DETECTING AND IMPROVING DISTORTED FINGERPRINTS USING RECTIFICATION TECHNIQUES

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Abstract- Elasticated distortion of fingerprints is one of the major causes for false non-match. While this problem affects all fingerprint recognition applications, it is dangerous in negative recognition applications, such as watch list and duplication applications. In negative recognition application to avoid identification the mischievous users intentionally distort their fingerprints. In this paper, we proposed novel algorithms to detection and rectification of fingerprint image. Distortion detection is viewed as a two-class classification problem, for which the registered orientation map and period map of a fingerprint are used as the feature vector and a SVM classifier is perform the classification task. Distortion field estimation is inserting the distorted fingerprint and the result is the distortion field. To solve this problem, a database of various distorted reference fingerprints and corresponding distortion fields is built in the offline stage, and then in the online stage, the nearest neighbor of the inserted fingerprint is found in the reference database and the Corresponding distortion field is used to transform the inserted fingerprint into a normal one.

IndexTerms- Fingerprint, Distorted Fingerprint, Fingerprint Detection, Fingerprint Rectification.

I. INTRODUCTION

Fingerprints are one of many forms of biometrics used to identify and verify individual and their identity. Fingerprint recognition refers to the automated method of authenticating match between two human fingerprints. Fingerprint identification is popular because of that no two persons have the same fingerprints, so they are unique. Because of their uniqueness and consistency, fingerprints have been used for over a long time.

Fingerprint matcher is very conscious to image quality, due to variation in image quality the matching accuracy of the same algorithm varies significantly among different datasets. The variation between the efficiency of plain, rolled and latent fingerprint matching is even larger as recognized in technology evaluations conducted by the NIST. A fingerprint recognition system classified as a positive recognition system and negative recognition system. In a positive recognition system, like physical access control systems, the user is supposed to be cooperative and wishes to be identified. In a negative recognition system, the user of interest (e.g., criminals) is supposed to be uncooperative and does not wish to be identified such as identifying persons in watchlists and detecting multiple enrollments under different names. In a positive recognition system, low quality fingerprint will lead to false reject of legitimate users and thus bring inconvenience. The negative recognition system is the consequence of low quality fingerprint much more serious, since malicious users may intentionally reduce fingerprint quality to prevent fingerprint system from finding the true identity. In fact, law enforcement officials have a number of cases where criminals attempted to evade identification by damaging or surgically reformed their fingerprints. In Fig. 1, the right one contains severe distortion while the left two are normal fingerprints. According to Veri- Finger, the match score between the left two is much higher than the match score between the right two. This immense difference is due to distortion rather than overlapping. It is possible to make the matching algorithms permit large skin distortion; this will lead to more false matches and slow down matching speed.

Fig. 1.1 Sample Fingerprints

Two types of Degradation can be photometric degradation and geometrical degradation. Photometric degradation can be caused by dirty sensor surface, complex image background and non-ideal skin conditions. Photometric degradation has been number of enhancement algorithms and quality evaluation algorithms have been proposed. Geometrical degradation can be caused by skin distortion; due to skin distortion has not yet received sufficient attention, against of the importance of this problem. Fingerprint-based identification is the oldest method among all the biometric techniques which has been successfully used in numerous applications.

II. OBJECTIVE OF THE WORK

1. To design a system that will detect the fingerprint.
2. To detect the distortion fingerprint with high accuracy.
3. To rectify the distortion completely in this process we need to detect the distortion type and then we need to correct the type distortion related error.

III. LITERATURE SURVEY

Name of author	Paper Title	Method	Future Scope
Manish Yadav., Praveen Yadav.	Fingerprint recognition using core detection technique.	1) Image conversion into binary form there is requirement of thinning of image for detection process. 2) Apply core detection for recognition of fingerprint.	Fingerprint distortion detection.
S. Kasari, M. Deriche, B. Boashash	Fingerprint feature extraction using block direction on reconstructed image.	1) In this paper use Ridge extraction algorithm. 2) Maintain natural shape of grey level ridge as well as location of minutiae.	Operates only segmented foreground block or regions.
Xuanbin Si, Jie Zhou, Jianjiang feng	Detecting fingerprint distortion from single image.	1) Novel approach based on ridge period and orientation information. 2) It is uses for detecting distorted fingerprint.	Rectification of distorted fingerprint.
Andrew Senior., Rudde Bolle	Improved fingerprint matching by distortion removal.	1) Removing distortion to achieve best match quality. 2) Minutiae based fingerprint matcher used for removing distortion.	Performance
Manvjeet kaur., Akshay Gridhar., Prarvinder Sandhu	Fingerprint verification system using minutiae extraction technique.	1) In this paper uses minutiae extraction technique. 2) Minutiae extraction technique implemented for fingerprint enhancement and extraction.	Improved quality of image by improving image enhancement technique.

