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Human identification based on Gait using Fuzzy Logic

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Abstract: Gait a behavioral biometric trait, shows a particular way or manner of moving and gait recognition is the process of identifying a person by the manner they walk. An advantage of human gait is that it can be captured from a distance without knowledge of the subject. We have considered dynamic features of human body and applying geometrical approach along with Euclidean distance. For classification Fuzzy Inference Systems has been applied.

Keyword: Gait, Euclidean Distance, Fuzzy.

I. INTRODUCTION

Recognition of an individual is an important task to identify people. Identification through biometric is a better way because it associate with individual not with information passing from one place to another. Biometrics is a physiological or behavioral characteristic, which can be used to identify and verify the identity of an individual. There are numerous biometric measures which can be used to help derive an individual identity shown in figure 1.

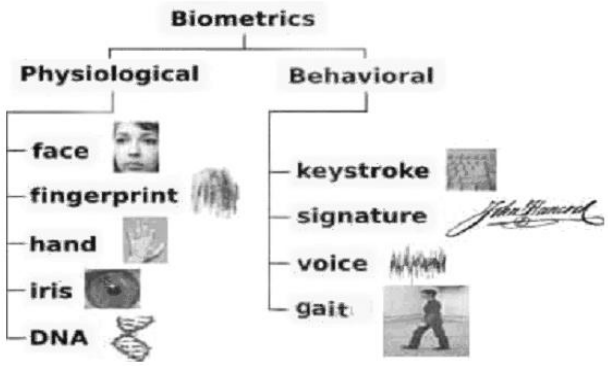

Figure 1. Classification of biometrics

Behavioral Biometrics: Extract characteristics based on an action performed by an individual. They indirect measure of the characteristics of human form the main feature of a behavioral biometric is the use of time as a metric. Established measure includes key-stroke scan and speech patterns.

Physiological Biometrics: these are biometrics which is derived from a direct measurement of a part of human body. The most prominent and successful of these types of measures to date are finger prints, face recognition, iris scans and hand scans.

In [1], the literature describes the general method and development actuality of gait recognition, they describe three methods of gait recognition, which include statistical based method, model based method and fusion based method. The statistical based method characterizes body movement by the statistic of the space temporal pattern generated in the image sequence by the locomotive person. The advantages of this method are low computational cost and less time consuming. Model based method constructs human model to recover explicit features describing gait dynamics such as stride dimensions and the kinematics, of joint angle. The advantage of this method is the ability to drive gait signature from model parameter and free from the effect of the different clothing and view point. However, it is time consuming and costly [5]. Fusion is combination of both statistical and model based method. In the previous work many method has been proposed for solving gait analysis. Which include analysis of subject trajectory, velocity movements, discrete symmetric operator, continuous HMM [2] and some other approach based on kinematics and dynamics model. Han and Bhanu [3] use gait energy image for gait analysis. They used statistical feature extraction approach for learning effective feature and feature fusion strategy is used to improve recognition. In [4], Eigenspace transformation based on Principal Component Analysis (PCA) is applied to reduce the dimensionality of the input feature space. Then supervised pattern classification techniques are finally performed in the lower-dimensional eigenspace for recognition. Su and Zanga [5] use fuzzy principal component for recognition. Firstly they processed the original gait sequence and gait energy image is obtained then Eigen value and Eigen vector are extracted by fuzzy principal component analysis, which are called fuzzy logic. Finally NN classier is utilized in feature classification. In [6], proposed low resolution method used manifold sampling, back projection and multi linear tensor based learning without tuning parameter. Davrondzhon proposed important gait recognition using cycle matching in which they use wearable accelometer, to record ankle motion for measuring cycle [7]. In [11] considered dynamic features of human body for gait recognition. Two features of human body i.e hand and feet for gait recognition. Second feature feet are subdivided into two i.e toe and heel. Both left and right legs toe and heel are considered. they follow an approach of parametric line equation for formulating two triangles between these features i.e first triangle is formed between hand and toe of both legs(right and left) and second triangle is formed between same hand and heel of both legs(right and left). They calculated mean

value of angles and intersecting points of an individual subject gait cycle frames and match mean value with database for recognition.

