An Efficient Human Identification on the Biometric Gait Recognition System using the Inner Angle of the Triangle

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ABSTRACT
Gait based human recognition system is most important and attractive method of biometrics. Gait the way of walking capture from distance and provide more efficient means of verification. In this paper, we propose an efficient algorithm which works on angle based technique. Initially video converted into frames and then feature abstraction is done. Here we are taking three lower body parts for recognition and a correlation of triangle is derived. Using cosine formula each inner angle of triangle is calculated and stored in database for identification. The gait system is designed using MATLAB to accomplish this research work.

Keywords
Biometrics, Image processing, Gait recognition, Pattern Recognition, Security.

1. INTRODUCTION
Biometrics is term by which a person can be uniquely identified by his physiological or behavioral traits. The term gait recognition to signify the identification of an individual from a video sequence of the subject walking. Unique identity is most important feature of security in the world. Biometrics refers the unique identification as per behavior and physiological. In this work we are using one type of behavioral identification system that is gait. Gait means a person's way of waking. The very important features of gait are distance from camera and without knowledge of person.

In this paper we discus about angle based gait recognition. Static images of CASIA A dataset are taken for so the results. Here, lower body position both feet a viewing hand are taken as a feature abstraction.

2. RELATED WORK
Gait recognition work is based on static and dynamic parts of images. Static part means the body parts which usually did not move when a person walk (upper body part like head, chest) and dynamic means which parts moves when a person is walk (Lower body part hand, legs). Many researchers used static part or dynamic part for recognition and many researchers used both parts for recognition. The most common and effective method using Gait Energy Image (GEI), silhouette image and motion contour Image (MCI) as gait representation. MCI, GEI and silhouette image that captures not only static but also motion characteristic of gait. In the field of this a lots of work is done on dynamic portion [paper] like triangle based techniques many researcher work on this part. Position joint base human body detection gives the correct classification rate of 90 percent [2]. Angels based gait detection Gait Recognition with Geometric Characteristic and Fuzzy Logic uses fuzzy concept on the dynamic part and obtained CCR 90 percent [3]. A Novel Method of Gait Recognition Using Fuzzy Inference System is also used the dynamic feature of human for recognition.

3. GAIT SYSTEM
Gait recognition system is multistage work which perform on many steps as shown in figure first video sequence is captured by camera where camera position is decided that all portion of human is covered and most important that it captured at least one gait cycle figure 2. Second step convert video into images for one cycle that is called gait cycle, in third part feature extraction is done, then classifier check the result in database and show it if new person match with stored then print result that person is match otherwise ask for store that Do you Want to store or not.

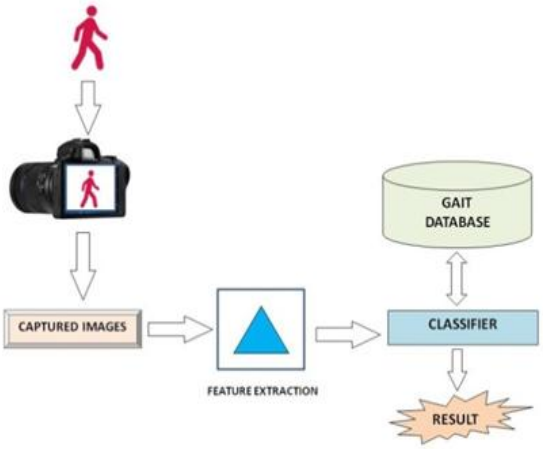

Figure 1: Gait Cycle System

Gait cycle is shown in figure 2 each cycle is divided into two portion stance and swing. Stance covers 60 percent of gait from initial contact to toe off and swing phase covers 40 percent of gait from toe off to again initial contact this cycle are repeated.

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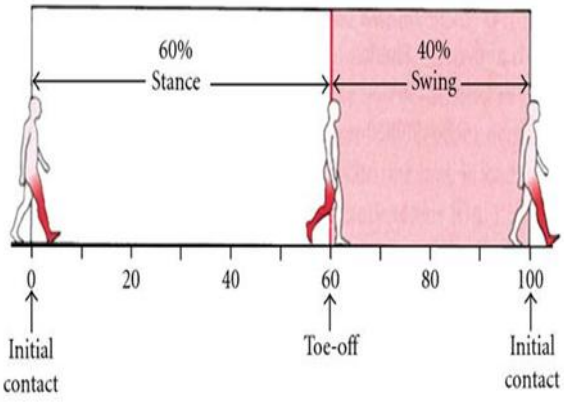


Figure 2: Gait Cycle with Stance and Swing

4. PROPOSED WORK

In our proposed work we are taking lower body part for recognition. As shown in figure 3 we are taking both feet and hand after feature extraction one triangle is formed. For these triangle inner angles values are calculating with the help of cosine formula.