IV. EXISTING SYSTEM APPROACH

In Existing system several challenging research problems, for example, recognizing low quality fingerprints. Fingerprint matcher is very sensitive to image quality as observed in the FVC2006, where the matching accuracy of the same algorithm varies significantly among different datasetsdue to variation in image quality. The difference between the efficiency of plain, rolled and latent fingerprint matching is even larger as observed in technology interpretation conducted by the NIST. The consequence of low quality fingerprints depends on the type of the fingerprint recognition system. A fingerprint recognition system can be classified as a positive recognition system or negative recognition system. In a positive recognition system, such as physical access control systems, the user is supposed to be cooperative and wishes to be identified. In a positive recognition system, low quality will lead to false reject of reliable users and thus bring inconvenience. In a negative recognition system, is supposed to be uncooperative and does not wish to be identified, such as identifying persons in watch lists and detecting multiple enrollments under different names, the user of interest

(e.g., criminals). In fact, law enforcement officials have a number of cases where criminals attempted to evade identification by damaging or surgically modify their fingerprints.

V. PROBLEM STATEMENT

The problem we attempts to address is Geometrical degradation due to skin distortion does not received satisfactory consideration, against of the concern of this problem. Note that, a negative fingerprint recognition system, its security level is as weak as the weakest point. Thus it is crucial to develop distorted fingerprint (DF) detection and rectification algorithms to fill the hole.

VI. PROPOSED SYSTEM APPROACH

In this paper, novel algorithms are expected to deal with the fingerprint distortion problem. Distortion detection is performed on input fingerprint. If input fingerprint is determined to be distorted, distortion rectification is performed to transform the input fingerprint into a normal one. A distorted fingerprint is related to a face with expression, which affects the matching accuracy of face recognition systems. Rectifying a distorted fingerprint into a normal fingerprint is related to transforming a face with expression into a neutral face, which can improve face recognition performance. Distortion detection is viewed as two class classification problems, for which a SVM classifier is trained to perform the classification task and the registered orientation map and period map of a fingerprint are used as the feature vector. Distortion field estimation inserting the distorted fingerprint and the result is the distortion field. To solve this problem, the nearest neighbor of the inserted fingerprint is found in the database of distorted reference fingerprints and the corresponding distortion field is used to rectify the inserted fingerprint. A crucial property of the proposed system is does not require any changes to existing fingerprint sensors and fingerprint acquisition scheme. Such property is crucial for convenient incorporation into existing fingerprint recognition systems. The proposed system has been assess on FVC2004 DB1 whose images are markedly damaged by distortion, Tsinghua distorted fingerprint database which contains 320 distorted fingerprint video files, and NIST SD27 latent fingerprint database. Experimental results determine that the proposed algorithms can enhance the matching accuracy of distorted fingerprints.

VII. SYSTEM ARCHITECTURE

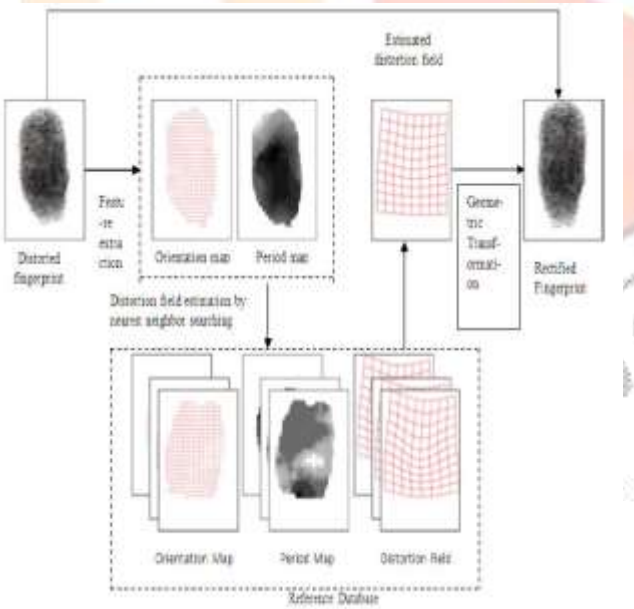

Fig. 7.1 Rectifying Distorted Fingerprints

Explanation

Apply a new distortion field d to the normal fingerprint which is also new for establish distorted fingerprint. If we can measure the distortion field d from the given distorted fingerprint, we can simply rectify it into the normal fingerprint by implement the inverse of d. So we need to address a regression problem, which is quite difficult because of the high dimensionality of the distortion field. In this paper, a nearest neighbor regression approach is used for this work. The proposed distorted fingerprint rectification algorithm subsists of an offline stage and an online stage. In the offline stage, transforming several normal reference fingerprints with different distortion fields sampled from the statistical model of distortion fields for achieve database of distorted reference fingerprints. In the online stage, given a distorted inserted fingerprint, we recover its nearest neighbor in the distorted reference fingerprint database and then use the inverse of the corresponding distortion field to rectify the distorted inserted fingerprint.

