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# In Accessible Multimodal Biometric Recognition Based on the Fusion of the Iris and the Fingerprint

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**ABSTRACT:** With the development of various services through the web and especially with the emergence of electronic commerce, all suppliers of product and services are providing considerable effort to secure against all possible fraudulent instructions. It appears that biometric is the only method that can satisfy the requirement of remote identify in terms of relevance and reliability. In this project, Proposed about client server network architecture for a remote multimodal biometric identification. As a matter of fact, Can use two modalities, namely the human **IRIS** and his **FINGERPRINT** in order to strengthen the security, since the unimodal biometric systems cannot always be used reliably to perform recognition. However, the association of the information presented by the various modalities may allow a precise recognition of the identity. Concerning the fusion of these two modalities, Here used a new approach at the sores level based on a classification method by the decision tree and a combination method by the sum. The results obtained confirm that the proposed method helped significantly to optimize the performance of the identification.

**KEYWORDS:** Iris, Fingerprint, Client Server Network.

## I. INTRODUCTION

Although automatic fingerprint recognition technologies have rapidly advanced during the last forty years, there still exists 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 datasets due to variation in image quality. The difference between the accuracies of plain, rolled and latent fingerprint matching is even larger as observed in technology evaluations 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 either a positive or negative 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 negative recognition system, such as identifying persons in watch lists and detecting multiple enrollments under different names, the user of interest (e.g., criminals) is supposed to be uncooperative and does not wish to be identified. In a positive recognition system, low quality will lead to false reject of legitimate users and thus bring inconvenience.

The consequence of low quality for a negative recognition system, however, is much more serious, since malicious users may purposely reduce fingerprint quality to prevent fingerprint system from finding the true identity. In fact, law enforcement officials have encountered a number of cases where criminals attempted to avoid identification by damaging or surgically altering their fingerprints.

Hence it is especially important for negative fingerprint recognition systems to detect low quality fingerprints and improve their quality so that the fingerprint system is not compromised by malicious users. Degradation of fingerprint quality can be photometric or geometrical. Photometric degradation can be caused by non-ideal skin conditions, dirty sensor surface, and complex image background (especially in latent fingerprints). Geometrical degradation is mainly caused by skin distortion. Photometric degradation has been widely studied and a number of quality evaluation algorithms and enhancement algorithms have been proposed. On the contrary, geometrical degradation due to skin distortion has not yet received sufficient attention, despite of the importance of this problem. This is the problem this paper attempts to address. Note that, for a negative fingerprint recognition system, its security level is as weak as the weakest point. Thus it is urgent to develop distorted fingerprint (DF) detection and rectification algorithms to fill the hole.



## II. ELASTIC DISTORTIONS

Elastic distortion is introduced due to the inherent flexibility of fingertips, contact-based fingerprint acquisition procedure, and a purposely lateral force or torque, etc. Skin distortion increases the intra-class variations (difference among fingerprints from the same finger) and thus leads to false non-matches due to limited capability of existing fingerprint matchers in recognizing severely distorted fingerprints. In Fig. 1, the left two are normal fingerprints, while the right one contains severe distortion.

According to Veri-Finger 6.2 SDK, the match score between the left two is much higher than the match score between the right two. This huge difference is due to distortion rather than overlapping area. While it is possible to make the matching algorithms tolerate large skin distortion, this will lead to more false matches and slow down matching speed.

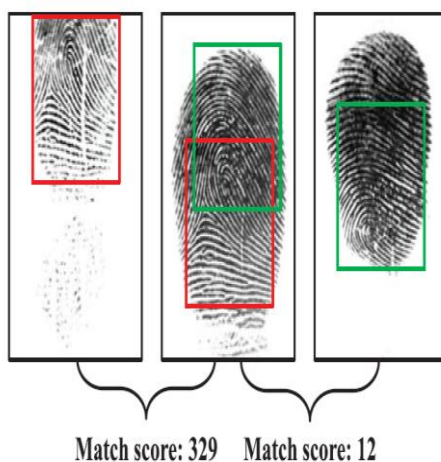


Fig-1 Fingerprint Distortion

An input fingerprint, distortion detection is performed first. If it is determined to be distorted, distortion rectification is performed to transform the input fingerprint into a normal one. A distorted fingerprint is analogous to a face with expression, which affects the matching accuracy of face recognition systems. Rectifying a distorted fingerprint into a normal fingerprint is analogous to transforming a face with expression into a neutral face, which can improve face recognition performance.

