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SHAPE MATCHING TECHNIQUE BY MAKING THE FUSION OF LTrP & SIFT FOR GESTURE RECOGNITION

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Abstract: Here presents a new approach for shape matching by using Local Tetra Pattern for feature extraction and Scale Invariant Feature Transformation algorithm for matching of features very correctly. The valuable part of this system is to match texture and high probable to recognize it accordingly by collaborating some special features such as invariance in the scale transform deformation lenience and should be able to work in orientation free atmosphere. The local tetra pattern is proposed to extract the image texture features and then scale invariant feature transformation algorithm which is a powerful one for doing texture classification and recognition of shape. Based on the characteristics of recently proposed shape descriptors, fusion of the techniques used for extraction and matching method, the projected approach performs shape matching by providing a competent way.

Keywords: *Gesture recognition; Local Tetra Pattern (LTrP); Shape descriptor; Scale Invariant Feature Transformation (SIFT)*

I INTRODUCTION

Gesture recognition is one of the emergent fields of research and study now days which gives a comfortable and more efficient way of human machine interaction significantly for dump or handicapped people. Gestures are some forms of actions or moves which a person expresses for expressing the relative information to other people or device without saying it for e.g. sign languages. In day to day life, we observe various hand gestures habitually used for conveying message or communication purpose like to make a call, victory, done, not done, various directions etc.

Various methods using visual interpretation based have been utilized and evaluated for hand or other parts gesture recognition. Oliver Bernier, Jean, Sebastiean Marcel, Emmanuel Viallet and Danieal Collobert have given alike using Input-output Hidden Markov Models [1]. Xia Liu and Kikuo Fujimura have proposed the system using depth data analysis [2]. For hand exposure and detecting relative features, many approaches used motion and color information from collective segments [3, 4]. Tamas Sziranyi and Attila Licsar have worked on and developed a hand movement gesture recognition module by using static gestures over shape analysis [5]. One more research evaluated that detection of the hand posture can be done via color segmentation which was proposed by E. Stergiopoulou and N. Papamarkos [6]. Jung Soh, Yun-Mo Yangc, Ho-Sub Yoon, Byung-Woo Min and Toskiaki Ejima have recommended the way of Hand Gesture Recognition and evaluation using Hidden Markov models [7]. Another most promising technique is recommended by Meide Zhao, Francis K.H. Quek and Xindong Wu [8]. They have used R-MINI and AQ Family Algorithms for discovery of Hand Gestures. There is one more another efficient and well utilized technique but the method is computationally and analytically more expensive one which uses rapid one Multi-Scale Analysis to recognize hand gestures just as that of recommended by Kongqiao Wang and Hanqing Lu, Yikai Fang, Jian Cheng [9]. The method for performing accelerated hand movement and gesture recognition for hand and other movement gestures and also Rotation Invariant technique is broadly accepted for texture and movement classification and recognition, Chris Joslin have suggested it. Timi Ojala have suggested and given the method by making the use of Local Binary Patterns for texture classification [10, 11]. By observing the various methods and their respective results it could be not bad to come to the statement that still there is a scope to work over this perspective area.

II PROPOSED APPROACH

The Figure 1 shows the system design and the work flow over the main modules in the system. Identifying modules in the architectural design are pre-processing step, segmentation of area, extraction of important features, matching technique or method to be used and finally it includes how and in what manner the recognition and classification has to be done.

A. Preprocessing Step

In preprocessing work Gaussian filter is imposed and used for filtering noise from the input images. It is significantly nice to be able to do a sort of noise reduction over an image. Such a type of noise reduction is typically a pre-processing step for improving the results of later steps.