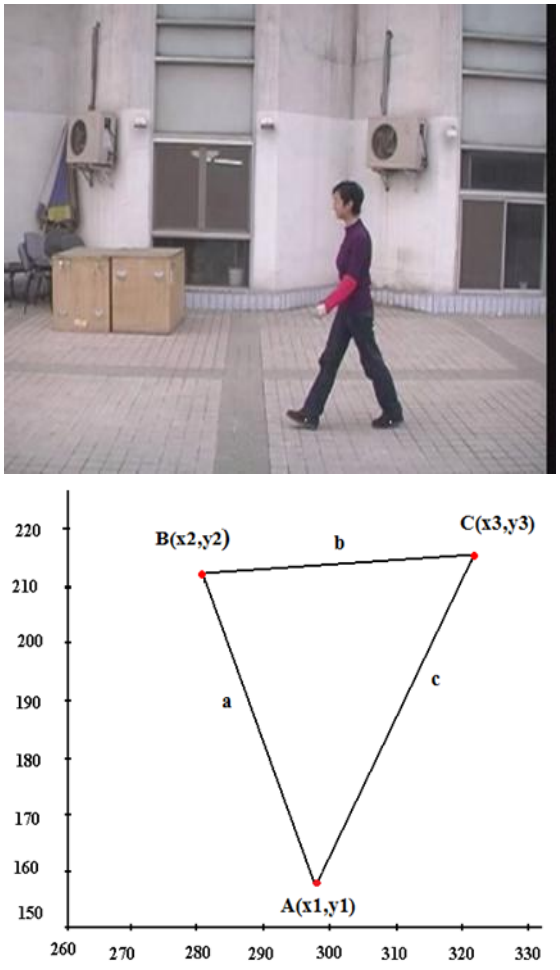


Figure 3: Image and after feature extraction Triangle ABC after connecting points

5. PROPOSED ALGORITHM

1. Take an input video for one cycle.
2. Convert video into frames (colored).
3. Convert each colored frame into gray scale.
4. Extract pixel values (x1, y1), (x2, y2) and (x3, y3) which are values of Hand, Right feet and Left feet.
5. Construct logical triangle between pixel values of each desired frame.
6. Calculate angles of a triangle by formula.
7. Calculate mean of each angle (Θ1, Θ2, Θ3) for one cycle.
8. Print the result of mean.
9. Exit.

Here ABC triangle is created between coordinate points (x1, y1), (x2, y2) and (x3, y3) where x1, x2, x3 and y1, y2, y3 represents pixel values. Angles are BAC, ABC and ACB. Point A represents hand point, point B represents left feet and C represents right feet. Then we calculate edges of triangle AB, BC and CA the value is respectively a, b and c by following a formula:

a = sqrt ((x2 - x1)2 + (y2 – y1)2)
b= sqrt ((x3 – x2)2 + (y3 – y2)2)
c= sqrt ((x3 – x1)2 + (y3 – y1)2)

Here we represent angles BAC, ABC and ACB by respectively by Θ1, Θ2, Θ3 we calculate angles of triangle by cosine and sine formula as follows.

By cosine formula:

Θ2 = cos-1 ((a2 + c2 –b2) / 2*a*c)
// Computing second angle

By sine formula:

a/ Sin Θ1 = b/ sin Θ2 = c/sin Θ3

So

Θ3 =sin-1 ((c * sin Θ2) / b)

//Computing third angle

By triangle property

Θ1+ Θ2 + Θ3 = 180

Then Θ1 = 180 – Θ2 – Θ3
// Computing first angle

6. PROPOSED FLOW CHART

This flow chart show the work is done in different section from video capture to result. First video is captured and feature extraction on the basis of lower body part is done and then result is generated with the help of algorithm.