1) Generation of Database of Distorted Reference Fingerprint: We use nref ¼ 100 normal fingerprints from FVC2002 DB1_A to evolve the database of distorted reference fingerprints. The distortion fields are generated by consistently sampling the subspace spanned by the first two principle components. For each basis, 11 points are consistently sampled in the interval [2,2] for an example of generating distortion fields and applying such distortion fields to a reference fingerprint to generate corresponding distorted fingerprints. For resolve purpose, only one reference fingerprint (the fingerprint located at the origin of the coordinate system) is used to generate the database of distorted reference fingerprints, and for each basis, five points are sampled. In practice, multiple reference fingerprints are used to accomplish better performance.
2) Distortion Field Estimation by Nearest Neighbor Search: Distortion field estimation is identical to finding the nearest neighbor among all distorted reference fingerprints. The affinity is measured based on level 1 features of fingerprint, namely ridge orientation map and period map. We supposition that distortion detection and rectification of human experts also depend on these features instead of minutiae. The affinity computation method is different depending on whether the upper core point can be detected in the input fingerprint. If the upper core point is detected, we translate the input fingerprint by aligning the upper core point to center point. Then we do a full search of u in the interval ½_30; 30 for the maximum similarity.
3) Performance of Distortion Detection: We view distortion detection as a two-class classification problem. Distorted fingerprints are viewed as positive samples and normal fingerprints as negative samples. If a distorted fingerprint is restricted as a positive sample, a true positive occurs. If false positive occurs when normal fingerprint is restricted as a positive sample. By changing the decision threshold, we can obtain the receiver operating characteristic (ROC) curve. As we can see this figure, the current algorithm performs much better. Although most fingerprints can be correctly classified, there are some false negatives and false positives. False negatives are mainly because the distortion is minor. Fortunately, we found that this is not a severe problem since fingerprint matchers can successfully match minor distorted fingerprints. Minor distortion present in query fingerprints, the proposed detection algorithm fails to detect it as distorted one, but the matching score between the query fingerprint and the galley fingerprint is 305, a very high matching score according to VeriFinger. If this query fingerprint is rectified by the proposed rectification algorithm, the matching score can be further improved to 512. Due to the low image quality, small finger area, or non-frontal pose of finger false positives are occurs. In such cases, there is no satisfactory information for correctly coordinate and classifying the fingerprint.