## III. ROUTING DISTORTION DETECTION

In this system, distortion detection is viewed as a two class classification problem, for which the registered ridge orientation map and period map of a fingerprint are used as the feature vector and a SVM classifier is trained to perform the classification task. Distortion rectification (or equivalently distortion field estimation) is viewed as a regression problem, where the input is a distorted fingerprint and the output 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 input fingerprint is found in the database of distorted reference fingerprints and the corresponding distortion field is used to rectify the input fingerprint.

An important property of the proposed system is that does not require any changes to existing fingerprint sensors and fingerprint acquisition procedures. Such property is important for convenient incorporation into existing fingerprint recognition systems. Experimental results demonstrate that the proposed algorithms can improve the matching accuracy of distorted fingerprints evidently.

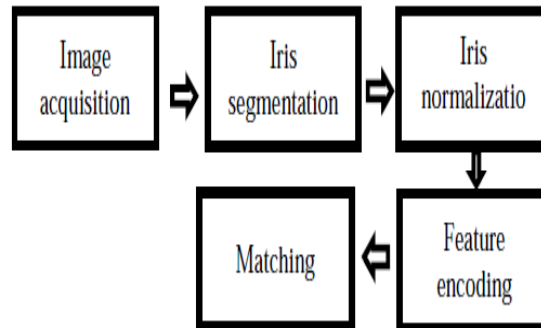


Fig 2 Iris recognition system

#### IV. METHODOLOGIES

##### DATASET

The dataset was gathered from a sum of 185 subjects. 200 pictures were gathered from each subject. When the pictures were gathered, the information was increased utilizing arbitrary estimations of interpretation, precise revolution, size, and level flipping of the pictures.

##### CONVOLUTIONAL NEURAL NETWORK

The initial five were the Convolutional layers. In these layers, different channels were convolved with NIR pictures to separate particular highlights from all the classes. These channels removed rich data from the pictures, for example, edges, bends, and shadings. In NIR pictures, vein data is spoken to by the more obscure locales inside the fingers, while the non-vein district is spoken to by the more brilliant areas inside the fingers. Whenever extraction was finished, those discriminative highlights were sent to the excess three completely associated layers, where loads were joined utilizing a misfortune work in a few emphases. As a matter of course, the design of the Convolutional Neural Network (CNN) utilized two Group Preparing Units (GPUs) to accelerate the handling. In our analyses, we utilized a solitary GPU thus, all the activities were performed inside the sole GPU.

##### FUZZY LOGIC SYSTEM

FLS focused a fluffy rationale framework to join the yields of all the biometric modalities that were utilized in our proposed framework (i.e., beat reaction, hand math, and finger–vein biometrics). The fluffy framework will deliver certainty esteem on a size of 0–1. The qualities almost 0 speak to that the individual is a faker, and qualities close to 1 speak to that the individual has a place with the anticipated class by the hand math and finger–vein frameworks.

##### CLASSIFICATION PROCESS

The proposed framework works in distinguishing proof mode, in which highlight vectors are contrasted with the put away layouts in the information base for each biometric quality during the enlistment module. Among the most popular measurable strategies for characterization, we locate the first k-Nearest Neighbor (K-NN); be that as it may, in this work we have examined and improved the fluffy k- Nearest Neighbor (FK-NN) for our multimodal biometrics framework for the grouping stage.

##### FUSION PROCESS

The fundamental structure of the proposed multimodal biometric framework depends on the successful blend of the face and iris modalities. In our proposition, the framework utilizes score level combination and choice level combination simultaneously to misuse the benefits of every combination level and improve the presentation of the biometric framework. In the score level combination, the scores are standardized with min-max and Z-score procedures, yet the combination is performed with the min rule, max rule, whole guideline and weighted entirety rule. In the choice level combination, and also have utilized OR rule.

##### FINGERPRINT RECOGNITION

A unique finger impression is the element example of one finger and accepted that each finger impression is remarkable. Every individual has his own fingerprints with the lasting uniqueness. So fingerprints have being utilized



for recognizable proof and acknowledgment. A unique mark is made out of edges and wrinkles which are equal and has same width. Nonetheless, in unique mark acknowledgment, fingerprints are not recognized by their edges and wrinkles are recognized by Minutia, which are highlights on the edges. There is assortment of minutia types on unique mark picture as in the underneath figure however two are generally critical and in weighty utilization one is called end, which is the quick completion of an edge and the other is called bifurcation, which is the point on the edge from which two branches infer.