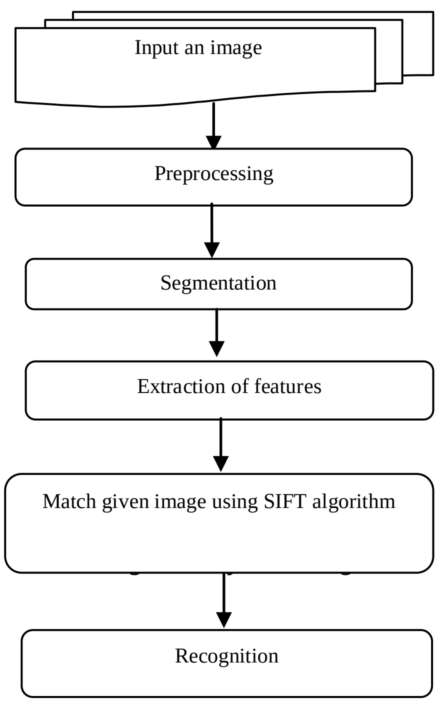

Figure 1. System Design

B. Segmentation

Image segmentation is the procedure of dividing a digital image in number of segments. The purpose of it is to simplify and convert the depiction of an image into a form which is more significant one and easier to examine. We performed the process of segmentation based on the variations in the pixels intensity values. The affected region will vary in the intensity of pixel values and using that we can easily identify the significant regions in the image.

C. Feature extraction

After segmentation there is a precision for feature extraction over segmented image. Here LTrP algorithm is used for extracting the texture features specifically thirteen important patterns have been selected which gives its associated histogram values. LTrP descriptor binary encodes the relation of a corresponding center pixel with its neighbors secularize with transformation consistency and efficiency statistics of directional derivative in vertically and horizontally sections. Then it transcribes binary code into decimal and estimates the histogram traversing each pixel. Fundamentally, LTrP is composed of two patterns, tetra and magnitude patterns. Tetra pattern gives first-order derivatives and transformation consistency statistics of directional derivative. The first-order derivatives with horizontally and vertically directional ways at main center pixel g_c can be evaluated with (1) and (2).

$$I^1_{hori}(g_c) = I(g_{k\_hori}) - I(g_c) \quad (1)$$

$$I^1_{verti}(g_c) = I(g_{k\_verti}) - I(g_c) \quad (2)$$

And the consequential track of every center pixel can be transformed into (3).

$$I^1{}_{Dir(g_c)} = \begin{cases} 1, I^1{}_{hori(g_c)} \geq 0, I^1{}_{verti(g_c)} \geq 0 \\ 2, I^1{}_{hori(g_c)} < 0, I^1{}_{verti(g_c)} \geq 0 \\ 3, I^1{}_{hori(g_c)} < 0, I^1{}_{verti(g_c)} < 0 \\ 4, I^1{}_{hori(g_c)} \geq 0, I^1{}_{verti(g_c)} < 0 \end{cases} \quad (3)$$

Next tetra pattern for every individually identified pixel can be evaluated with (4) and (5).

$$LTrP^2(g_c) = \{ f(I^1{}_{Dir}(g_c), I^1{}_{Dir}(g_0)), f(I^1{}_{Dir}(g_c), I^1{}_{Dir}(g_1)), \ldots, f(I^1{}_{Dir}(g_c), I^1{}_{Dir}(g_{N-1})) \} \quad (4)$$

$$f(I^1{}_{Dir}(g_c), I^1{}_{Dir}(g_k)) = \begin{cases} 0, & I^1{}_{Dir}(g_c) = I^1{}_{Dir}(g_k) \\ I^1{}_{Dir}(g_k) & otherwise, \end{cases} \quad (5)$$

D. Feature matching

Matching feature values and discovering significance of it is done by SIFT algorithm which produces important data for categorization. Here feature values are detected by going through complete scales and image locations. Producing regions those are invariant to the scale can be accomplished by searching for steady features transversely all the scales, by using a function of scale called scale space. This scale space is established with a Gaussian kernel G(x, y, σ) having different values of σ (6).

$$L(x, y, \sigma) = G(x, y, \sigma) * I(x, y) \quad (6)$$

Where ∗ is the convolution operation in x and y and

$$G(x, y, z) = \frac{1}{2\Pi\sigma^2} e^{-(x^2+y^2)/2\sigma^2} \quad (7)$$

The early step is to convolve an image with G(x, y, σ), which gives a blurred image of type L(x, y, σ). This function is repeated using G(x, y, kσ) which produces a further blurred image L(x, y, kσ). The change among two nearby blurred images are given as a difference of Gaussian image D(x, y, σ) which is given by

$$D(x,y,\sigma) = L(x,y,k\sigma) - L(x,y,\sigma) \quad (8)$$

E. Recognition

Depending on the results given by earlier steps feature extraction and matching has been done for the recognition of the shape or symbols.

