ISSN:0975-9646

Multimodal Finger Biometric Score Fusion Verification Using Coarse Grained Distribution Function

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***Abstract*-Multimodal biometric technology based on finger print and finger knuckle has attracted traction amongst researchers in recent times. Though Uni-modal system offers many advantages, it has certain inherent weaknesses which rob it of the charm. Uni-modal fingerprint biometric systems performed individual recognition based on a specific source of biometric information. However the match score value has to be improved by working with low quality small foreground area biometric images. Admittedly, the verification processes produced by Finger Knuckle Print (FKP) results in higher affine transformations. The deformations between FKP images of same finger are of higher proportion. The uni-modal biometric verification system often gets affected upon attaining higher match score value. Moreover, bimodal verification system does not achieve higher security level which leads to lesser fusion score value. To reduce affine transformation on multimodal biometric system, Non-Fracture based Fingerprint and Finger-Knuckle print Biometric Score Fusion (NFF-BSF) mechanism is proposed in this paper. Initially, distinct value of match score is measured using multimodal fitting coarse grained distribution function. Multimodal fitting coarse grained distribution function is used to work with low quality petite foreground biometric images that attain high fitting score on the test and training biometric images. Secondly, Non-Fracture deformation processing is carried out in NFF-BSF mechanism to reduce the change in shape of object by employing curve length on biometric image surfaces. Finally, a matching method in NFF-BSF mechanism is used to reduce the affine transformations. As a result, the affine changes on multimodal biometric system increases the match score fusion value. Experiment is conducted on factors such as genuine acceptance rate, matching score fusion level and error rate on multimodal matching.**

***Keywords*-Biometric Score Fusion, Fingerprint, Finger-Knuckle, Multimodal System, Curve Length, Affine Transformations, Security, Deformations**

I. INTRODUCTION

Biometrics is referred to the study of identifying individuals with the aid of two aspects namely, physical or behavioral traits. As an important biometrics characteristic, fingerprint or finger knuckle print has been receiving significant attention with its high merits, like user friendliness, accuracy and cost factor. Anyhow, there arises certain improvement for designing a multimodal system in the aspects of matching score, error rate and genuine acceptance rate.

Fingerprint matching scheme using Ridge Count (RC) [1] method used a breadth first search to maximize the rate of accuracy and the biometric recognition system. However, uni-modal fingerprint biometric systems only conducted individual recognition system based on a specific source of biometric information. Fuzzy Binary Decision Tree (FBDT) [2] used hand knuckle as a feature for biometric verification system with the aid of Ant Colony Optimization to differentiate between two classes, genuine and imposter. But, the match score on low quality small foreground area biometric images remained unaddressed. Online Finger-Knuckle-Print Verification (OFKPV) [3] introduced a new biometric authentication system using local convex direction map to increase the recognition rate. But, the process involved during verification resulted in higher affine transformations.

Identification of an individual using fingerprint acts as a pivotal element for surveillance. Finger print assessment [4] analyzed the effect of noise during the detection and localization of minutiae using Bayesian framework from varying image quality. However, the aspect of genuinity was not considered. To improve the genuinity factor, Band Limited Phase Only Correlation (BLPOC) [5] was introduced to improve the rate of recognition using finger knuckle print images. Though recognition rate was increased, but not with multiple finger knuckle print images. A hierarchical classification method based on Gabor filter [6] was introduced to increase the robustness of the finger knuckle print image being collected. However, multitude orientation of the features was not considered. Multiple orientation and texture information was integrated in [7] to improve the finger knuckle print verification accuracy.

Some of the authentication tools used in the current scenario is passwords and smartcards for effective verification of the authorized user. But one of the limitations of the passwords being used is that it dictionary attacks easily harm the passwords and smart cards may be either stolen or missed. As a result, the identification of authorized user remains a critical task making the hackers to get entry into the network easily. Therefore, the only solution for all these problems is the biometric verification system. Multimodal features like fingerprint and finger knuckle print [8] were considered to provide authentication with the aid of K-means clustering algorithm. The method not only improved the accuracy but was also proved to be secure. To improve the matching score, a multimodal biometric verification system [9] was introduced using Scale Invariant Feature Transform (SIFT) and Speeded up Robust Features (SURF). Another efficient matching algorithm using Phase Correlation Function (PCF) was introduced in [10] to improve the recognition rate and improve security.