### IRIS RECOGNITION

The iris acknowledgment measure comprises of five significant advances. The initial step is the picture securing of an individual's eye at enlistment time or check time. The subsequent advance is to section the iris out of the picture containing the eye and part of the face, which restricts the iris design. Stage three is the standardization; here the iris example will be separated and scaled to a predefined size. Stage four is the layout age; here the subtleties of the iris are separated, removed and spoken to in an iris code. The last advance is the coordinating stage, where two iris codes will be analyzed. A typical principle steps of an iris acknowledgment framework.

### V. FEATURE EXTRACTION METHODS

The four characteristic insertion methods: PCA, FDs, GLCM, and LBP are practical to remove the skin from face and iris images. The outcome of this stage is called feature vector or pattern which is stored in the template database.

#### A. PCA

The PCA strategy was utilized in numerous straight applications gives numerous offices, for example, highlight extraction, information pressure, measurement decrease, and excess evacuation. The cycle of PCA changes picture space into Principle Component space. The covariance framework, Eigen values, and Eigenvectors are figured utilizing (1), (2), and (3):

$$\text{mean}(\bar{A}) = \frac{1}{n} \sum_{i=1}^n a_i \quad (1)$$

$$(a,b) = \sum_{i=1}^n (a_i - \bar{A}_i)(b_i - \bar{B}_i) \quad (2)$$

$$\det(\text{cov}(a,b) - \lambda I) = 0 \quad (3)$$

Where:  $\bar{A}_i$  and  $\bar{B}_i$  are the mean values for a exact vector, while  $a_i$  and  $b_i$  are the current values in the vector  $a$  and  $b$ . The number of rows in the vectors is representing by  $n$ .

#### B. FDs

FDs is an essential strategy for shape depicting utilizing a scope of spatial frequencies that appropriate the line focuses called Fourier coefficients. The Fourier coefficients are intricate number where a little arrangement of these coefficients is utilized to portray the shape-signature.

The initial step of FDs method is processed the limit focuses and enlisted their intricate directions. The driven distance is applied to discover the shape signature where it speaks to the situation of shape from the limit utilizing. The Fourier change esteems are utilizing, it is significant advance in FDs methodology, where the recurrence esteems are created with the Direct Current worth.

$$r(t) = \sqrt{(x(t) - x_d)^2 + (y(t) - y_d)^2} \quad (4)$$

Where:

$$x_d = \frac{1}{N} \sum_{t=0}^{N-1} x(t), \quad y_d = \frac{1}{N} \sum_{t=0}^{N-1} y(t) \quad (5)$$

$$FD_n = \frac{1}{N} \sum_{t=0}^{N-1} (x(t) - x_d) \exp(-j2\pi n t / N) \quad (6)$$

Where  $N$  refers to sampling number,  $(t)$  and  $(t)$  indicate to complex number of boundary points.  $( )$  represent the centroid of the shape, while  $FD_n$  called FDs coefficients.

#### C. GLCM

The GLCM is a measurable technique that is used to remove the second request surface highlights for any intrigued object. The activity of GLCM is tallied how often the sets of-pixels with specific worth and heading that shows up in picture as appeared in fig.1. The GLCM grid is a two dimensional lattice contains the surface highlights that removed from picture with a square size equivalents to the quantity of level. There are four surface highlights can be acquired from GLCM grid: contrast, connection, homogeneity, and energy.



**D. LBP**

The activity of LBP relies upon the eight neighbors of the current pixel, where the middle pixel is utilized as an edge for its neighbors. The last code of focus pixel is created by consolidated the paired coding of its eight neighbors utilizing. The LBP activity could be extended to incorporate diverse number of neighbors by creating a hover of neighbor focuses around the middle pixel with range approaches to  $R$ . The dark estimation of neighbors is figured utilizing bilinear introduction and afterward the correlation is processed between the neighbors esteems and focus.

