International Journal of Enhanced Research in Science Technology & Engineering, ISSN: 2319-7463
Vol. 3 Issue 9, September-2014, pp: (1-7), Impact Factor: 1.252, Available online at: www.erpublications.com

GAIT Recognition using Hybrid Method

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Abstract: Identifying individuals using biometric methods has recently gained growing interest from computer vision researchers for security purposes at places like airport, banks etc. Gait recognition aims essentially to address this problem by identifying people at a distance based on the way they walk i.e., by tracking a number of feature points or gait signatures. We describe a new model-based feature extraction analysis is presented using Hough transform technique that helps to read the essential parameters used to generate gait signatures that automatically extracts and describes human gait for recognition and discrete wavelet transformation (DWT) Different gait patterns are characterized by differences in limb movement patterns, overall velocity, forces, kinetic and potential energy cycles, and changes in the contact with the surface. In literature canny edge detection was used for image pre processing but it was giving erroneous edges. To extract features correctly erroneous results are very dangerous. So before that wavelet transform is applied on captured frame and then canny edge detection is applied as wavelet transform the limitations of canny edge detection were removed by Hough transform.

Keywords: Gait analysis, discrete wavelet transformation, Hough Transform, Canny Edge Detection.

INTRODUCTION

Biometric technology is capable of establishing a much closer relationship between the user's identity and a particular body, through its unique features or behavior. In biometric authentication technology, where the user's identity is verified using a physiological or behavioral characteristic such as the iris pattern, a fingerprint, or the voice. Gait is a new biometric technique; to classify individuals by the way they walk. In order to achieve a high recognition rate, discriminative features must be extracted from the available data. It seems obvious to try to recognize people through their stride length, walking cadence, body weight, body height, and so forth. In fact, they are highly insecure due to their static nature, that allows an impostor to easily mimic them; e.g. an impostor can easily adjust his body weight, stride length, and cadence to match that of a legitimate user and try to gain access to a restricted area. Conversely, the dynamic properties of human gait are far more difficult to imitate, since they depend on physiological properties of the user's body, such as bone structure. The dynamic features are used for gait analysis. Three or four extracted features are sufficient to determine human gait. So in this paper the mostly used gait feature knee angle of left and right knee is used. The foot distance is another feature as whether the human is injured at feet, drunk or in other circumstances in which his/her normal walking is changed; the foot distance between toe of one leg to other leg's ankle will remain same in major cases. One more important feature that is left untouched even in literature as per my knowledge is palm angle. The hand movement is also unique body gesture of every human.

PROPOSED WORK

The gait feature like knee angle of left and right knee is used. The foot distance is another feature as whether the human is injured at feet, drunk or in other circumstances in which his/her normal walking is changed; the foot distance between toe of one leg to other leg's ankle will remain same in major cases. One more important feature that is left untouched even in literature as per my knowledge is palm angle. The hand movement is also unique body gesture of every human. For this purpose extracted silhouettes of walking movement of an object is taken from the database uploaded at the home page of Shuai Zheng, a DPhil student at University of Oxford. Various steps are described step by step in detail below:

Step 1**:** Features from silhouettes are to be calculated. But before that pre processing on the loaded data need to be done. In pre processing edge detection is done and for this purpose canny edge detector is used in my case as the Canny method finds edges by looking for local maxima of the gradient of image. The gradient is calculated using the derivative of a Gaussian filter. The method uses two thresholds, to detect strong and weak edges, and includes the weak edges in the output only if they are connected to strong edges. This method is therefore less likely than the others to be fooled by noise,

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and more likely to detect true weak edges. The edge detection procedure starts from weak edges and then move to strong edges. This helps fill in gaps in the detected edges.

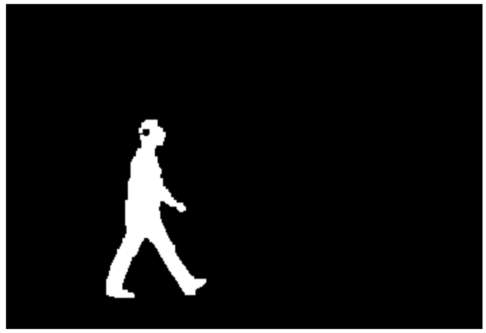
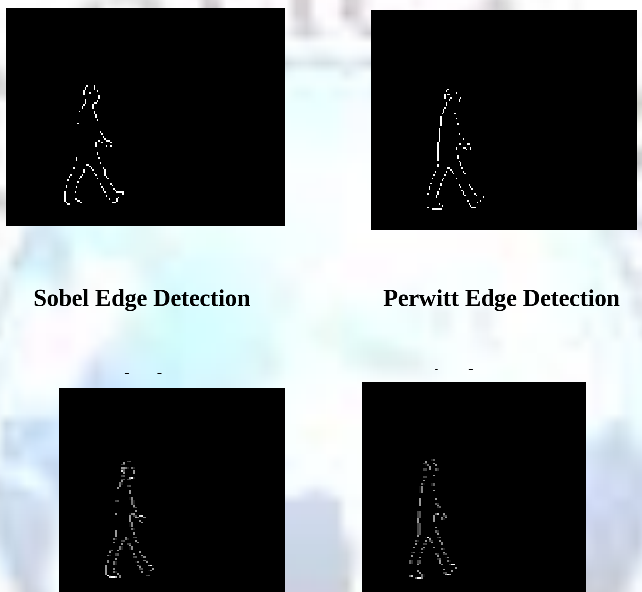


