shape, such as injuries or weight gain/loss. It can also be compromised by the use of fake hands or gloves to spoof the system.
- Researchers continue to work on improving the accuracy, robustness, and practicality of 3D hand geometry recognition systems for various applications

IV. CONCLUSION

The conclusion of 3-D Hand Geometry Based Recognition System For User Authentication Using Image Processing is that we proposed the new contactless palm print alignment method with the general web camera and the black screen without guidance pegs. This method used the corresponding key points from the fingertips and the concave of the fingers to find the affine transformation matrix which was used to align set of inquiry palm-print image against set of reference palm print image. The distance map error was used to find the correct matching between inquiry and reference palm print image. To improve the specificity for person identification, another features vector which contains the physical parameter extracted from the finger and palm including

the length and width of the finger was used. The proposed technique was tested successfully for person identification. The result is very promising with 100% accuracy.

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