III PERFORMANCE EVALUATION

The proposed method is evaluated with the help of subsequent quality parameters to find out its performance and relevancy. The database here used was developed as a part of the hand detection and pose estimation project, supported by the Polish Ministry of Science and Higher Education under research grant number IP2011 023071 from the Science Budget 2012-2013. For evaluating the performance and its relevancy, the dataset is observed below various circumstances for various types of images and the following values for the different parameters are obtained.

Tpos = 12, Tneg = 07, Fneg = 01, Fpos = 00

By using the standards for manipulating sensitivity, specificity and accuracy of the method the various outcomes have been evolved.

Sensitivity = [Tpos / (Tpos + Fneg)] * 100
= [12/ (12+1)] * 100
= (12/13) * 100
Sensitivity = 92.3077

Specificity = [Tneg / (Tneg + Fpos)] * 100
= [07/(07+00)] * 100
= (07/07) * 100
Specificity = 100

Accuracy = [(Tpos+Tneg)/(Tpos+Fneg+Tneg+Fpos)] * 100
= [(12+07)/ (12+01+07+00)] * 100
= (19/20) *100
Accuracy = 95

Table 1 shows the comparative examination of the results of proposed approach with some previously developed techniques.

Table 1. Performance Evaluation Metrics

Approach	Method	Sensitivity	Specificity	Accuracy
Dr.E.Annasaro *et al.*in [12]	Canny	90.9337	80.7851	86.9174
	Sobel	87.4499	76.7933	83.3197
	Prewitt	86.9029	64.9826	76.6149
	Robert	82.1839	63.3776	74.08013
Damien Michel *et al.* in [13]	DTW	--	--	89.9000
Proposed Approach	LTrP + SIFT	92.3077	100	95.0000

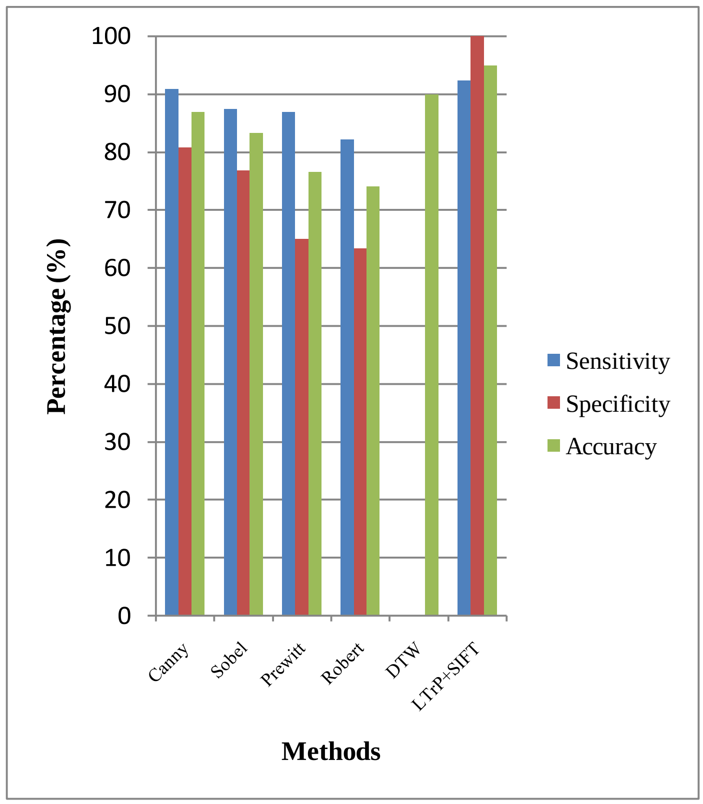

Figure 2. Comparative analysis of all the methods

Figure 2 Shows the comparative examination of all the methods specified in Table I in graphical form. The results by considering False Acceptance Rate (FAR) and Recognition Rate (RR) for different inputs have been observed under different threshold values.