Figure 1.1: Original frame



Sobel Edge Detection **Perwitt Edge Detection**

Log Edge Detection **Canny Edge Detection**

Figure 1.2: Edge Detected Frame with Various Edge Detection Algorithms

A comparison of different edge detection techniques on a sample frame is shown in fig 1.1 and 1.2. fig 1.1 show the original frame used for edge detection. Fig 1.2 clearly shows that canny edge detection algorithm gives real edges of frame. So in our proposed work it is used for pre processing of frames. Even after detecting edges form canny edge, discontinuities can be observed in edges in above figure. These discontinuities give rise to false feature extractions. So to avoid this discrete wavelet transform is applied on frame first and then edges are detected from the transformed image.

Discrete Wavelet transform detects the exact instant when signal changes. The DWT of images is a transform based on the tree structure with D levels that can be implemented by using an appropriate bank of filters. The DWT of a signal x is calculated by passing it through a series of filters. First the samples are passed through a low pass filter with impulse response g resulting in a convolution of the two:

$$Y[\mathrm{n}] = (\mathrm{x} * g)[\mathrm{n}] = \sum_{k=-\infty}^{\infty} x[\mathrm{k}]\,\mathrm{g}[\mathrm{n}-\mathrm{k}] \qquad \textbf{Eq.(1)}$$

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The signal is also decomposed simultaneously using a high-pass filter h. The outputs giving the detail coefficients (from the high-pass filter) and approximation coefficients (from the low-pass). It is important that the two filters are related to each other and they are known as a quadrature mirror filter.
However, since half the frequencies of the signal have now been removed, half the samples can be discarded according to Nyquist's rule. The filter outputs are then subsample by 2 (Mallat's and the common notation is the opposite, g- high pass and h- low pass):

$$y_{low}[n] = \sum_{k=-\infty}^{\infty} x[k]h[2n-k] \qquad \text{Eq.(2)}$$

$$y_{high}[n] = \sum_{k=-\infty}^{\infty} x[k]g[2n-k] \quad .... \quad ... \quad \text{Eq.3)}$$

This decomposition has halved the time resolution since only half of each filter output characterizes the signal. However, each output has half the frequency band of the input so the frequency resolution has been doubled.
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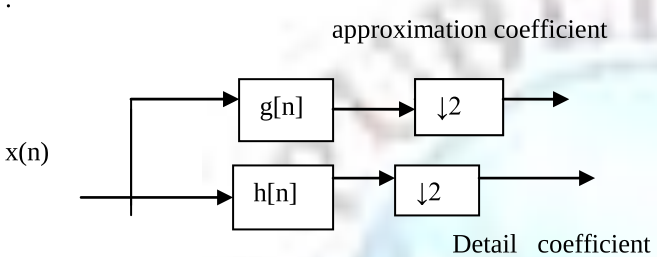


Figure 2: Block Diagram Of DWT Filter Analysis

With the sub sampling operator $\downarrow$

$$(y \downarrow k)[n] = y[kn] \quad .... \quad .... \quad . \text{Eq.(4)}$$ (frequency resolution of o/p signal is doubled)

the above summation can be written more concisely.

$$y_{low} = (x * g) \downarrow 2 \quad .... \text{Eq.(5)} \qquad y_{high} = (x * h) \downarrow 2 \quad .... \quad \text{Eq.(6)}$$

However computing a complete convolution $x * g$ with subsequent downsampling would waste computation time.

HOUGH TRANSFORM

The Hough transform is a feature extraction technique used in image analysis, computer vision, and digital image processing. The purpose of the technique is to find imperfect instances of objects within a certain class of shapes by a voting procedure. This voting procedure is carried out in a parameter space, from which object candidates are obtained as local maxima in a so-called accumulator space that is explicitly constructed by the algorithm for computing the Hough transform. Hough performs groupings of edge points into object candidates by performing an explicit voting procedure over a set of parameterized image objects.