VIII. EXPERIMENTAL RESULT

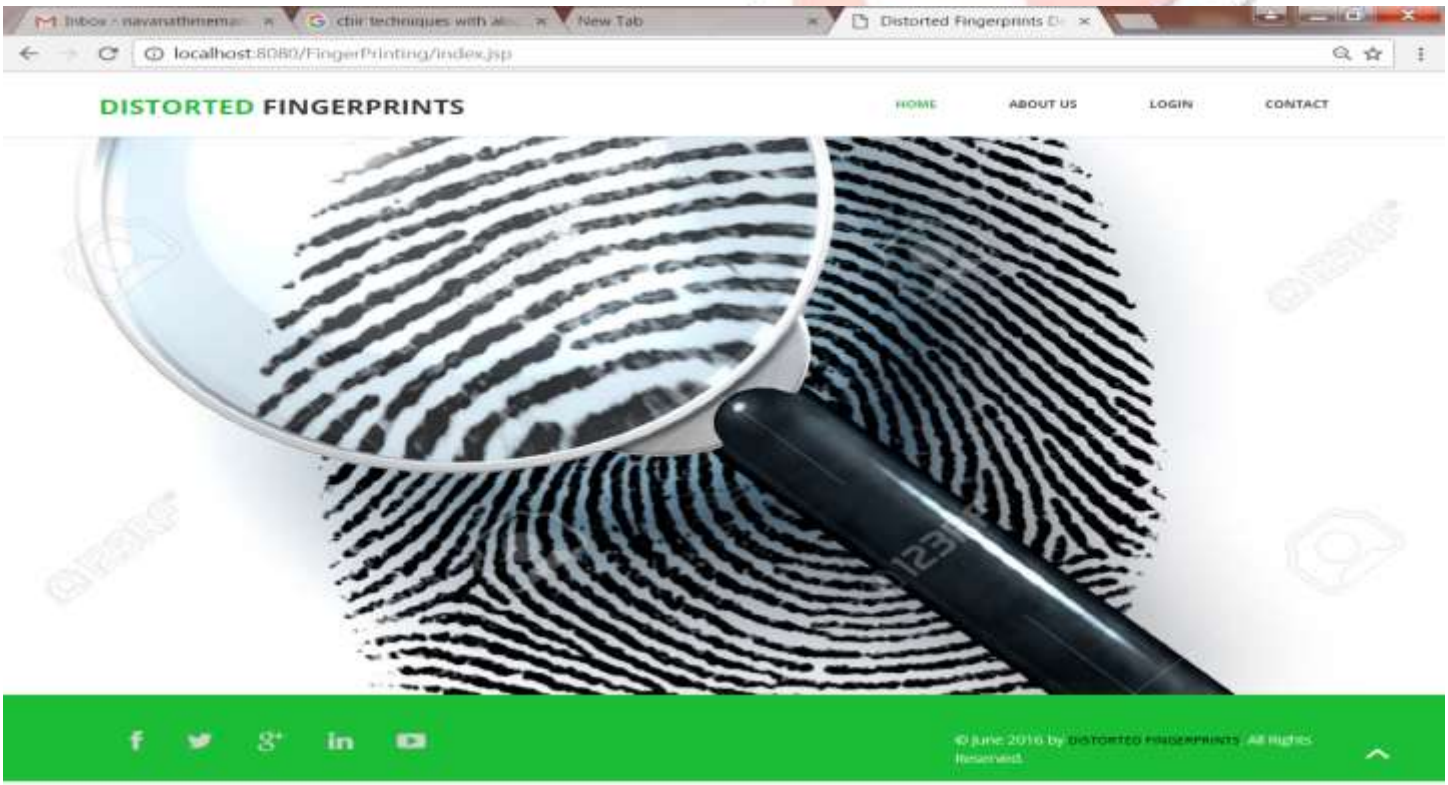

Fig.8.1 Home Page

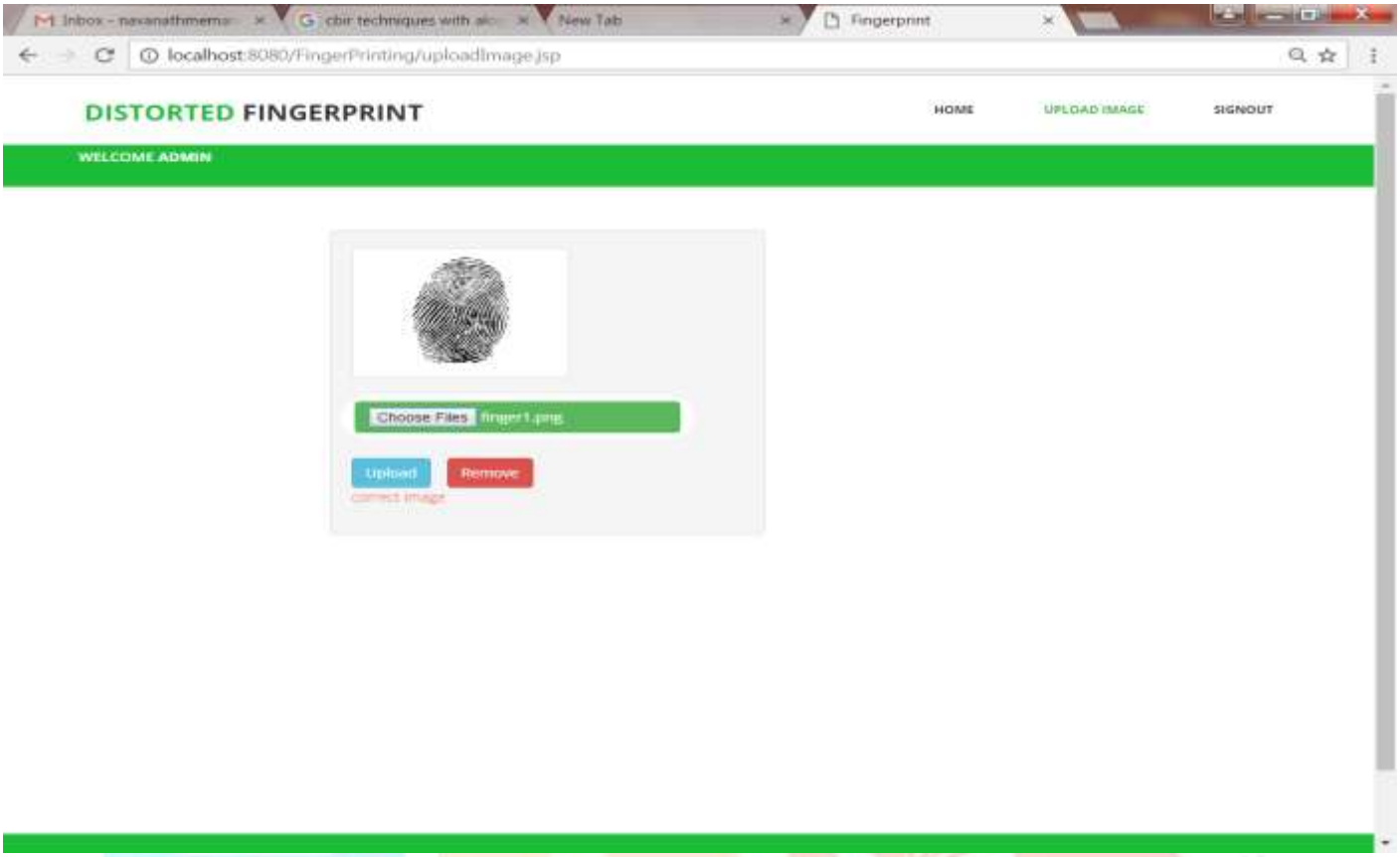

Fig.8.2 Registration

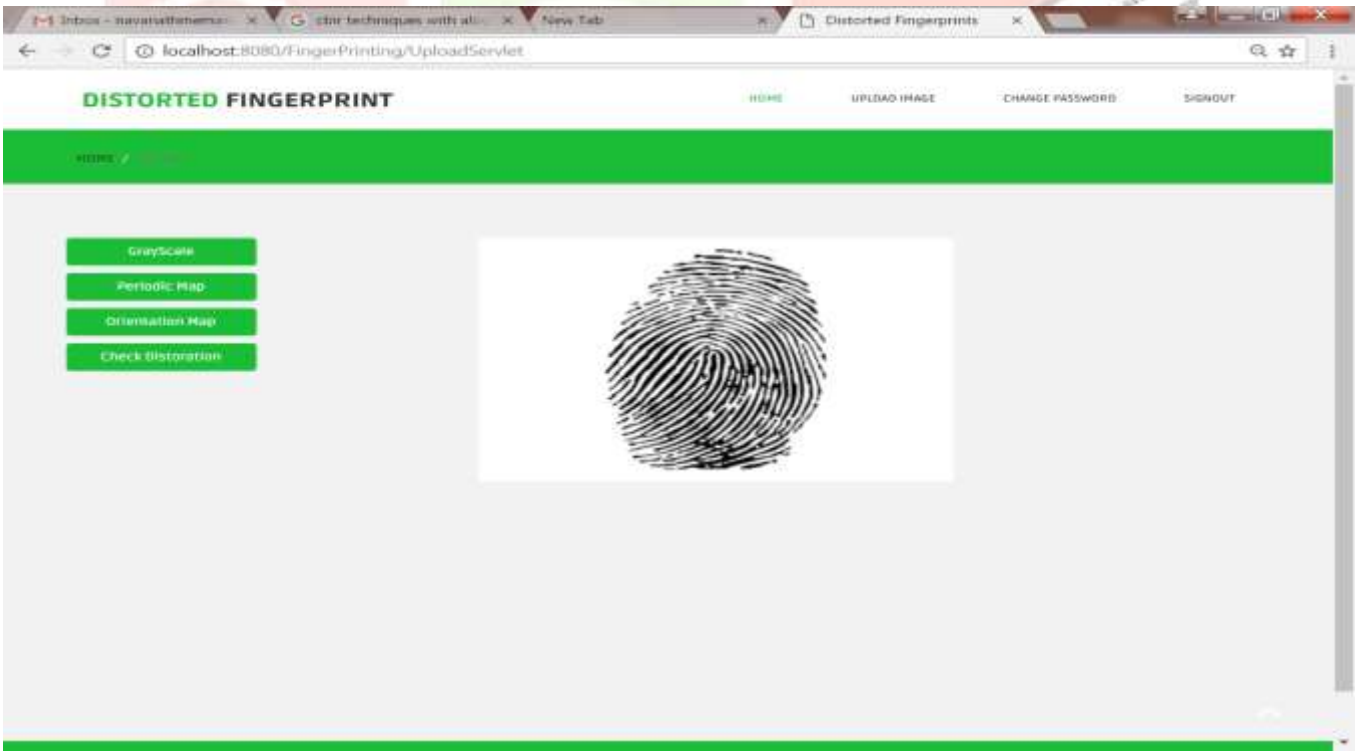

Fig.8.3 Grayscale

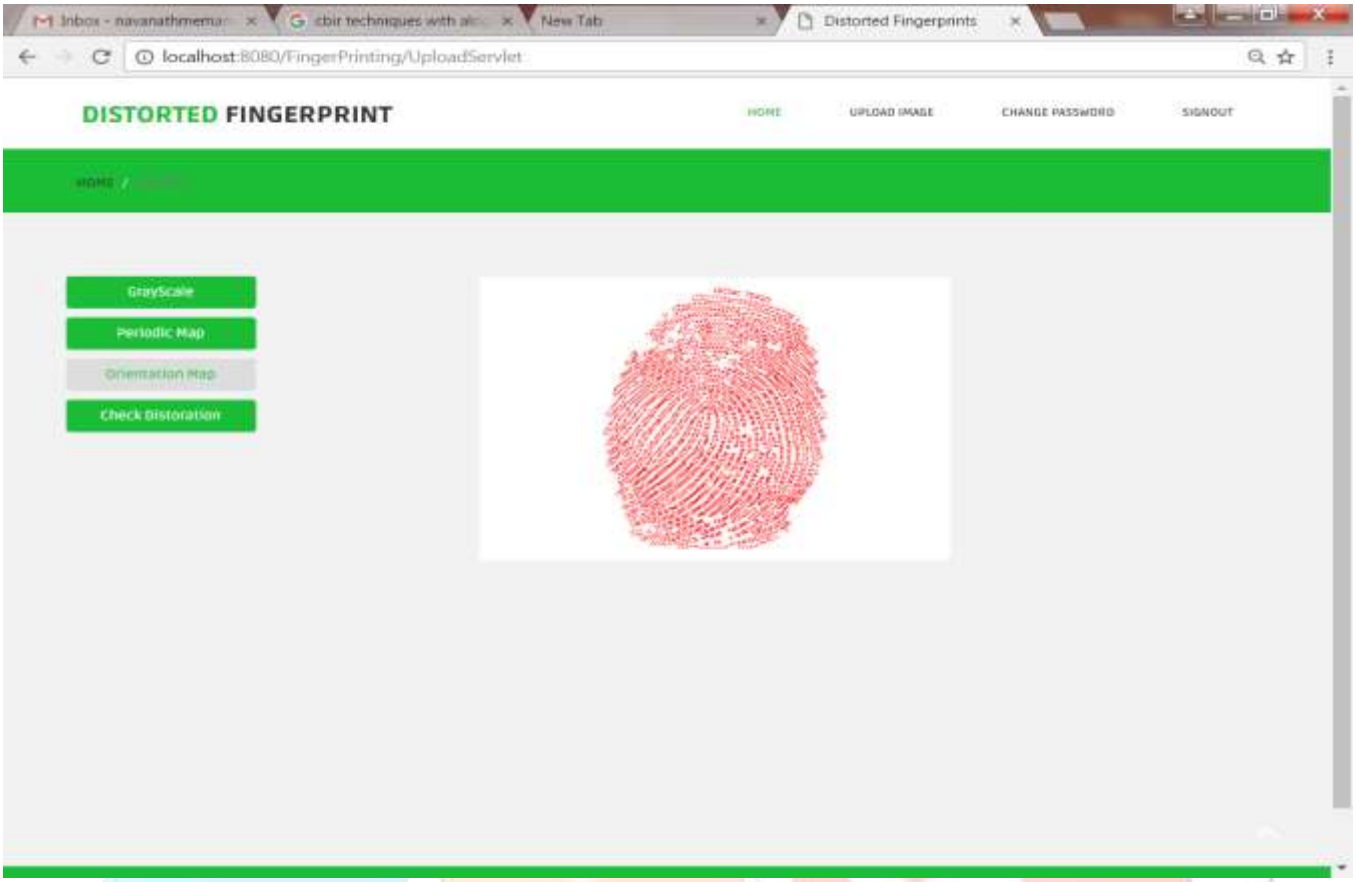

