IJSRTM
https://www.ijsrtm.com
Vol.3 Issue 4 Dec 2023: 13-16
Published online 11 December 2023
E-ISSN: 2583-7141

International Journal of Scientific Research in Technology & Management

Palm Based Recognition System: A Review

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Abstract*— There are certain biometric features through which a human can uniquely identified. Some of them are fingerprint, iris, face and palm print. Fingerprint based authentication is more popular as compare to others, but palm print is newly introduced feature through which a system can be developed that can works like fingerprint authentication system. A handprint, by virtue of covering more skin area, includes more identifying details, making false positives all but impossible and simultaneously making intentional falsification much more difficult. In other situations, such as criminal investigations, a full or partial palm print may sometimes be obtained when fingerprints are absent. A criminal might, for example, wear gloves to avoid leaving fingerprints but inadvertently leave a partial palm print when a glove slips during the commission of a crime. There are so many systems proposed till now which are based on palm print and there are so many techniques through which palm print features can be extracted. Some of them are Local Binary Pattern, Gabor filter, Weber's Local Descriptor and many more. Palm print based authentication system can be implemented in both mode either by touch based or touch-less.

Keywords*— Palm Print, Authentication, Crease, Touch, Touch-less.

I. INTRODUCTION

Biometric is the automated use of physiological or behavioral characteristics to determine or verify and identify a person. A palm print refers to an image acquired of the palm region of the hand. The palm itself consists of principal lines, wrinkles and epidermal ridges. It contains information such as texture, indents and marks which can be used to identify the individual human being. Palm print recognition system may use scanning devices or a camera to process the image of palm. In palm print authentication system, feature is extracted from the middle part of the palm image and later feature is being match with template stored in the database or a palm image which has been captured at the time of enrollment. There are so many techniques have been proposed till now, let it be more precise in the next section.

Fig. 1. Palm Prints [9]

II. LITERATURE REVIEW

A. Related Works

Several approaches have been proposed for palmprint recognition using feature-based techniques. Parihar et al. (2013) introduced a system for contact-less palmprint recognition that employs point-based features using Harris and SIFT algorithms. Their method focuses on the central region of the palm to extract unique crease patterns, which are then matched against a trained database.

However, the system reported a relatively high false acceptance rate, indicating occasional misidentification of unauthorized users, which limits its reliability for secure authentication [1]. In contrast, George et al. (2014) proposed a ridge-based palmprint recognition system that utilizes principal lines, including the thenar, hypothenar, and interdigital regions. This approach achieved a low false rejection rate (5.7143%), demonstrating higher robustness by accurately granting access to authorized users while effectively rejecting unauthorized attempts [2]. These studies highlight the evolution from point-based to ridge-based techniques to improve the accuracy and reliability of palmprint authentication systems. Several advancements have been made in palmprint-based person identification and recognition techniques. Awate and Dixit (2015) proposed a system that utilizes Canny edge detection to extract palm edges, combined with morphological preprocessing to enhance image quality, and tested using the PolyU palmprint database [3]. Jaswal et al. (2015) employed texture-based recognition using 2-D Gabor filters, calculating similarities between images via Euclidean distance, achieving an average accuracy of 83.12% [4]. Aishwarya et al. (2016) implemented a liveness detection technique based on Weber's local descriptor for feature extraction, incorporating principal lines, datum points, wrinkles, and ridges, with Euclidean distance used to compute both false rejection and false acceptance rates [5]. Kaushik and Singh (2016) introduced a hybrid approach in a PCA-based palmprint recognition system, combining three image processing techniques along with Gabor filtering for preprocessing and K-Nearest Neighbor for feature matching [6]. Agarwal et al. (2017) optimized palmprint recognition using SVM-based classification on the PolyU database, extracting features such as ridge lines, wrinkles, and principal lines, and applying Gabor filters for enhanced preprocessing [7]. Rajeev and Agaian (2017) leveraged 3-D palmprint modeling for biometric verification, employing 3-D depth information and low-pass filtering for denoising, with 3-D ROI used instead of 2-D to more accurately map the palm's informational regions [8]. These studies collectively illustrate the evolution from basic edge- and texture-based techniques to hybrid and 3-D approaches, highlighting improvements in feature extraction, preprocessing, and classification methods in palmprint recognition systems.