The simplest case of Hough transform is the linear transform for detecting straight lines. In the image space, the straight line can be described as y = mx + b and can be graphically plotted for each pair of image points (x, y) [6]. In the Hough transform the characteristics of the straight line is considered in terms of its parameters, i.e., the slope parameter m and the intercept parameter b. Based on that fact, the straight line y = mx + b can be represented as a point (b, m) in the parameter space. However, one faces the problem that vertical lines give rise to unbounded values of the parameters m and b. For computational reasons, it is therefore better to use a different pair of parameters, denoted r and θ (theta), for the lines in the Hough transform. The parameter r represents the distance between the line and the origin, while θ is the angle of the vector from the origin to this closest point. Using this parameterization, the equation of the line can be written as which can be rearranged to;

$$r = x\cos\theta + y\sin\theta$$

The (r,θ) plane is sometimes referred to as Hough space for the set of straight lines in two dimensions where r (the distance between the line and the origin) is determined by θ. This corresponds to a sinusoidal curve in the (r,θ) plane, which is unique to that point. In our approach, the output of the Hough transform rho(r) is used as another feature extraction technique. This value of r is found to be unique and hence could be used directly for matching.

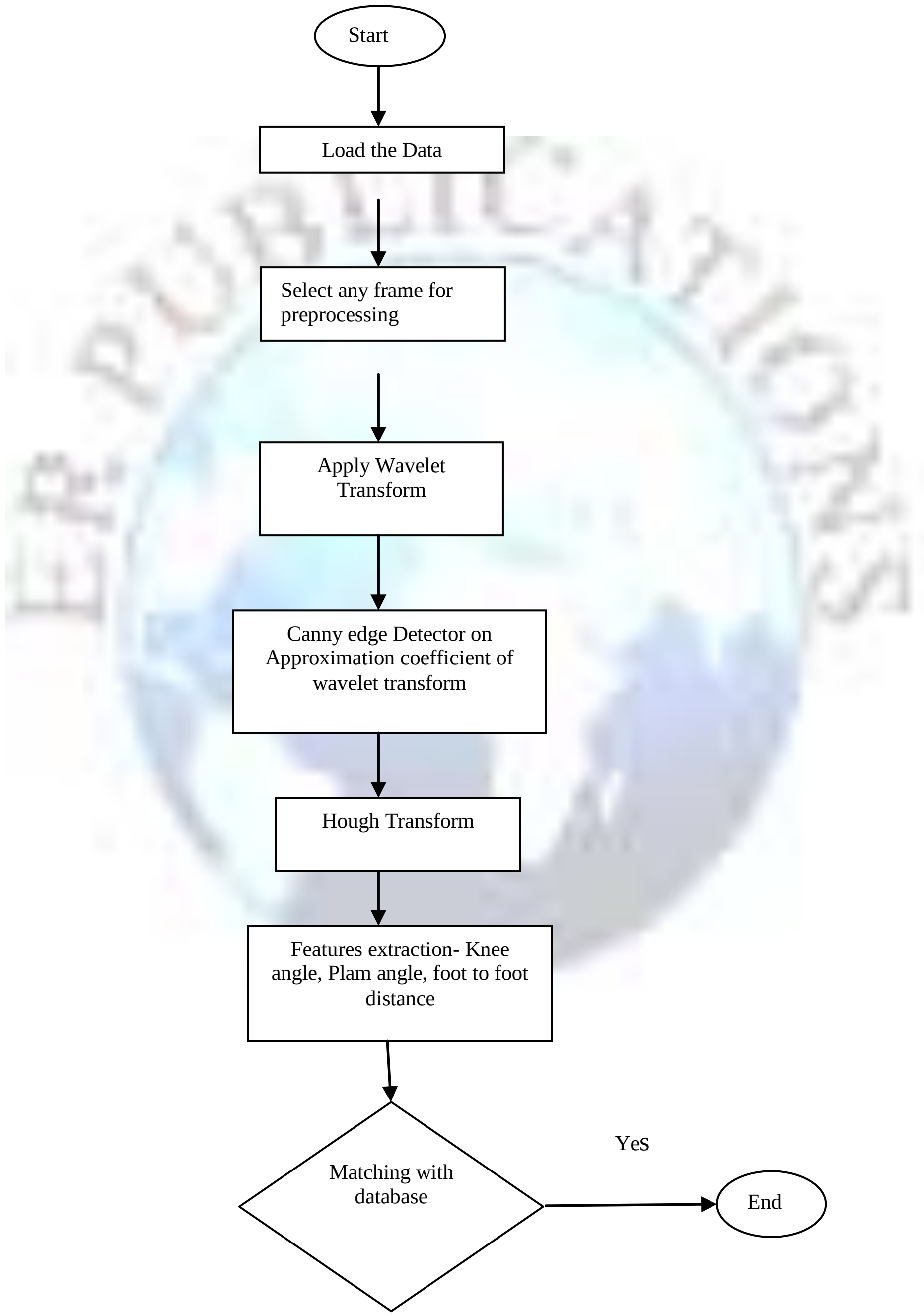
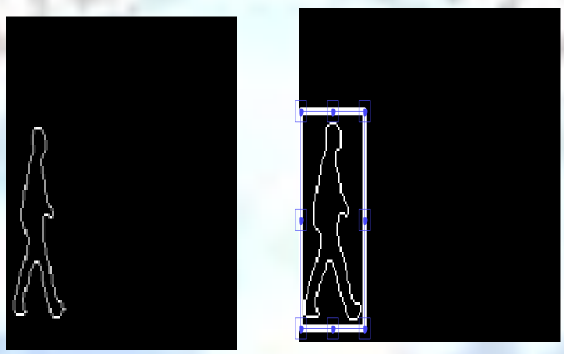