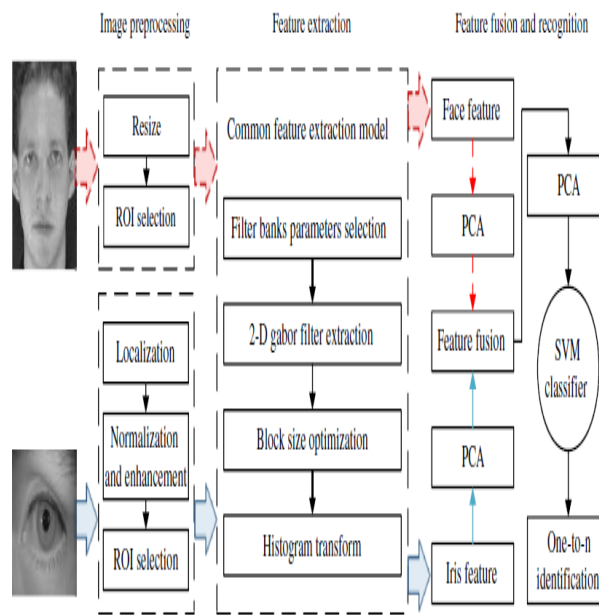
$$xL = gp - gc \tag{7}$$

$$(xL) = \{1 \text{ if } xL \geq 0, 0 \text{ if } xL < 0\} \tag{8}$$

$$LBPP(xc, yc) = \sum s(xL) 2^{pp-1} p = 0 \tag{9}$$

Where  $gp$  and  $gc$  alludes to the dim estimation of neighbors and focus pixel individually. While  $2p$  demonstrates to binomial worth. The two boundaries  $xc$  and  $yc$  are eluded to the directions of the middle pixel.  $P$  alludes to the complete number of neighbors, while  $p$  alludes to the current neighbor esteem.

There are two sorts of LBP code: uniform and non-uniform example, where the uniform example removes the main highlights like edge, corner, end line and it is utilized in this work. The LBP code is called uniform example when it has two advances from 0 to 1 or the other way around and furthermore if there is no advances in pieces. This sort is saved memory where the absolute length of uniform code is equivalent to  $(P-1)+3$ , while non-uniform is equivalent to  $2p$ .



**Fig 3 System framework**

**VI. PREPROCESSING OF PALM PRINT AND FINGERPRINT IMAGES**

The initial step of the proposed multimodal framework is to pre-measure the information unique mark and palm print pictures.

The pre-handling sets up an organize framework to adjust palm print and unique mark pictures and to fragment area of interest (ROI) by which highlights can be handily recognized. For this, methods of finish and diminishing are utilized. Finish changes the dim level pictures over to paired pictures.

In order to learn statistics of realist fingerprint distortion, we collected a distorted fingerprint database called Tsinghai distorted fingerprint database. A FTIR fingerprint scanner with video capture functionality was used for data collection.

Each participant is asked to press a finger on the scanner in a normal way, and then distort the finger by applying a lateral force or a torque and gradually increase the force. A total of 320 videos (with a frame rate of 10 FPS) were obtained from 185 different fingers. For distortion rectification (or equivalently distortion field estimation), a nearest neighbor regression approach is used to predict the distortion field from the input distorted fingerprint and then the inverse of the distortion field is used to transform the distorted fingerprint into a normal one.

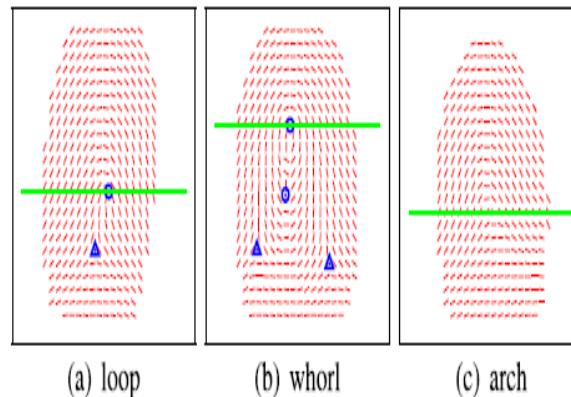


Fig 4 Orientation maps of three Patterns

## VII. CONCLUSION

False non-match rates of fingerprint matchers are very high in the case of severely distorted fingerprints. This generates a security hole in automatic fingerprint recognition systems which can be utilized by criminals and terrorists. For this reason, it is necessary to develop a fingerprint distortion detection and rectification algorithms to fill the hole. This system described a novel distorted fingerprint detection and rectification algorithm. For distortion detection, the registered ridge orientation map and period map of a fingerprint are used as the feature vector and a SVM classifier is trained to classify the input fingerprint as distorted or normal.

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