III. Problem Identification

Most of the existing systems are based on Gabor filter for preprocessing palm print images and feature extraction is based on ridge patterns, principal lines, wrinkles, etc. Extracting only dark or principal lines and make comparison on that basis is not effective at the rate of accuracy. Most of the systems contain false acceptance rate which possess system towards failure. Instead of that it requires a system that has no false acceptance rate along with best level of accuracy that can accept only true credentials. Harris and SIFT based method has less accuracy in the field of biometric system where it is mandatory to provide 100 % of false rejection rate with high level of accuracy. This system acquires some false acceptance rate which does not possess good authentication system.

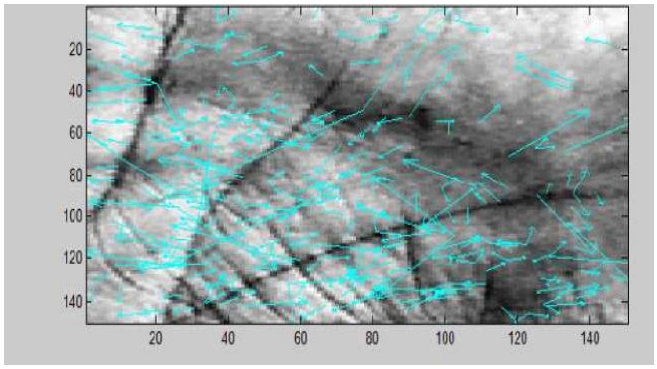

Fig. 2. SIFT Method [1]

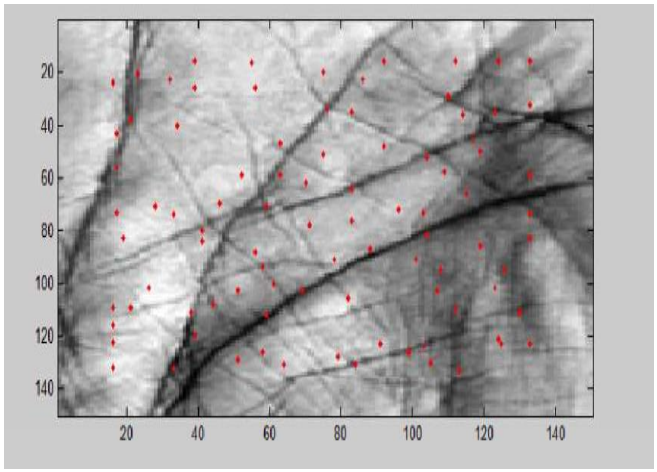

Fig. 3. Harris Method [1]

Few systems are based on principal lines such as thenar, hypothenar, and interdigital having 5.7143 FRR (False Rejection Rate) which is very less as it should be. FRR means unauthorized users will not get access. More FRR means system has high proficiency to reject false users.

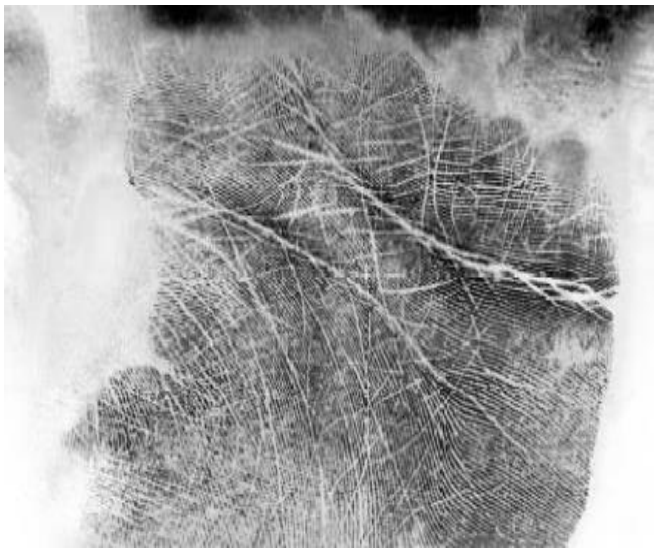

Fig. 4. Ridges Present in the Palm [2]

Some systems are based on Canny edge detection method to detect edges presented on palm which has 91% of precision rate which should be high for better accuracy because if a single user will get access by its fake input then system will become fail.

Fig. 5. Image of Palm-Print [3]

Gaurav Jaswal, Ravinder Nath, Amit Kaul proposed a system which is based on Gabor filter and the accuracy of the system is an average of 83.12 % which is bit lesser. If true user will be rejected then there is no issue but if unauthorized user will get access then the whole system will become failed.