Fig. 3 Algorithm For Gait Analysis Is In The Form Of Flow Chart

RESULTS AND DISCUSSIONS

A toolbox for gait analysis is designed in MATLAB. It allows selecting desired frame from database. Database for our work is imported from the home page of Shuai Zheng, a DPhil student at University of Oxford. We have selected frames captured of a man moving from left to right and from right to left

Selected sample Canny Edge Detected Image



Wavelet Transformed Edges

Fig. 4 Skeleton Part Selected For Hough Transform

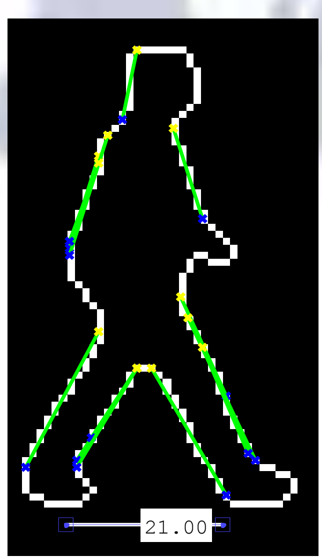


Fig. 5 Hough Transform Lines Displayed Over Skeleton

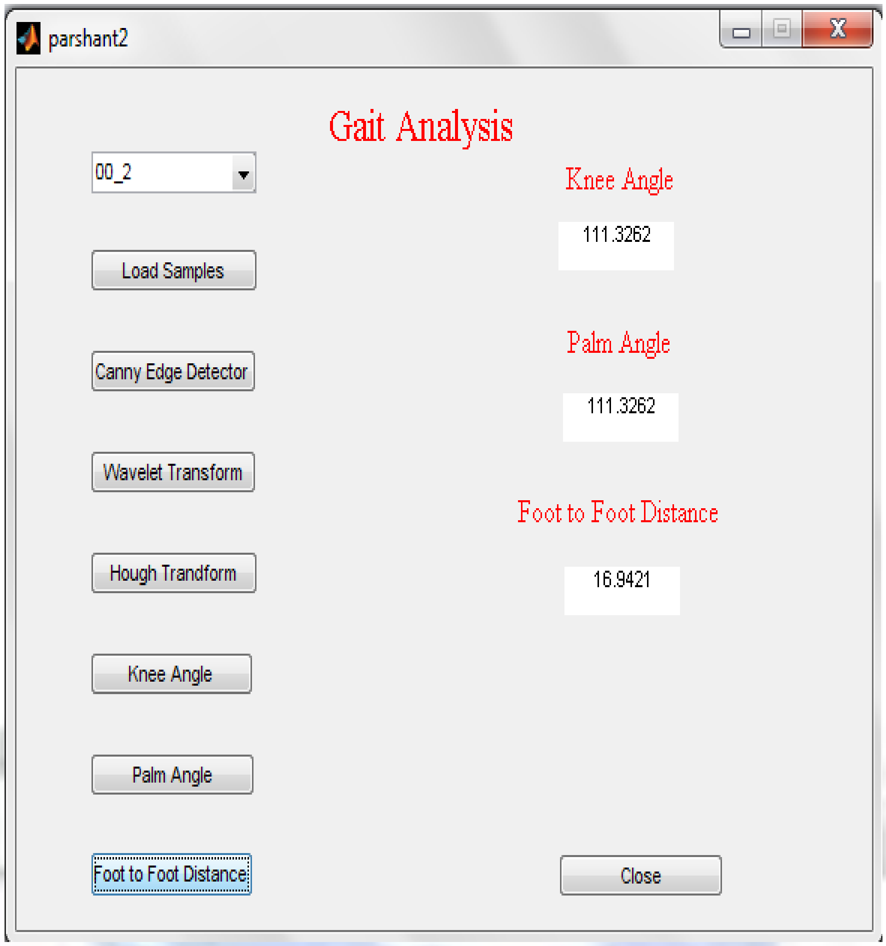


Fig. 6 Toolbox GUI Showing Foot To Foot Distance

Table 1: Knee Angle In Different Frames

Frame No.	Front Knee Angle	Frame No.	Back Knee Angle
4	89.8629	9	56.9761
5	103.6658	10	45.3031
6	116.4625	11	38.3867
7	123.0667	12	30.5826

Table 2: Palm Angle In Different Frames

Frame No.	Palm Angle
4	121.9642
5	132.1136
6	125.8195
7	135.9392

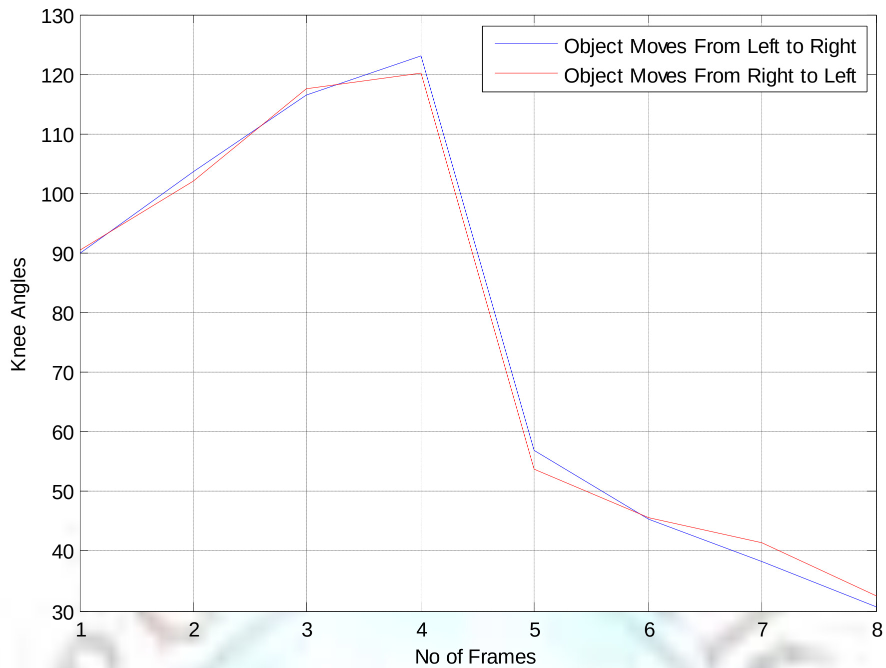


Fig. 7 Graph Showing Comparison Of Knee Angles In Case Of Two Moving Directions Of A Same Object

CONCLUSION

It was found that knee angle, palm angle and foot to foot distance are such features which are unique to every human and very difficult to copy. In literature canny edge detection was used for image pre processing but it was