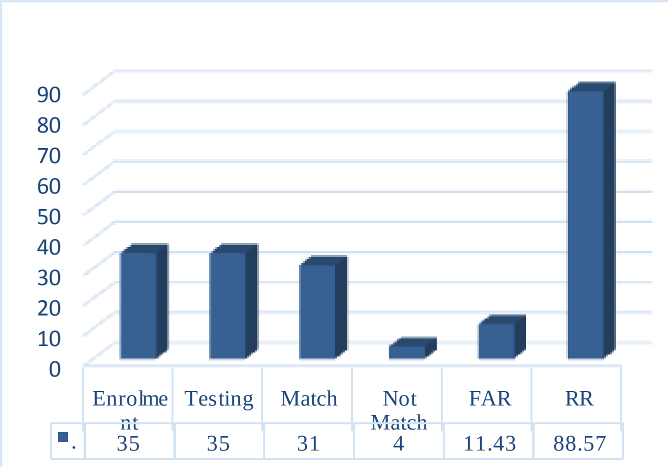

Figure 3. Single Input Image Enrolment and single input testing (1:1) with threshold value 0.035

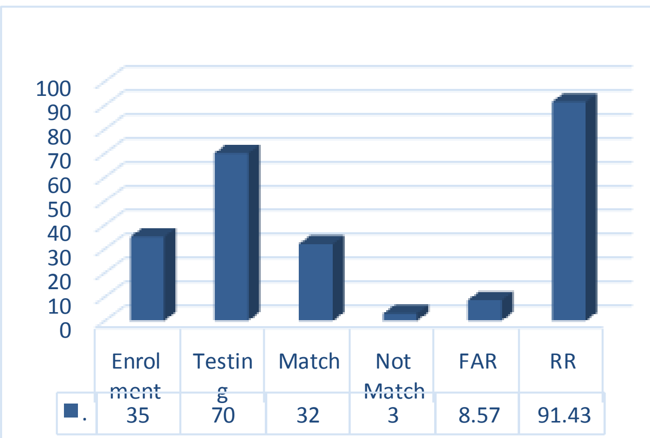

Figure 4. Single Input Image Enrolment and Two input testing (1:2) with threshold value 0.05

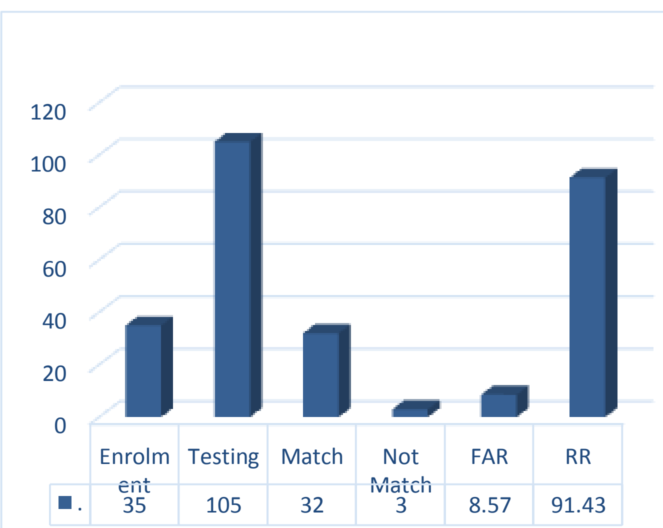

Figure 5. Single Input Image Enrolment and Three input testing (1:3) with threshold value 0.07