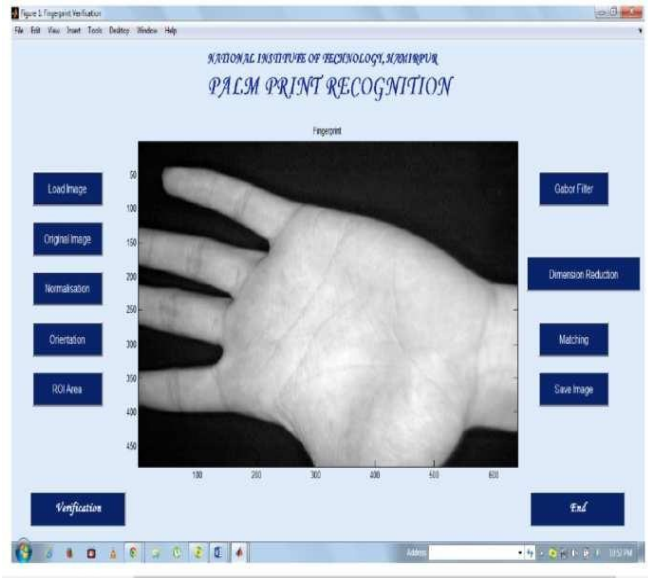

Fig. 6. Graphical user Interface for Palm print Recognition [4]

One of the systems is based on Weber's local descriptor algorithm to extract the information from palm and later compare it with the template which has been stored in the database. Euclidean distance formula has been used for calculating false rejection rate as well as false acceptance rate which calculates the accuracy of the system. System follows the principal lines, datum points, wrinkles and ridges.

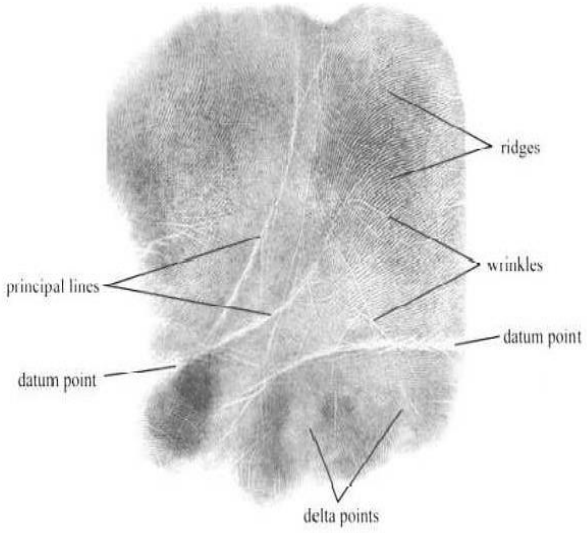

Fig. 7. Palm Features [5]

Shivkant Kaushik, Rajendra Singh proposes a system which has been proposed in this paper is based on hybrid approach for palm print recognition. In the phase of feature matching K-Nearest Classifier has been used. Accuracy is bit higher as compare to the earlier systems but still has some error rate which trails the system towards failure.

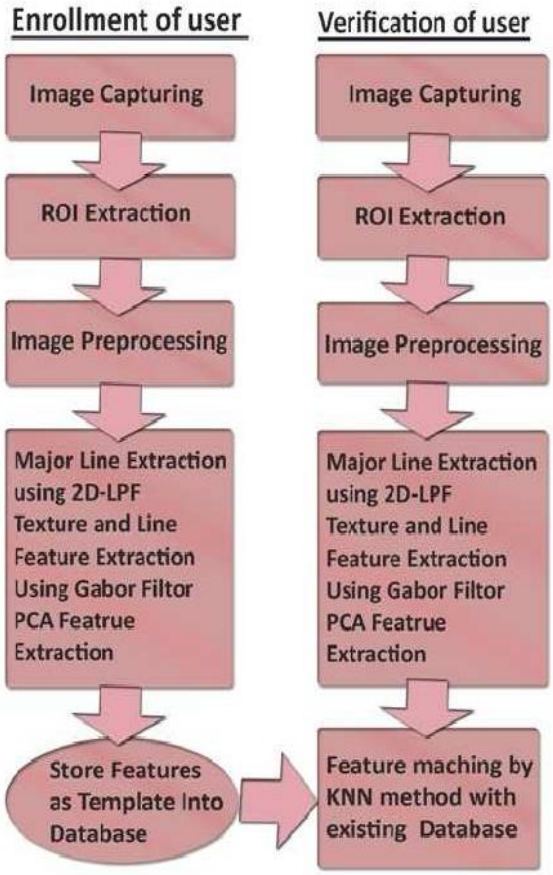

Fig. 8. Approach Steps [6]

Shalini Agarwal and her team proposed a system which has been proposed in this paper is based on SVM classification method to generate feature vectors and experiment performed on polyU palm print database. Proposed method has 94.52 % of the accuracy which is not enough for better authentication system.