Based on the aforementioned techniques and methods, we propose a Non-Fracture based Fingerprint and Finger-Knuckle print Biometric Score Fusion (NFF-BSF) mechanism to reduce affine transformation on multimodal biometric system. The framework collects samples of finger print and finger knuckle print and performs model matching based on the fusion of scores. Using Fitting coarse grained distribution function, discrete value of match score processing is performed. Then, a non-fracture deformation process is applied with the aid of curve length on biometric image surface to reduce the shape of object. Finally, affine transformations are reduced by following a matching method that applies Tan-h estimator to increase the match score fusion value. Extensive experiments showed that our multimodal finger biometric score fusion verification increased the genuine acceptance rate and the matching score fusion value with lesser error rate on multimodal matching.

The paper is organized as follows: Section 2 provides related research with respect to fingerprint, finger knuckle print and multimodal biometric system for biometric verification. In Section 3 the detailed explanation of Non-Fracture based Fingerprint and Finger-Knuckle print Biometric Score Fusion (NFF-BSF) mechanism is described with the help of a neat framework using algorithmic description. Section 4 provides a detail description about the experimental setup required to design NFF-BSF mechanism. Section 5 discusses in detail about the experimental settings provided for NFF-BSF. Finally, Section 6 concludes the work.

II. RELATED WORKS

The identity of individual can be obtained either with the help of physiological or behavioral characteristics. Every biometric method has its own advantages as well as disadvantage. Therefore, no biometric method can be treated as the best and can be used for any applications. A novel person identification system [11] used Radon transform to increase the recognition accuracy. Multimodal biometric system was introduced in [12] to improve the matching score level using Daugman's algorithm. However, multimodal biometric system with multiple fusion rules remained unaddressed. A multi objective fitness function called as the Particle Swarm Optimization (PSO) approach was introduced in [13] to minimize the time consumed during the identification of error rate.

With the increasing demand for individual identification, several applications using finger biometrics were applied in different scenarios. A multi-biometric cryptosystem using fingerprint and finger knuckle print were considered by applying feature level fusion [14] to increase the two aspects namely, recognition accuracy and security. Cancelable biometric system [15] was introduced to address the privacy related issues and security using finger knuckle prints. Though security was provided, measures for authentication were not included. A novel recognition methodology using histogram equalization and K-means algorithm [16] was introduced to provide authentication. To preserve the performance level of the system being protected, a new representation using special spiral curves [17] was designed.

The dorsum of hand, also referred to as the finger back surface is significantly used for the individual identity, but has not received the attention of research communities. In [18], a cost effective and user friendly biometric identifier called as the finger knuckle back surface was introduced. Though cost effective, it only served as a unimodal identifier. Multimodal biometric verification system using finger print and finger knuckle print [19] used Random Triangle Hashing (RTH) method proved an efficient means for security and authentication. A Phase congruency model [20] extracted the local orientation of the finger knuckle print to improve the finger knuckle print recognition accuracy.

In the literatures provided above, a mixture of both unimodal and multimodal biometric verification system was analyzed in several aspects. In this paper, the importance of effective matching score fusion level using multimodal finger biometric verification system has been recognized. Hence, proposed to incorporate different testing and training biometric images to reduce affine transformation with updated matching score fusion level. The multimodal biometric verification system thus incorporates both the model matching based on fusion scores and reduce the change in shape of object by employing curve length.