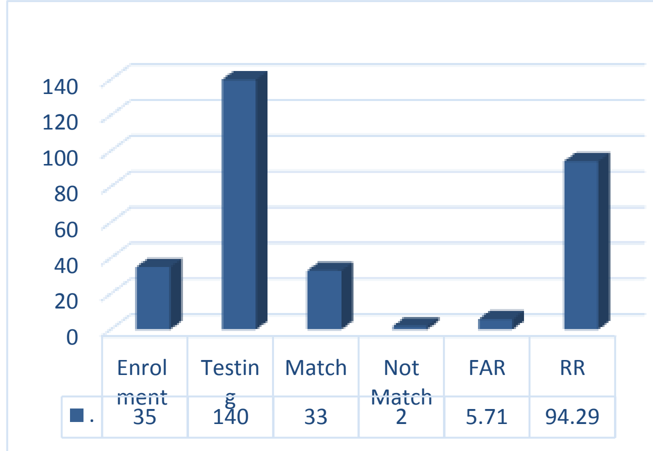

Figure 6. Single Input Image Enrolment and Four input testing (1:4) with threshold value 0.09

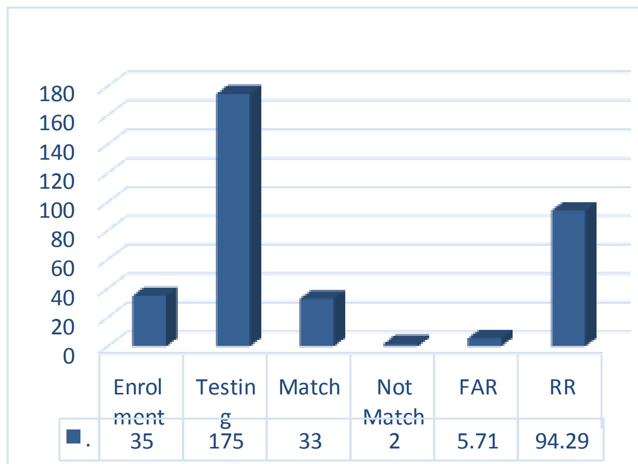

Figure 7. Single Input Image Enrolment and Five input testing (1:5) with threshold value 0.1

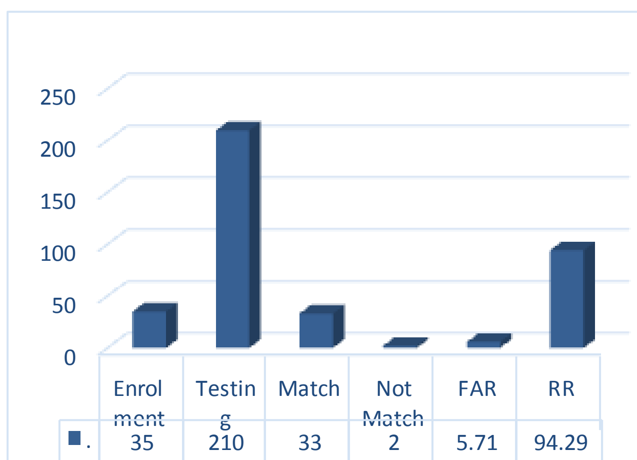

Figure 8. Single Input Image Enrolment and six input testing (1:6) with threshold value 0.13

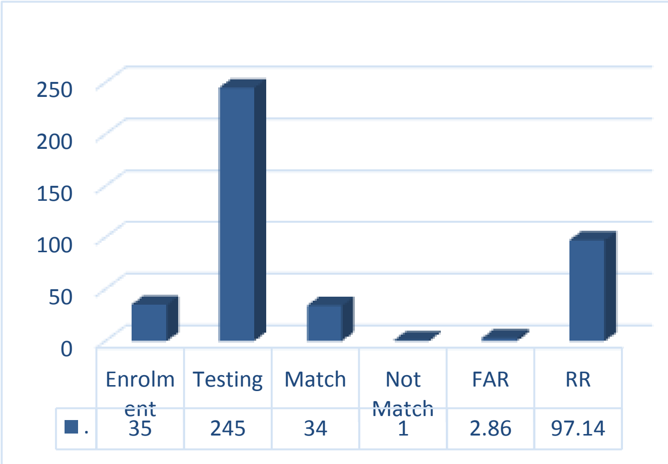

Figure 9. Single Input Image Enrolment and Seven input testing (1:7) with threshold value 0.17

The results observed after complete analysis part ensures that as the threshold value changes, the performance of system get fluctuated, and at some point gets stable for a specific range of threshold values.