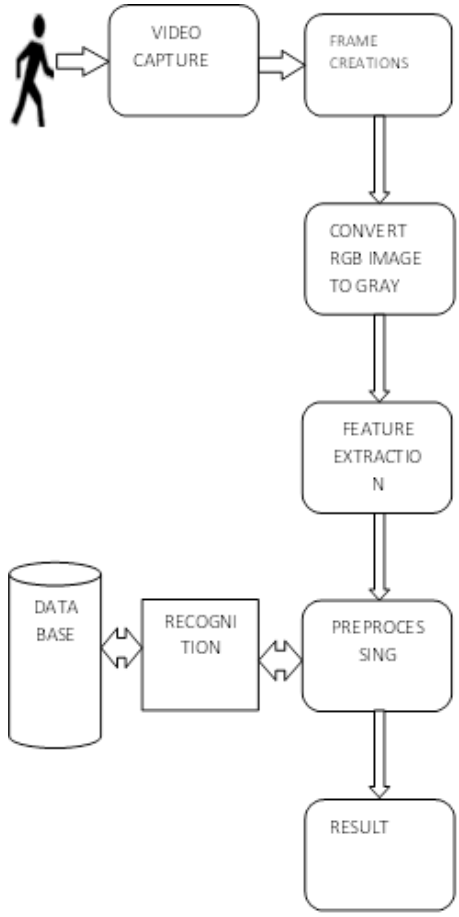
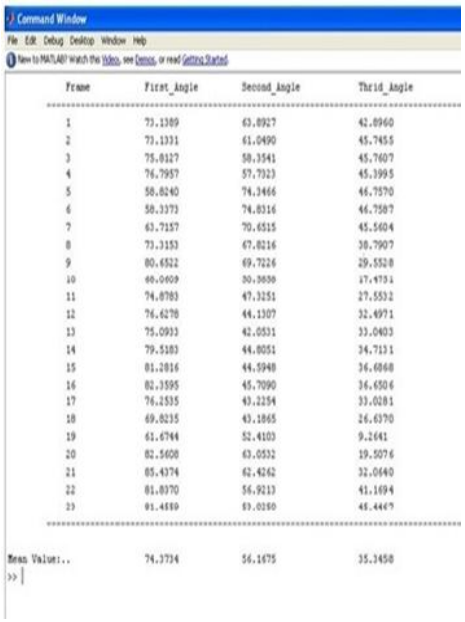


Figure 4: Flow Chart

7. RESULT

We used CASIA A data set for our experiments here we used 15 different subject and check identification of uniqueness. Our result is shows that unique identification is done with 90 percent CCR



Frame	First_Angle	Second_Angle	Third_Angle
1	73.1389	63.8927	42.8960
2	73.1331	61.0490	45.7455
3	75.0127	58.3541	45.7607
4	76.7957	57.7323	45.3995
5	58.8240	74.3466	46.7570
6	58.3373	74.8316	46.7587
7	63.7157	70.6515	45.5604
8	73.3153	67.8216	38.7907
9	80.6522	69.7226	29.5520
10	66.0609	80.3650	17.4731
11	74.8783	67.3251	27.5532
12	76.6270	64.1307	32.4971
13	75.0933	62.0531	33.0403
14	79.5183	64.8051	34.7131
15	81.2816	64.5948	36.6868
16	82.3595	65.7090	36.6504
17	76.2535	63.2254	33.0281
18	69.8235	63.1865	26.6370
19	61.6794	52.4103	9.2641
20	82.5600	63.0532	19.5076
21	85.4374	62.4262	32.0640
22	81.8070	56.9213	41.1694
23	81.4880	63.0160	45.4467
Mean Value:..	74.3734	56.1675	35.3458

Figure 5: Table shows the experimental results of a particular subject

Figure 6: Shows multiple frames of Gait Cycle

8. CONCLUSION AND FUTURE WORK

In this work two dynamic feature of human (hand and feet) taken as a feature extraction. Here triangle is generated and inner angle of triangle is calculated with cosine formula. We used Matlab tool to implement our work with CASIA A data set and generated result. In our work the correct classification rate is 90% which is better than some other method.

Technology never stop for future we can apply this method for upper body parts or with other body parameter for identification our work is fix for CASIA A data set only.

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