III. BIOMETRIC SCORE FUSION

In this section, we briefly explain the Non-Fracture based Fingerprint and Finger-Knuckle print Biometric Score Fusion (NFF-BSF) mechanism. The proposed multimodal biometric system is a pattern recognition scheme on different biometric characteristics. In NFF-BSF proposed work, the multimodal biometric characteristics such as fingerprint and finger-knuckle print are extensively used in security applications. Multimodal biometric fusion called Non-Fracture based Fingerprint and Finger-Knuckle print Biometric Score Fusion (NFF-BSF) mechanism utilizes more than one source of evidence for authentication. The fusion in NFF-BSF mechanism is carried out through the match score level. Each fusion optimally combines the matching scores with the multiple modalities based on generalized densities estimated from genuine matching score. The match score level based fusion in NFF-BSF is briefly exemplified.

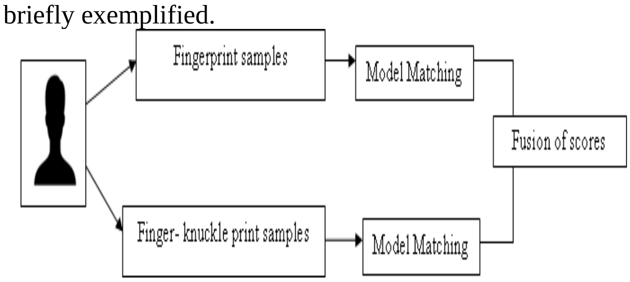


Fig. 1. Architecture Diagram of Match Score Level Fusion

Match Score level fusion is employed in NFF-BSF to minimize the compatibility between different feature vectors and also reduce the difficulty on identifying the good classifier for maintaining the security level. Figure 1 takes the samples of the multimodal biometric and performs the model matching. The model matching through the Fitting coarse grained distribution function and total cubic curve method in NFF-BSF mechanism reduces the deformations on multimodal biometric system. The block diagram of Non-Fracture based Fingerprint and Finger-Knuckle print Biometric Score Fusion (NFF-BSF) Mechanism is illustrated in Figure 2.

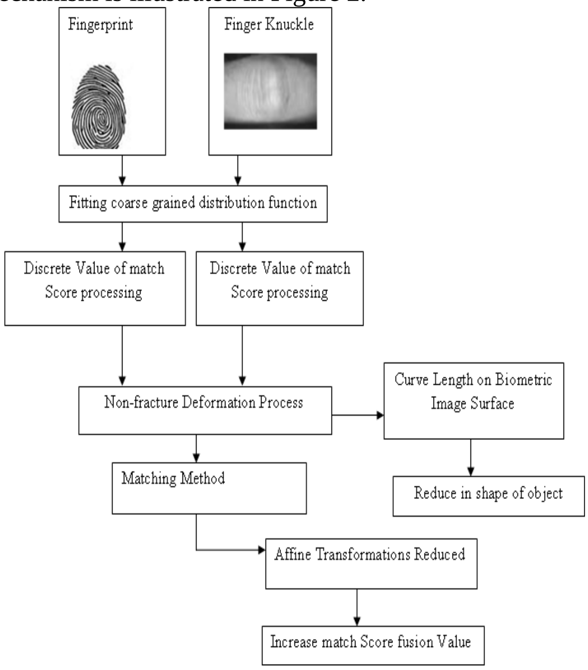


Fig. 2. Block Diagram of NFF-BSF Mechanism

Fig. 1 shows the block diagram of the Non-Fracture based Fingerprint and Finger-Knuckle print Biometric Score Fusion (NFF-BSF) mechanism. Initially fingerprint and finger- knuckle biometric are attained using the biometric device. As shown in the block diagram, initially, discrete value score processing step is applied in NFF-BSF. The discrete value scores are attained using Fitting coarse grained distribution function. Coarse grained system consists of both the smaller and larger components which are fine grained to fit the training and test samples with higher match score value. A fitted coarse-grained distribution function score value used to measure the curve length of multimodal biometric image. The curve length measures the non-fracture deformation process that results in the increase of the score value by reducing the shape changes. The total cubic curve method generates the curves to measure the length and reduces the deformations. The curve length used to fix the curve points and improve the matching level of the test and training image. The matching method for the combination of fingerprint and finger-knuckle print produce lesser affine transformations. The affine transformations reduced on preserving the points and improve the score fusion value. The fusion matching score ranges from 0 to 100 in the NFF-BSF multimodal biometric system. In the forthcoming section, the fitting coarse grained distribution function together with total cubic curve method is explained in detail with the help of an algorithm.

