Lips Identification using Fuzzy Based Triangular Feature Set

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Abstract— *Biometric traits are now highly explored by researchers to identify a person. This paper presents a biometric identifier, namely lips for personal identification. A Fuzzy based on Triangle Feature Set is applied to the lips verification system. This method demonstrates that the minutiae template of an user may be used to reconstruct the lips image of Computer Education and Training Society (CETS) students and staff members. The performance of the method is also reported. This paper proposes the concept of fixed number of triangles in the lips. It improves the performance of the method.*

Keywords— Distortion, Lip, Matching, Orientation, Verification.

I. INTRODUCTION

Biometrics refers to metrics related to human characteristics and traits. Biometrics authentication is used as a form of identification and access control. Biometric identifiers are the distinctive, measurable characteristics used to label and describe individuals. Biometric identifiers are often categorized by physiological characteristics and behavioral characteristics. A human body posses several physiological characteristics that can serve as biometric features. Also a human being develops several unique behavioral traits which can also serve as biometric features. The various physiological characteristics that are generally used are face, iris, fingerprints, palm prints, hand geometry and voice. Automated biometric systems by including data obtained during these processes vastly improve the accuracy of the system. A good biometric is characterized by use of a feature that is highly unique. The chance of any two people having the same characteristic will be minimal, stable so that the feature does not change over time. This can be easily captured in order to provide convenience to the user, and prevent misrepresentation of the feature. This section is devoted to the description of the most common traits that are presently used for biometric purpose.

Lip is the tactile sensory organ constituting the visible portion of the mouth. Since the lip data can be captured at a distance, it represents a passive biometric as it requires no active user participation. The lip biometric lies on the area of uniqueness and circumvention.

II. LITERATURE SURVEY

Yasuo Tsuchihasi and Kazuo Suzuki at Tokyo University [1, 2] studied the lip prints of people of all ages and concluded that lip characteristics are unique and stable for a human being. Much recently, it has been studied that lip prints can also be used to determine the gender of a human being [5]. The pioneer of Chieloscopy, Professor J. Kasprzak, analysed 23 unique lip patterns [3-4] for finding features of human beings. Such patterns (lines, bifurcations, bridges, pentagons, dots, lakes, crossings, triangles etc.) are very similar to fingerprint, iris or palm print patterns. The statistical characteristics features extracted from the lip prints also account for unique identification. Michal Choras has re-affirmed the belief in his recent studies [6, 7] that the lip can be used as a primary biometric modality for successful identification purposes. He has shown that geometrical analysis of the anatomical parameters of the human lip can be monitored for successful identification. Lukasz Smacki has also done significant research studying the groove patterns in the human lips for personal identification [8]. He has also proposed a method of lip print identification using DTW algorithm [9].

III. PROPOSED WORK

In a face region lip is present in the lower portion. Then the lip region is extracted from the face images by taking some estimations thus the lip region is extracted from the face images in the databases. For eliminating the influences from the camera noise and various light changing fast box filtering and histogram stretching are using. It provides a contrast enhanced and smoothed result.

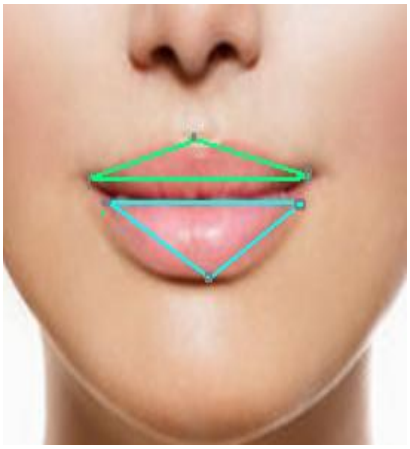

FIG.1. TRIANGLES FORMED IN THE LIPS

IV. FUZZY FEATURE MATCHING

First step of the approach is to define the lips features. The next step is to define a local triangle feature set. The block of the matching is the local triangle feature of the lips. The feature vector of a lips structure is defined by the distance between minutiae, the angle between the directions from minutiae, the orientation differences within the region of minutia. The feature set is denoted by Lp.

$$Lp = \{ulD_1, ulD_2, ulD_3, LlD_1, LlD_2, ud_{ij}, ud_{jk}, ud_{ik}, Ld_{ij}, Ld_{jk},$$

$Ld_{ik}, u\Psi_i, u\Psi_j, L\Psi_k, L\Psi_i, L\Psi_j, L\Psi_k, uOZ_i, uOZ_j, uOZ_k, LOZ_i, LOZ_j, LOZ_k, u\alpha_i, u\alpha_j, u\alpha_k, L\alpha_i, L\alpha_j, L\alpha_k \}$. U denotes the upper lip and the L denotes the lower lip. The triangles are constructed by the triplets of minutiae satisfying the following constraint; the maximum length of the edge in a triangle should be less than thr1, and the minimum length of the edge should be greater than thr2. Lip matching is to find a similarity between two feature vector set, one from the template and another from the input lips respectively. A set of lip images are used to derive a genuine distorted pattern parameter space. The database set contains lip images captured from students and staff members' of CETS. In order to compute the genuine distorted pattern parameter space of the lips, we matched those impressions from the same hand and trained the distorted pattern parameters.