This paper focus on person identification based on Gait using geometrical method and finding Euclidian Distances. We have used Fuzzy Inference Systems for classification.

II. PROPOSED APPROACH

In this paper we have given an approach for human recognition based on Gait illustrated in Figure 2.

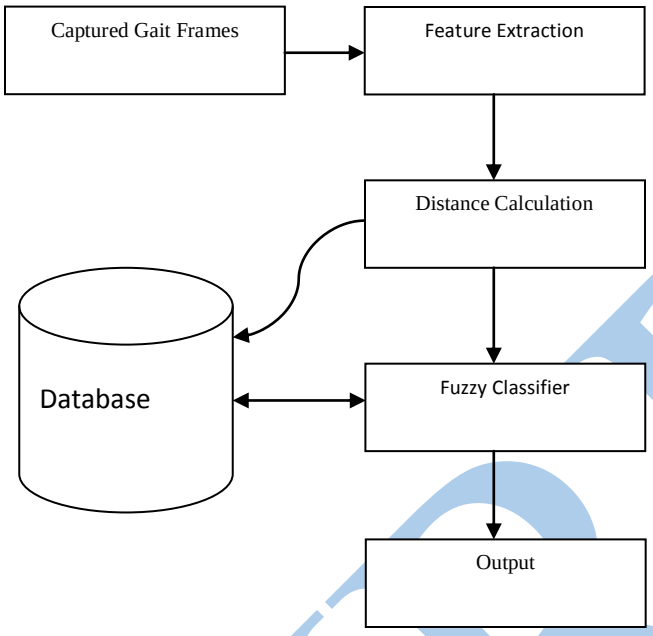

Figure 2. Proposed Block diagram

In the proposed approach shown in figure2, gait frames are captured from each individual person. Then these frames are inputted into proposed model for feature extraction. The proposed model is designed in Matlab 7.5. Features include left hand, left and right feet. A triangulation is formed between these features. After triangulation formation distance between all three sides has been computed through Euclidean distance method.

$$D1 = \sqrt{(x2 - x1)^2 + (y2 - y1)^2}$$

$$D2 = \sqrt{(x3 - x2)^2 + (y3 - y2)^2}$$

$$D3 = \sqrt{(x3 - x1)^2 + (y3 - y1)^2}$$

After calculating means of each subjects distances, fuzzy rules are applied to get the better Correct Classification Rate.

Algorithm:

Step 1: Capture Subject Frames.

Step 2: Perform feature extraction i.e hand, left feet and right feet

Step 3: Compute three distance (D1, D2, D3) between features of step2,using Euclidean distance.

1. hand and left feet.
2. left feet and right feet.
3. right feet and hand.

Step 4: Compute mean values of three distances [D1, D2,D3].

Mean (μ) = $\frac{\sum_{i=1}^{n} xi}{n}$

Step 5: Store step 4 values in database.

Step 6: Apply Fuzzy classifier for analysis [To get output]

Step 7: Repeat step 1 to 6 for next subject frames.

Subjects three mean distance values are shown in table 1.

Table 1 show 17 subjects Mean distances of three sides

Subjects	D1	D2	D3
A	55	38	65
B	58	48	66
C	58	49	64
D	75	50	79
E	81	72	93
F	61	52	66
G	61	40	64
H	56	52	62
I	57	45	63
J	63	53	68
K	58	40	63
L	81	65	91
M	61	55	70
N	65	49	76
O	56	46	68
P	71	56	81
Q	63	56	70

III. RESULT ANALYSIS

Our proposed model is designed using matlab 7.5. We have used CASIA Set A dataset [10] for evaluation. We have performed two analyses, with Fuzzy classifier and without fuzzy classifier shown in figure 3.