A. Fitting coarse grained distribution function

This section discusses in detail about the design considerations of fitting coarse grained distribution function. The Coarse grained distribution function uses the Boltzmann weighting factor to handle both smaller and larger test samples. Similar points in biometric characteristics share same space and allot similar weighting factor whereas different points in the finger print and finger-knuckle print biometric defines dissimilar Boltzmann weight factor to evaluate the discrete value of match score. The fitted coarse grained distribution produces the expected number of match score value using the NFF-BSF mechanism.

The fitting coarse grained in NFF-BSF mechanism reduces the degree of freedom in multimodal biometric system by reducing the number of iterations, leading to higher security level. The integration of match score and angle potentials of finger print and finger-knuckle print discrete value is derived as given below,

$$D(r1,r2) = \frac{A}{\omega\sqrt{\frac{\pi}{2}}}\exp\left[\frac{-2(r1_T - r1_{Training})^2}{\omega^2} + \frac{-2(r2_T - r2_{Training})^2}{\omega^2}\right] \quad (1)$$

The discrete value D of the finger print as '$r1$'and discrete value D of the finger-knuckle print as '$r2$' with 'A' constant points is given in (1). 'ω' is the fitting score point for the finger print and finger-knuckle print test 'T' and '$Training$' samples. The fitting score point 'ω' depends on the Boltzmann weighting factor. The Boltzmann weighting factor values is computed as,

$$Weighting\ Factor\ (r1,r2) = -K_B(C)\ln D(r1,r2) \quad (2)$$

The weighting factor of fingerprint and finger-knuckle print '$r1$' and '$r2$' respectively in (2) uses the Boltzmann constant 'C' value. The NFF-BSF mechanism fits the test and training samples accurately with potential match target value. The resultant potential discrete value is considered to identify the curve length of biometric image. The curve length measure produces the optimal solution by reducing the changes in the shape of multimodal biometric points.

B. Total Cubic Curve Method

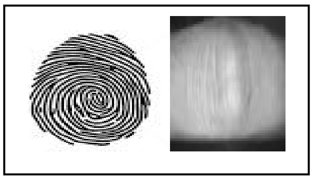
This section gets insight into the total cubit curve method to determine the curve length of multimodal biometric using finger print and finger-knuckle print. The cubic curve based length measure is carried out by generating curves on fingerprint and finger-knuckle print to control the deformation process. Using NFF-BSF mechanism, Non-fracture Deformation Process is controlled by matching the cubic curve points accurately with the training and test sample image. In order to generate a curve and measure the curve length, 'n' points are united together to perform the computations. Each point is generated using the cubic curve and the total cubic curve is measured as given below,

$$Total\ Cubic\ Curve = \sum K_B(w).P_{Fitted}\ [r1 + r2] \quad (3)$$

The total cubic curve sum up the Boltzmann weighting factor of the finger print and finger-knuckle print and reduces the deformations. Let us assume 'n' curve points in training image and 'n+1' deformed biometric images. Then the deformed shapes of the biometric image are detected as given below,

$$d = \frac{\sum \int K_B(w)(n+1).dt}{\sum \int K_B(w)(n).dt} \quad (4)$$

The Boltzmann weighting factor 'w' measures the control points of finger print and finger-knuckle print with 'n' curve length point measure and '$n+1$' being the deformed biometric mage. The '$n+1$' deformed image is reduced by comparing the curve length of the finger print and finger-knuckle print biometric image. The curve length is then measured for identifying the high match score value by using the total cubic curve points.