Table 2 Database evaluation of shape matching

Sr. No.	Enrolment	Testing	Match	Not Match	FAR	RR
1	35	35	31	4	11.43	88.57
2	35	70	32	3	8.57	91.43
3	35	105	32	3	8.57	91.43
4	35	140	33	2	5.71	94.29
5	35	175	33	2	5.71	94.29
6	35	210	33	2	5.71	94.29
7	35	245	34	1	2.86	97.14

The overall estimate to show the performance evaluation of a system is shown in Figure 10 and Figure11.

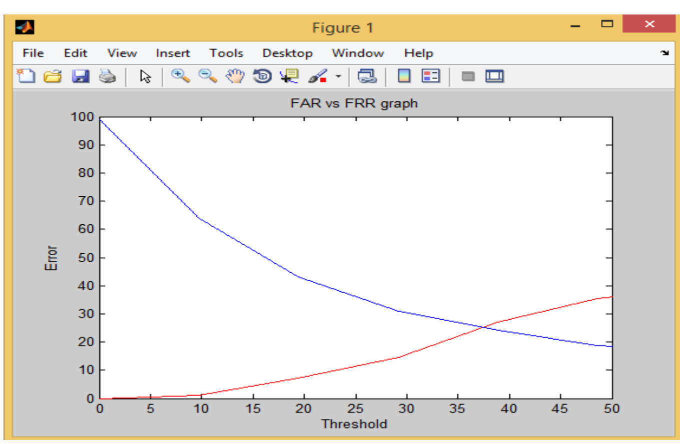

Figure 10. FAR vs FRR Graph

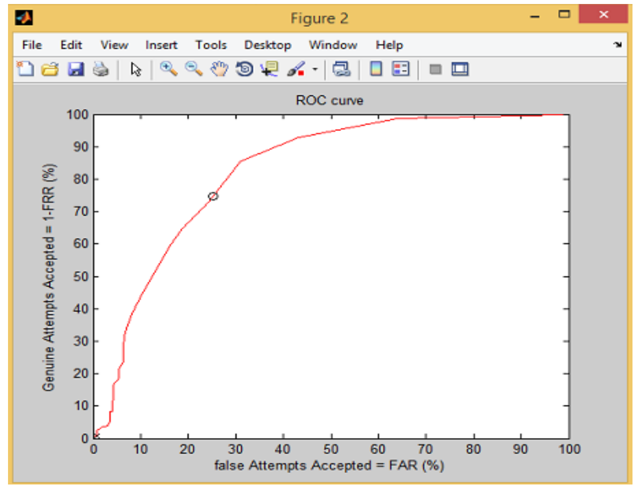

Figure 11.Receiver Operating Characteristic (ROC) curve

IV CONCLUSION ANS FUTURE SCOPE

The proposed approach can be considered as in good health solution to the problem of shape matching. The motivation and main contribution of the effort lies in by using proposed method trying to raise accuracy and performance of the system. As the results evaluated says the technique has given the sensitivity 92.31%, specificity 100% and accuracy up to 95%. At last, these relative experimental results demonstrate the effectiveness and helpfulness of the proposed method compared to existing ones.

This work may extend to further to make actions according to eye movement, and even it can also have a scope to increase the count of number of features to be considered to matched, for more efficient shape matching by applying other matching technique, utilizing scale space for roughly matching, developing other applications and matching shapes with various contours, perform matching over 3D images also.

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