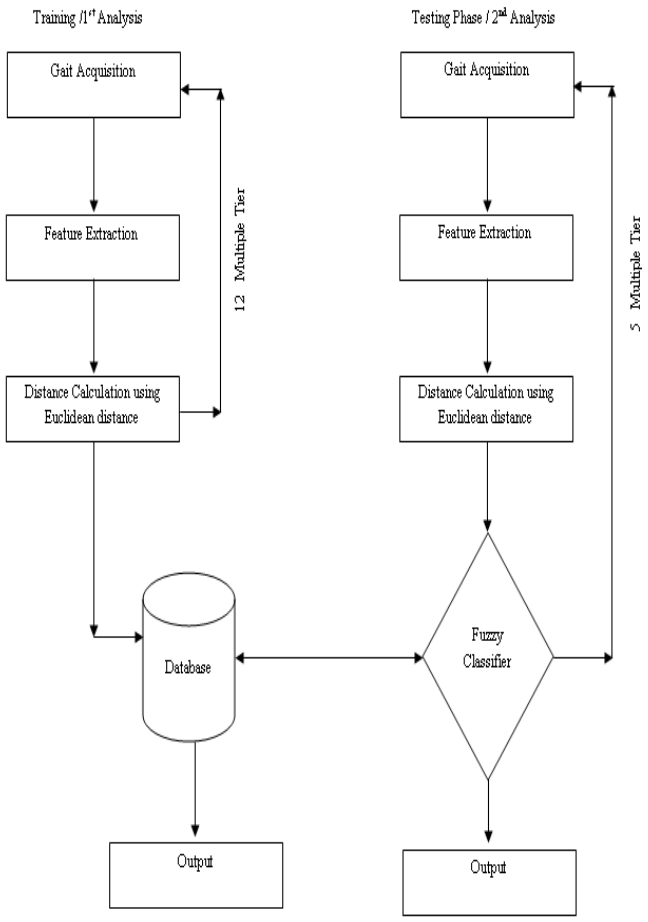

Figure 3: Flow Diagram of two analyses (Without Fuzzy Classifier and with Fuzzy Classifier)

A. Without Fuzzy Classifier

We perform analysis on mean values of 17 subjects shown in table 1, to find correct classification rate (CCR). Figure 4 shows the three mean distance variations of 17 subjects.

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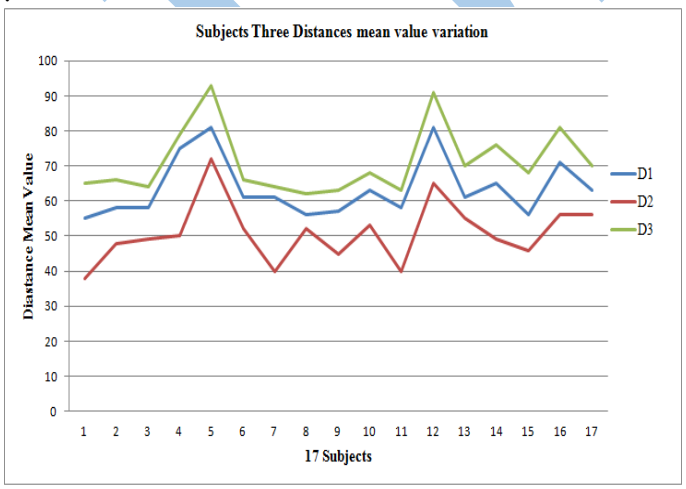

Figure 4. Shows variation of 17 subjects three distances mean value.

Table 2, result of first analysis, without fuzzy classifier.

Parameter	CCR
D1	64.70
D2	76.4
D3	70.58

From this analysis, we find that distance2 (Left feet and right feet) give better classification rate.

B. With Fuzzy Classifier

in this analysis we have used fuzzy on three features Distance 1(hand and left feet), Distance 2(Left feet and right feet) and Distance 3(Hand and Right Feet). Here fuzzy Rules outputs four classification i.e Excellent (E), Good (G), Average (A) and Poor (P). We have kept the threshold value above 79%, if the output value of fuzzy classifier is above the threshold, than it is considered to be excellent match and the subject come under this threshold considered recognized. This analysis testing is classified into two parts:

1. Analysis with same subjects
2. Analysis with testing subjects.

Analysis with Same Subjects:

in this analysis 12 subjects value has been stored in database and rest 5 subjects kept for testing. 12 subjects stored parameters are tested with itself for analysis to find False Match Error Rate. Global threshold value is kept 79% , matching output above this threshold is considered to be recognized. From figure5 (output of fuzzy classifier) , it is concluded that , there are 4 mismatch out of 12 subjects i.e the false match rate is 33.33%. and correct classification rate achieved is 66.67%.