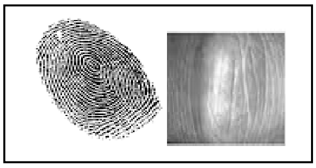


Fig. 3. (a) Original Image (b) Deformed Image

The cubic curve points in NFF-BSF mechanism change the length points when the biometric image deforms. The Non-fracture Deformation Process includes the connective control point computation by readily producing the higher ratio on avoiding the deformations. NFF-BSF mechanism with Non-fracture Deformation Process step wise procedure is described as,

//Total Cubic Curve Procedure

Begin

Step 1: Control points 'n' on biometric fingerprint and finger knuckle structure

Step 2: Compute the curve length on measuring the unimodal biometric system

For all the multimodal biometric characteristics

Step 2.1: If curve length (Test Image =Training Image)

Step 2.2: Match score value computed

Step 2.3: Else Deformation occurred

Step 3: Non-fracture Deformation process

Step 3.1: Deform the control points 'n+1' on the test image

Step 4: Remove the deformed control points from the actual (i.e., training curve length measure) to improve the processing and security level of multimodal biometric matching

End

The total cubic curve point reduces the deformations of multimodal biometric images using cubic length measure. If the test and training image control points are fitted, then the matching score value of finger print and finger-knuckle print biometric is improved. NFF-BSF mechanism reduces the affine transformations and briefly explains the matching method in the coming section.

C. Matching Method

Score level fusion is the combination of finger print and finger-knuckle print matching to attain higher security level to the users. But at the initial stage of the fusion step, normalization technique is adopted. The NFF-BSF mechanism uses the tan-h estimator normalization technique to achieve higher robustness and efficiency level. The Tan-h estimator normalization score is formularized as,

$$Normalization\ (r1) = \frac{1}{2}\tanh\left(0.01\left(\frac{K_B - \mu_D}{\sigma_D}\right)\right) + 1 \quad (5)$$

The mean and standard deviation of the discrete value estimates are denoted by μ_D and σ_D respectively in (5). The resultant value Boltzmann is used to normalize the score and perform the fusion operation. In a similar manner, normalization of 'r2' is measured. The larger the multimodal biometric systems, the match score value are combining through the sum rule. The sum rule is shown as,

$$Score\ Fusion = \sum Normalization\ score\ (r1, r2) \quad (6)$$

The score fusion follows the sum rule and attains good score value for improving the security level, where '$r1$' and '$r2$' are the matching score value of the finger print and finger-knuckle print biometric system. The affinity transformations are reduced using NFF-BSF mechanism by measuring the discrete score values at the initial stage of the test and training image matching. The different biometric characteristic fusion is carried out through the tan-h estimator normalization score value. The improved fusion score value improves the security level with higher robustness ratio.

IV. EXPERIMENTAL EVALUATION

Non-Fracture based Finger print and Finger-Knuckle print Biometric Score Fusion (NFF-BSF) mechanism implements the experimental work on MATLAB coding. The experiment conducted with Hong Kong Polytechnic University (PolyU) Finger-Knuckle-Print Database samples. For the experimentation evaluation Hong Kong Polytechnic University (PolyU), finger print image database of hand images are acquired from 100 users. Among the different types of biometric sample finger-knuckle print and fingerprint samples are taken for assessment. The finger-knuckle-print refers to the intrinsic patterns of the outer surface around the joint of one's finger and serves as an individual biometric identifier.

The Biometric Research Centre (UGC/CRC) at The Hong Kong Polytechnic University has developed a valid time finger-knuckle capture device and finger print capture device, and builds a large-scale multimodal biometric verification process. To move forward in the research work and to provide researchers an effective recognition system, finger-knuckle print samples from 165 volunteers are taken. The 125 males and 40 female's volunteers' samples are composed in two splitted sessions.