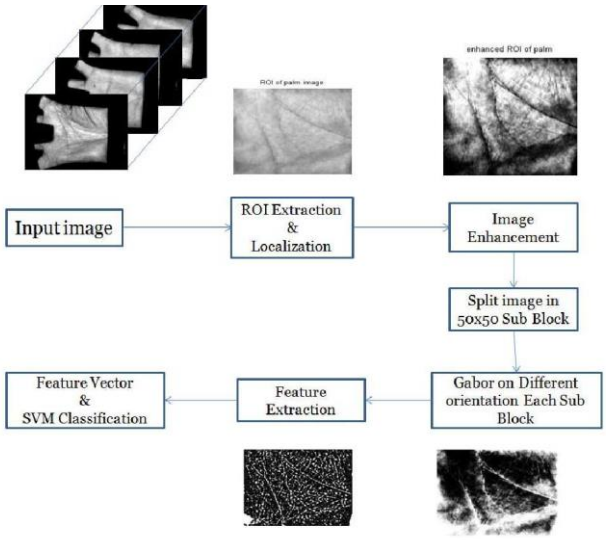

Fig. 9. Proposed Methodology to reduce false rejection of palm print [7]

3-D technologies has made it easier to capture and store 3-D images. This system uses low pass filter for smoothing or denoising the palm print image. System uses 3D ROI instead of 2D ROI for mapping correct region of information that palm contains. This system is based on textural graph of palm print image to exact the features and later comparing it with the samples.

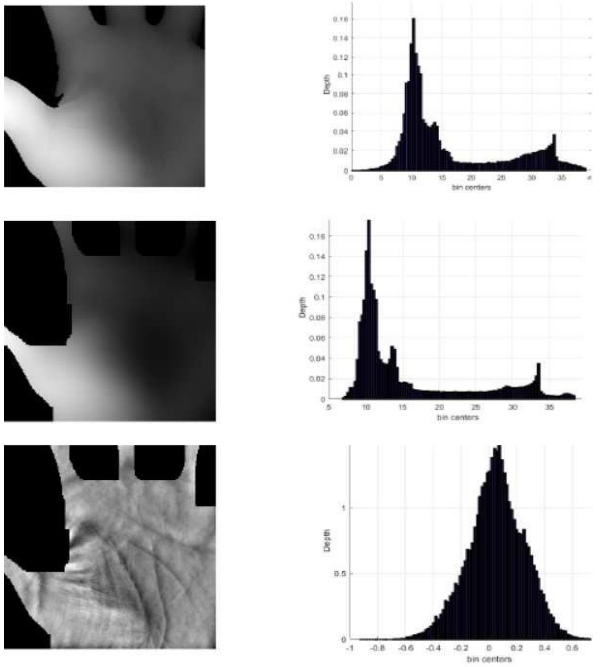

Fig. 10. Preprocessing 3D Palm Print [8]

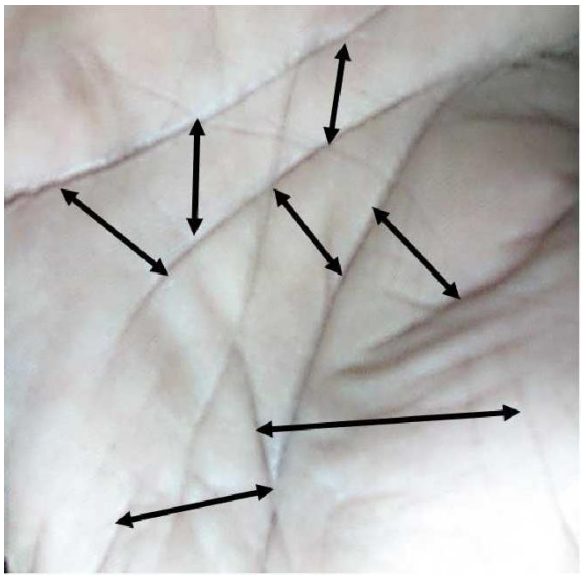

Fig. 11. 3D Palm Print Euclidean Distance [8]

IV. Conclusion

Thus the survey of all these systems concluded at a point that palm print based authentication now introduced with high level of accuracy but having some error rate which requires overcoming with newly introduced algorithm that does not possess any false acceptance rate. This concept of palm print authentication system can replaces so many systems that are based on fingerprint; it can work with touch-less device which will work more frequently as compare to touch based devices. So, this is the new era of authentication system which provides high level of accuracy.

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