Table 3. Shows the out values of fuzzy classifier for testing with same subjects.

Subject	A	B	C	D	E	F	G	H	I	J	K	L
A	80.234	77.3592	77.1511	70.4131	64.9138	75.96	78.3495	76.6009	77.7764	74.5979	78.1093	65.9146
B	77.3592	80.234	79.6917	74.9104	67.1817	78.9731	77.4546	77.7187	78.5578	77.5125	78.434	68.2682
C	77.1511	79.6917	80.234	75.1462	67.1794	78.1128	78.1661	78.3009	78.9259	76.7749	78.6536	68.3183
D	70.4131	74.9104	75.1462	80.234	73.2385	75.4254	71.4641	74.0416	72.7841	75.5688	70.7399	74.3742
E	64.9138	67.1817	67.1794	73.2385	80.234	68.4432	66.2874	67.1241	66.2309	69.2698	65.5603	79.2783
F	75.96	78.9731	78.1128	75.4254	68.4432	80.234	77.8481	78.7542	77.0534	78.9063	76.2283	69.7782
G	78.3495	77.4546	78.1661	71.4641	66.2874	77.8481	80.234	76.1822	78.0516	76.307	79.6357	67.1738
H	76.6009	77.7187	78.3009	74.0416	67.1241	78.7542	76.1822	80.234	78.6234	77.6078	77.3008	68.7211
I	77.7764	78.5578	78.9259	72.7841	66.2309	77.0534	78.0516	78.6234	80.234	75.8062	79.2632	67.1328
J	74.5979	77.5125	76.7749	75.5688	69.2698	78.9063	76.307	77.6078	75.8062	80.234	74.8753	70.5747
K	78.1093	78.434	78.6536	70.7399	65.5603	76.2283	79.6357	77.3008	79.2632	74.8753	80.234	66.4346
L	65.9146	68.2682	68.3183	74.3742	79.2783	69.7782	67.1738	68.7211	67.1328	70.5747	66.4346	80.234

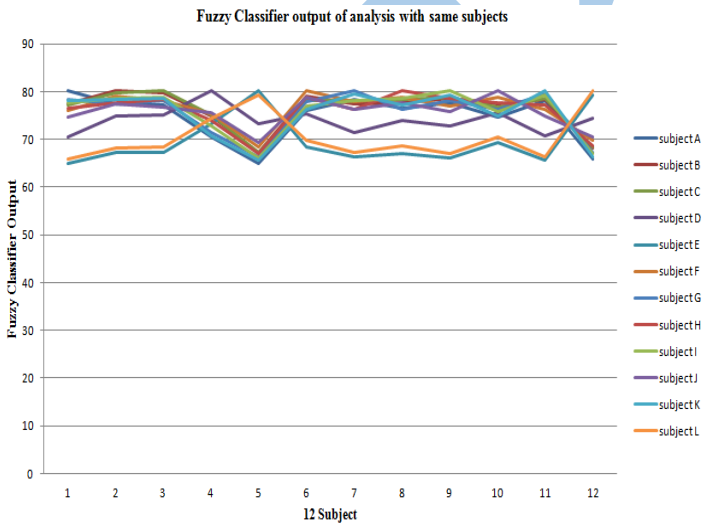

Fig 5. 1st Analysis with fuzzy classifier

Subject	M	N	O	P	Q
A	73.89463	72.4604	77.81416	69.48586	73.38601
B	77.09841	77.1901	78.44549	72.62313	76.49848
C	76.78262	77.62533	77.8236	72.73432	75.87236
D	74.66064	78.19217	73.84934	77.97228	74.5491
E	69.38277	70.07304	66.98245	73.24656	69.88232
F	78.99299	76.75734	77.37478	74.85597	77.8789
G	76.53652	74.94524	76.4689	71.24696	75.43811
H	76.64151	75.26221	78.17749	73.4599	75.77943
I	75.59005	74.97534	78.83642	70.91862	74.62224
J	78.54502	77.46714	77.7628	75.9894	79.4243
K	74.93644	73.60904	77.2753	70.24152	73.96181
L	71.19998	71.32538	68.00851	74.52805	71.79144

Analysis with testing subjects:

Here 5 subjects have been used for testing with stored 12 subject's values. Results of analysis are shown in figure 5. From figure 6 depicts that there is 1 false acceptance in database. So the false match rate is 20% and correct classification rate is 80%.