During each session, the experiments were conducted using 6 different images for each of the left index finger, the left middle finger, the right index finger, and the right middle finger. DBI consists of a small training dataset and a large test dataset. The images of the same finger in both databases were collected from two different sessions where 'S' represents the session of the captured image with X denoting the image number of each session. The NFF-BSF Mechanism is compared against the existing matching scheme using Ridge Count (RC) [1] method, Fuzzy Binary Decision Tree (FBDT) [2] and Online Finger-Knuckle-Print Verification (OFKPV) [3] to choose the optimal fusion parameters. Experiment is conducted on factors such as genuine acceptance rate, matching score fusion level, affine transformation rate, and error rate on multimodal matching.

V. Results Analysis Of NFF-BSF

The Non-Fracture based Finger print and Finger-Knuckle print Biometric Score Fusion (NFF-BSF) mechanism is compared against the existing Ridge Count (RC) [1] method, Fuzzy Binary Decision Tree (FBDT) [2] and Online Finger-Knuckle-Print Verification (OFKPV) [3]. For conducting experiments, 35 samples each 20 from male and 15 from female are considered with an average time interval between first and second session observed was about 25 days. The experimental results using MATLAB are compared and analyzed with the aid of graph form given below.

A. Effect Of Genuine Acceptance Rate

The genuine acceptance rate using NFF-BSF mechanism is the ratio of number of authentic attempts made using finger print and finger-knuckle print to that of the total number of authentic attempts made using Boltzmann weighting factor. It is measured in terms of percentage (%).

$$GAR = \frac{\text{Number of authentic attempts accepted}_{\text{finger print \& finger-knuckle print}}}{\text{Total number of authentic attempts made}} \quad (7)$$

Figure 5 shows the genuine acceptance rate over 35 samples provided as input using MATLAB simulation. From the figure, with an increase in the number of samples provided, the genuine acceptance rate also increases, though observed to be not linear. However, till 25 samples provided as input, the genuine acceptance rate shows a steady raise whereas, it decreases when the samples are increased to 30 and then increased when the sample provided was 35. This is because the samples collected were from different individuals. As a result, the percentage increase or decrease in genuine acceptance rate does not remain the same.

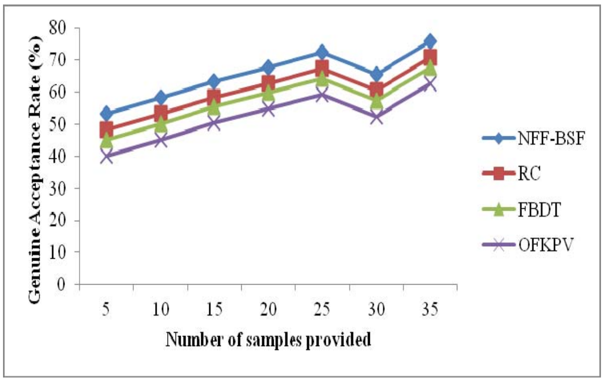


Fig. 5. Impact of Genuine Acceptance Rate

Fig. 5 show the variation of the genuine acceptance rate as a function of Finger-Knuckle-Print Database samples and finger print image database of hand images of 35 samples provided as input. Comparatively, the GAR observed is higher using NFF-BSF mechanism compared to that of RC [1], FBDT [2] and OFKPV [2] respectively. The authentic acceptance rate is increased in the proposed mechanism by using Boltzmann weighting factor that handles both smaller and larger test samples of both finger print and finger-knuckle print images. Moreover by integrating both the match score and angle potentials of finger print and finger-knuckle print discrete values using a fitting score point 'ω'.

The NFF-BSF mechanism in turn fits the test and training samples of both finger print and finger-knuckle print with potential match target value resulting in an increase in the authentic acceptance rate by 6 – 9 % compared to RC, 10 – 15 % compared to FBDT and 17 – 24 % compared to OFKPV respectively.