Fig.8.4 Orientation Map

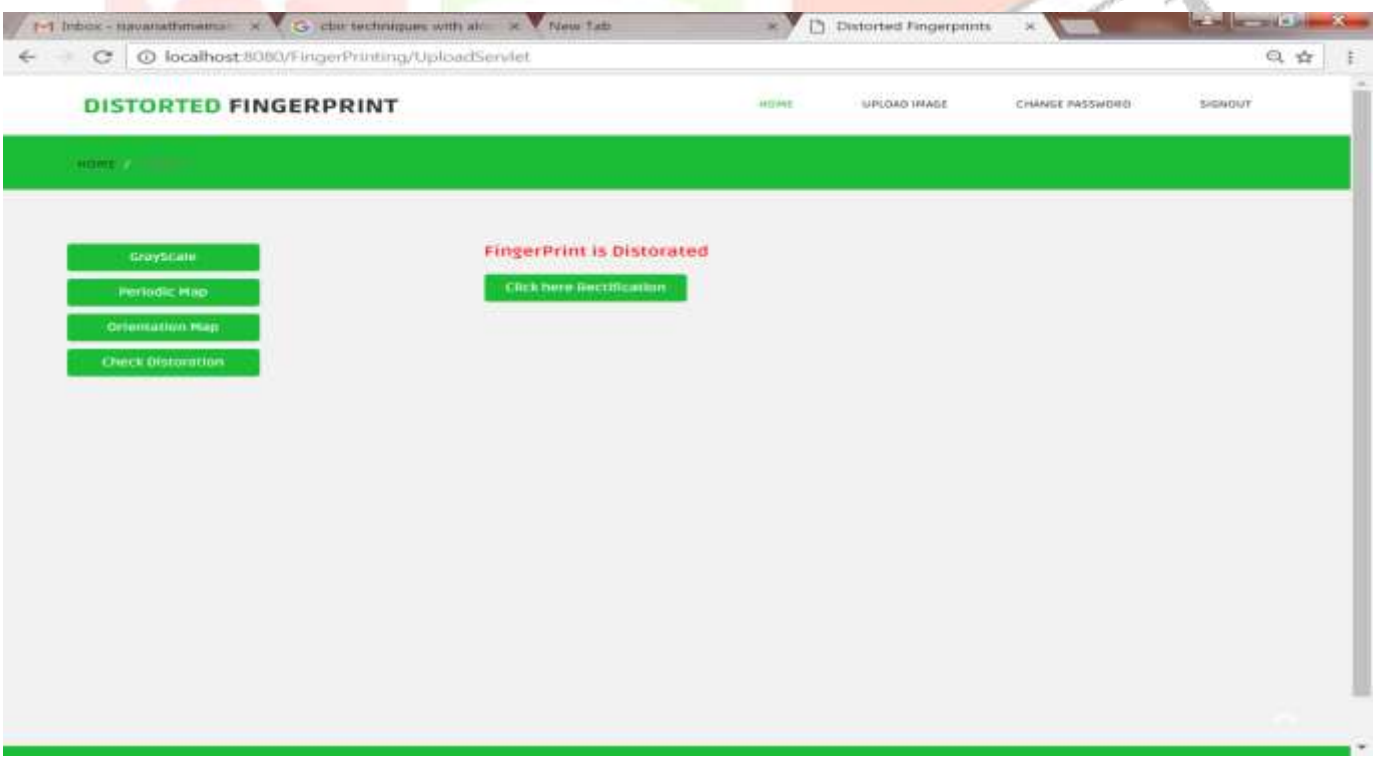

Fig 8.5 Distorted Fingerprint

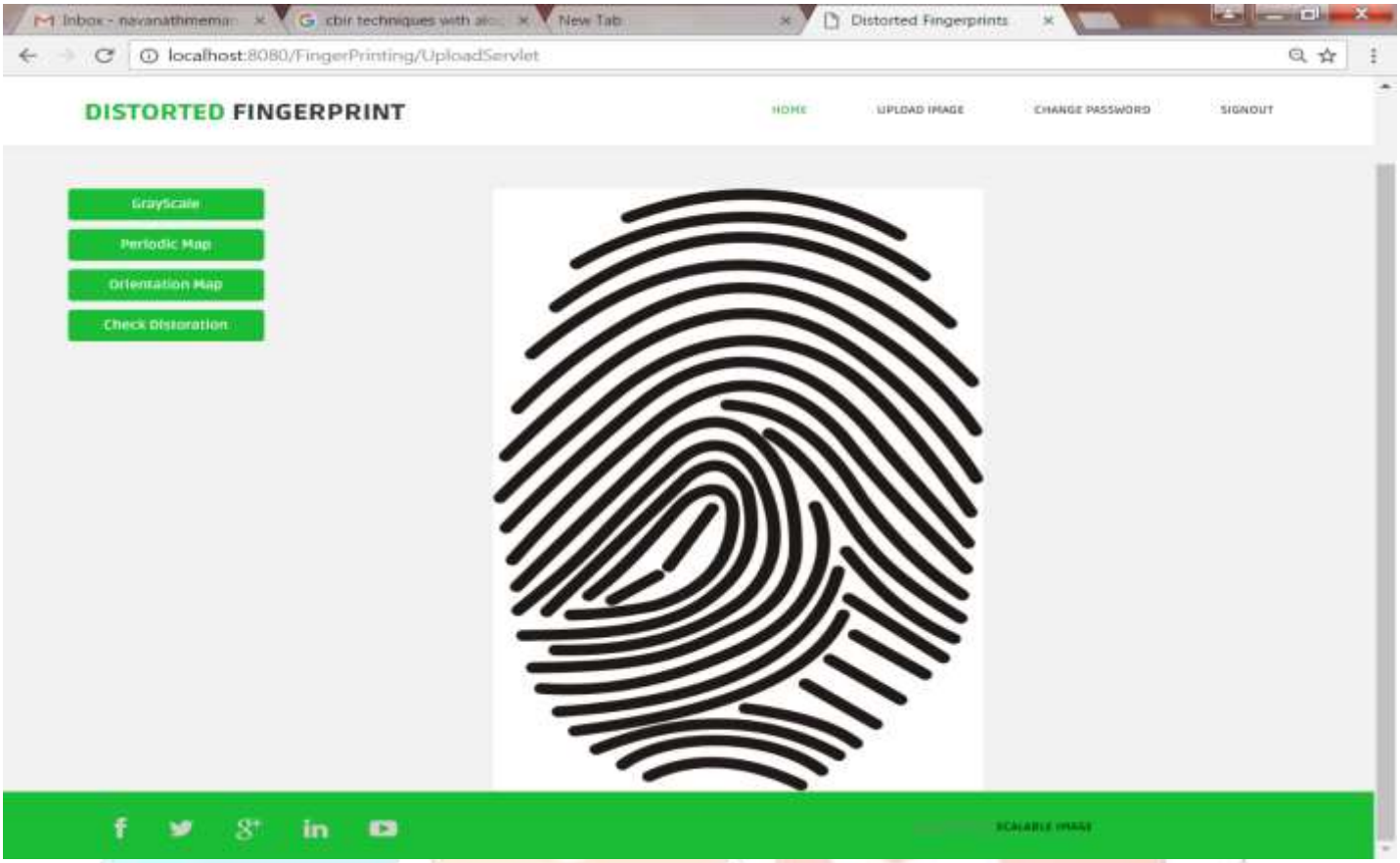

Fig. 8.6 Rectification

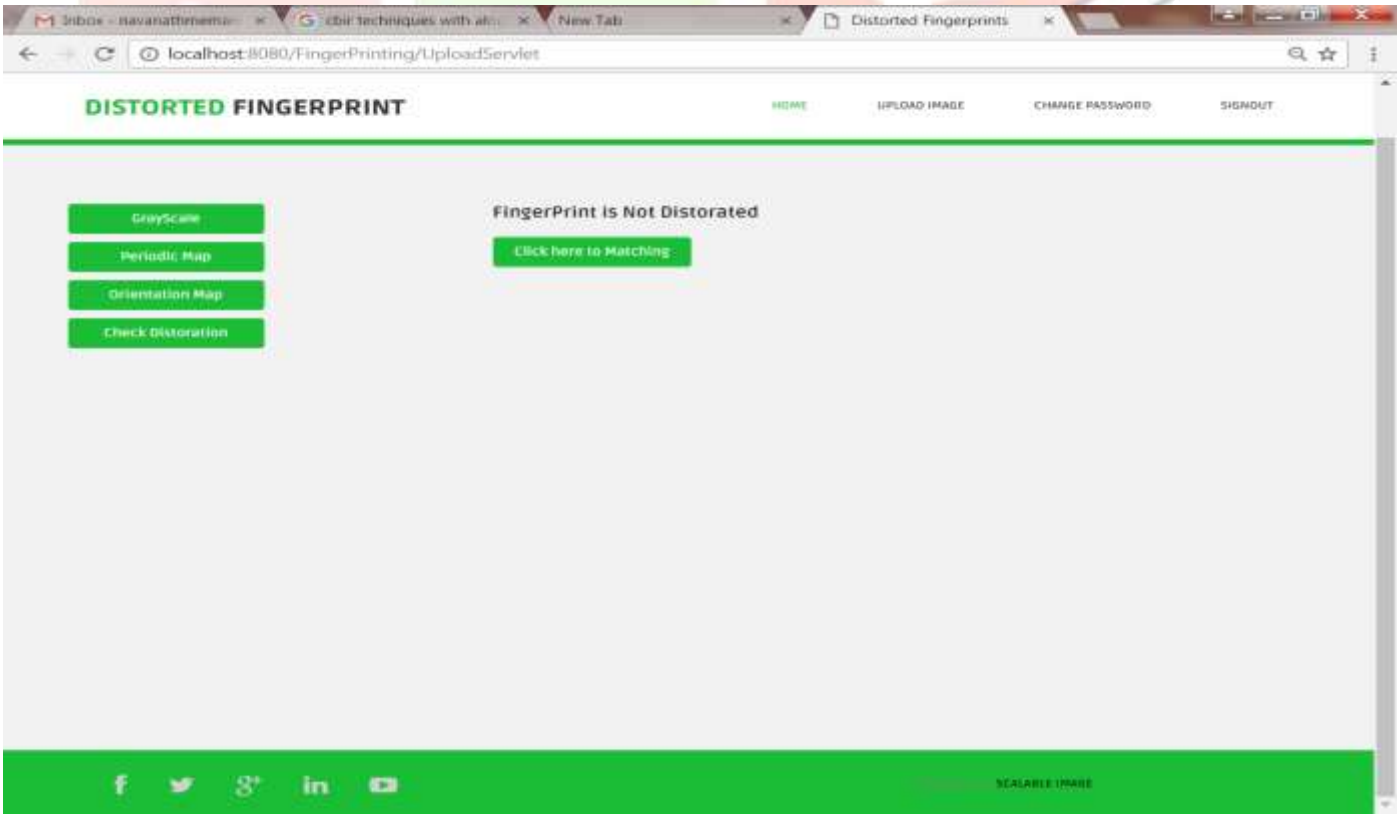

Fig. 8.7 Normal Fingerprint

IX. CONCLUSION

This paper explains a new distorted finger print detection and rectification algorithm. Distortion detection is done by the use of registered ridge orientation map and period map of a fingerprint as the feature vector, a SVM classifier is made to classify the input fingerprint as distorted or normal. In distortion field estimation, a nearest neighbor regression method is occupied to await the distortion field from the inserted distorted fingerprint, later the inverse of the distortion field is used to change the distorted fingerprint into a normal one. The experimental results of proposed algorithm can enhance rate of identification of distorted fingerprints unmistakably. In the future we can extend our system to implement it on 3D Fingerprint.

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