Based upon fuzzy feature representation of lips, the similarities between the fuzzy features are used to characterize the similarity between lips. The FFM method maps a similarity vector pair to a normalized quantity, within the real interval [0, 1], which quantifies the overall image to image similarity. The image-level similarity is constructed from triangle-level similarities. The FFM method computes the inner products of similarity vectors with weight vectors. To choose weight vectors, take the location of the triangles into account and assign higher weights to triangles closer to the center of the lips. Another choice is the area scheme. It takes the area covered by the triangle as the weight based on the viewpoint that the triangle of the proper area in a fingerprint. In the FFM method, both area and center-favored schemes are used. Consequently, the FFM measure for template and input fingerprints is defined as

$$Sim = [\ (1-p)\ w_A + pw_B\ ]\ L^{(T,I)} \tag{1}$$

Here w_A is the normalized area percentage of both template and input fingerprints, w_B is the normalized weight which favor triangle near the image center, p€[0,1] adjusts the significance of w_A and w_B and $L^{(T,\ I)}$ is the weighted entries of similarity vector of the overall image.

The modified Cauchy function is chosen due to its good expressiveness and high-computational efficiency. The membership function of the fuzzy feature set is defined as

$$C(\vec{f}) = \begin{cases} 1, & \text{if } h(\vec{f}, \vec{g}) = \text{True} \\ \frac{1}{1+\left(\frac{\|\vec{f}-\vec{g}\|}{m}\right)^{a}}, & \text{otherwise} \end{cases} \tag{2}$$

The similarity between template and input lip is constructed by triangle similarities. It is difficult to get the closed-form equation. The minutiae number of the template and input lips, respectively. Here, we analyze the matched number of triplets

of minutiae which satisfy the entire criterion in the matching process, and the probability of the local triangle feature set matching model.

V. PERFORMANCE ANALYSIS

The proposed system can analyze to predict whether a person should be claimed as a true client or an imposter. In order to evaluate the success of the system, a standard measurement is used to verify the acceptance errors and rejection errors. They are defined as follows:

- False Reject Rate (FRR)
- False Acceptance Rate (FAR)

The FRR is the percentage of clients or authorized person that the biometric system fails to accept. FRR is defined as

$$FRR = \frac{\text{Number of rejected clients}}{\text{Total number of client access}} * 100\%$$

The FAR is the percentage of imposters or unauthorized person that the biometric system fails to reject. FAR is defined as

$$FAR = \frac{\text{Number of accepted imposter}}{\text{Total imposter access}} * 100\%$$

The accuracy of the biometric system is defined as

$$\text{Accuracy} = \max (100 - (FRR+FAR)/2)$$

TABLE1
FAR, FRR AND ACCURACY RATE

Traits	Algorithm	FAR (%)	FRR (%)	Accuracy (%)
Lips	Fuzzy Feature Matching	8.49	0.87	95.37

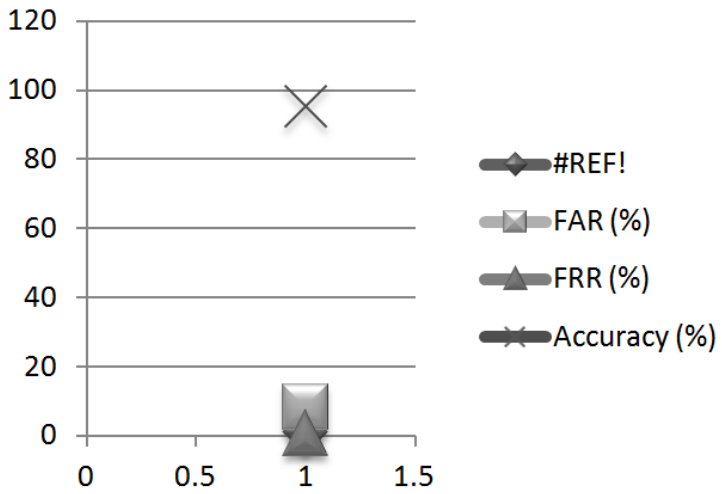

FIG.2. FAR, FRR AND ACCURACY RATE

VI. CONCLUSION

A novel method for lip matching is analyzed. The lips are represented by the fuzzy feature that is local triangle feature set. The similarity between the fuzzy features is used to character the similarity between lips. A fuzzy similarity measurement for two triangles and extend it to construct a similarity vector including the triangle-level similarity in two lips are introduced. Finally, the FFM method maps a similarity vector pair to a normalized quantity which quantifies the overall image to image similarity within the real interval [0, 1]. The algorithm has been experimented and evaluated with the lips of CETS students and staff members' database. Experimental results confirm that the algorithm works well with the nonlinear distortions. Here we found 95.37% of accuracy in matching. The proposed concept of fixed area and fixed number of triangles in the lips

improves the performance of the triangularization method. The proposed system reduces the complexity of the local triangularization method. It also improves the accuracy.

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