B. Effect Of Matching Score Fusion

The match score fusion rate is obtained by checking the condition of score fusion is less than the fitting score point. If the condition is satisfied, then the matching score fusion rate is 1 else it is set to 0.

$$MSF = \begin{cases} 1 & \text{if Score Fusion} < \text{'}\omega\text{'} \\ 0, & \text{Otherwise} \end{cases} \quad (8)$$

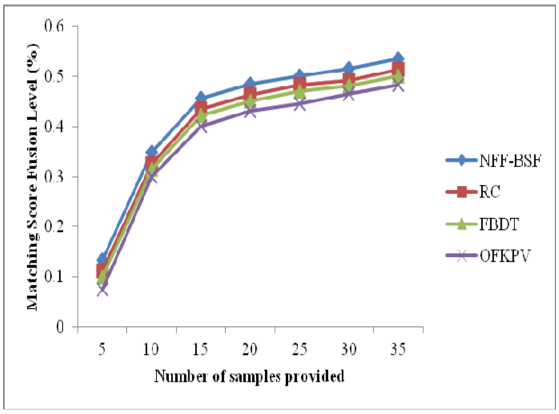


Fig. 6. Impact of Matching Score Fusion Level

The convergence plot for 35 test images is depicted in fig. 6. From the figure we can note that the proposed NFF-BSF mechanism achieved higher matching score fusion level compared to other methods. We also figure out that, in

Figure 6, the proposed Non-Fracture based Finger print and Finger-Knuckle print Biometric Score Fusion shows an increase in the beginning of the convergence graphs with the setting of updated position and velocity during the early iterations. However, when 10 test images were measured, the matching score fusion level increases in a sweeping manner because of the changes in 6 different images for each of the left index finger, the left middle finger, the right index finger, and the right middle finger for different test images being considered.

The figure shows that the graph become tranquil and better matching score fusion level is observed with a drift increase when 15 test images are considered. The matching score fusion level observed is because of the total cubic curve method that generates the curves in order to measure the length and minimizes the rate of deformations and to cause a significant gain. The curve generated fixes the curve points and improve the matching score fusion level of test and training image thereby improving the matching fusion score level by 4 – 16 %, 6 – 25 % and 9 – 44 % compared to RC [1], FBDT [2] and OFKVP [3] respectively.

D. EFFECT OF AFFINE TRANSFORMATION RATE

The Non-Fracture based Finger print and Finger-Knuckle print Biometric Score Fusion (NFF-BSF) mechanism is compared with the three existing methods in terms of affine transform rate in this section. The training images consists of 35 samples, with 25 male samples and 20 female samples was selected and applied to total cubic curve algorithm conducted in MATLAB using PolyU Finger-Kunckle-Print and Finger print images. The convergence plot using total cubic curve algorithm with differing samples is depicted in Figure 7. We can observe that the proposed NFF-BSF had better affine transform rate compared to the state-of-the-art works respectively.

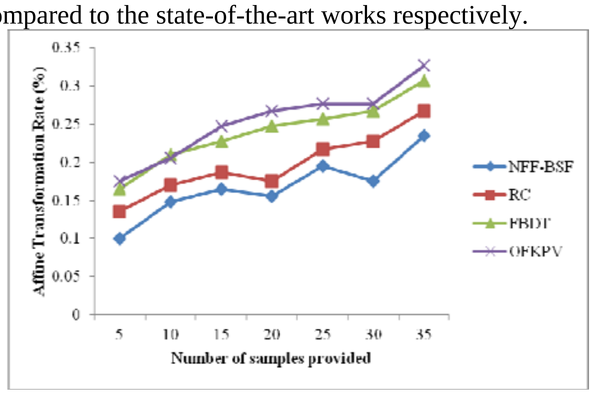


Fig. 7. Impact of Affine Transformation Rate

The convergence plot for measuring affine transformation rate using PolyU finger-knuckle print and finger print image is shown in Fig 7. From the figure we can notice that the NFF-BSF converge lower affine transformation rate than RC [1] and FBDT [2] and OFKPV [3] respectively by yielding lower affine transformation rate which increases the performance measure. Moreover, NFF-BSF had obtained the affine transformation rate of 17.5 % followed by RC, FBDT and OFKPV with affine transformation rate of 26.7 %, 30.7 % and 32.7 % respectively.