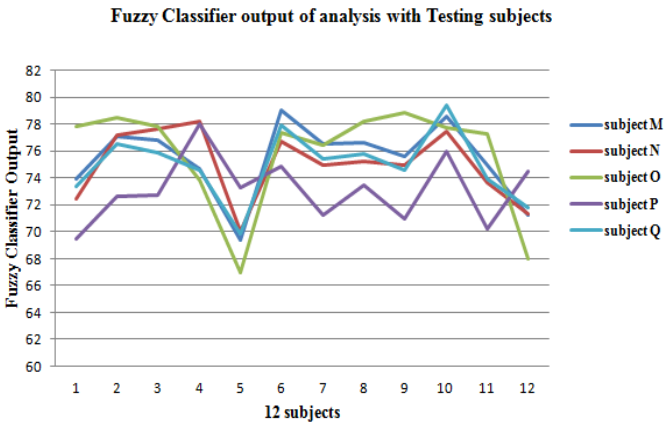

Figure 6: 2nd analysis of fuzzy classifier with testing

subjects

Table 3. Results of 2nd analysis.

Testing	CCR
Test 1	66.66%
Test 2	80%

IV. Conclusion

Gait is a behavioral trait of biometric system. Large scale of research has been proposed by researchers in this field. We have proposed an approach to identify an individual based gait using Fuzzy. It is concluded that the average classification rate of first analysis is 70.56% and average classification rate of second analysis if 73.33%.

REFERENCES:

[1]. Yi-Bo Li, Tian-Xiao Jiang, Zhi-Hua Qiao, Hong-Juan Qian, "General method and development actuality of gait recognition*", International conference on wavelet analysis and pattern recognition*, Beijing, china, 2-4 N0v. 2007.

[2]. Iwamoto, K. and Sonobe, K. and Komatsu, N. , "A gait recognition method using HMM", *SICE Annual conference in fukui* , august 4-6 2003.

[3]. J. Han and B. Bhanu, "Individual recognition using gait energy image," *IEEE Trans. on Pattern Analysis and Machine Intelligence*, vol. 28, no. 2, pp. 316-322, Feb. 2006..

[4]. Sanjeev Sharma, Ritu Tiwari, Anupam shukla and Vikas Singh,"Identification of People Using Gait Biometrics", International Journal of Machine Learning and Computing, Vol. 1, No. 4, October 2011.

[5]. Su-li XU, Qian-jin ZHANG, "Gait recognition using fuzzy principal component analysis", *2nd International Conference on e-business and information system security* , IEEE, 27 may, 2010.

[6]. Junping Zhang, Member, IEEE, Jian Pu, Changyou Chen, and Rudolf Fleischer, "Low-Resolution Gait Recognition", *IEEE Transaction on system, man, and cybernetics- Part B: cybernetics* vol, 40, no. 4,August 2010.

[7]. L.R Sudha, Dr.R.Bhavani,"Biometric Authorization system Using Gait Biometry", International Journal of ComputerScience,EngineeringAnd.Applications(IJCSE A), August 2011,Vol.1,No.4.

[8]. Chiraz BenAbdelkader, Ross Cutler,and Larry Davis, "Motion-based Recognition of People in EigenGait Space",Fifth IEEE International Conference on Automatic Face and Gesture Recognition, 2002 ,pp: 267 - 272 .

[9]. A. Kale, A.N Rajagopalan, N. Cuntoor and V. Kruger, "Gait-based Recognition of Humans Using Continuous HMMs",Fifth IEEE International Conference on Automatic Face and Gesture Recognition (FGR.02) 2002 , pp: 336 - 341.

[10]. www.cbsr.ia.ac.cn

[11]. Jasvinder pal Singh and Sanjeev jain," Person Identification Based on Gait using Dynamic Body Parameters", IEEE International Conference on Trendz in Information Sciences & Computing (TISC) 2010, pp: 248 – 252