The affine transformation rate is reduced by applying Tan-h estimator normalization score. The Tan-h estimator normalization score, follows a sum rule at the initial stage of the fusion step by measuring the discrete score values resulting in the minimization of affine transformation rate. The figure shows that using NFF-BSF the acquired model had improvement on affine transformation rate by 13 – 35 %, 30 – 65 % and 38 – 75 % respectively which is consistent with the state-of-the-art methods RC [1], FBDT [2] and OFKPV [3].

E. Effect Of Error Rate On Multimodal Matching

The error rate on multimodal matching using NFF-BSF mechanism is the ratio of number of authentic attempts rejected for both finger print and finger-knuckle print with that of the total number of authentic attempts made. It is measured in terms of percentage (%).

$$Error\ Rate_{multimodal} = \frac{Number\ of\ authentic\ attempts\ rejected_{finger\ print\ \&\ finger-knuckle\ print}}{Total\ number\ of\ authentic\ attempts\ made} \quad (9)$$

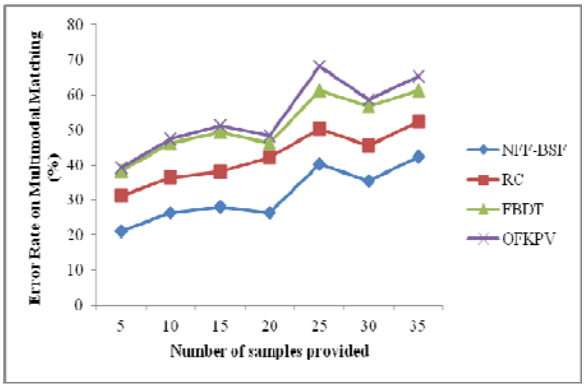


Fig. 8. Impact of Error Rate on Multimodal Matching

Convergence characteristics of measure of error rate on multimodal matching efficiency for thirty sample images and compared with three other methods and are shown in Fig. 8. The targeting results of error rate on matching image using NFF-BSF mechanism is compared with three state-of-the-art methods [1] [2] and [3] in figure 8 is presented for visual comparison based on the initialization of images being considered. The mechanism NFF-BSF differs from the RC [1], FBDT [2] and OFKPV [3] in that we have incorporated multimodal biometric system namely, finger print and finger-knuckle print images that efficiently reduces the error rate on matching multimodal images. This reduces the error rate on matching image by 23 – 60 % compared to RC.

With the application of Fitting coarse grained distribution functions and total cubic curve method, the error rate gets reduced. Further, with the aid of Coarse grained system, both the smaller and larger components are fine grained to fit the sample image with higher match score and reducing the error rate by 44 – 80 % compared to FBDT. Finally, with the high match score, the curve length of multimodal biometric image is measured that in turn measures the non-fracture deformation process resulting in the increase of the score value by minimizing the error rate on multimodal matching by 54 – 85 % compared to OFKPV respectively.

VI. CONCLUSION

In this work, a Non-Fracture based Fingerprint and Finger-Knuckle print Biometric Score Fusion (NFF-BSF) mechanism is presented. The NFF-BSF mechanism applies the coarse grained distribution function to efficiently attain high fitting score on test and training biometric images using total cubic curve method. The total cubic curve in addition to the Boltzmann weighting factor measures the control points to identify the high match score value. Then, Non-Fracture deformation process is applied to reduce the change in shape of object using curve length on biometric image surface. Finally, affine transforms are reduced and an increase in match score fusion value is observed using efficient score fusion matching method. Experimental results demonstrate that the proposed NFF-BSF mechanism not only leads to noticeable improvement over the authentic acceptance rate and matching score fusion level, but also outperforms the error rate on multi modal matching and minimizes the affine transformation rate on several samples over methods, namely, RC, FBDT and OFKPV respectively.

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