giving errorneous edges as proved. To extract features correctly erroneous results are very dangerous. So before that wavelet transform is applied on captured frame and then canny edge detection is applied as wavelet transform detects the exact instant when the signal changes and categorise that into different energy coefficients. The limitations of canny edge detection were removed by Hough transform. Hough transform successfully extracted features form the edges. I previous work till now no one has given freedom to user to select the joint angles which are to be extracted. But here in my work it is made customised. User can select the which knee angle is to be measured and by drawing a reference line along the hough line, that can be measured. Frame data of a same person is captured when he moves form right to left and vice versa.

REFERENCES

[1]. Gurmeet Kaur Baljinder Kaur Munish Kumar," Human Gait Authentication with AVR Using Labview" IJARCSSE Volume 3, Issue 3, March 2013 ISSN: 2277 128X.
[2]. Alexandre Gadiou," Person Identification by Gait Analysis" MEng in Electronics Systems (August 2012).
[3]. Imed Bouchrika, Michaela Goffredo," On Using Gait in Forensic Biometrics" J Forensic Sci, July 2011, Vol. 56, No. 4.
[4]. Nyo Nyo Htwe, Nu War,"Human Identification Based Biometric Gait Features using MSRC" IJARCET Volume 2, No 5, May 2013.
[5]. Ahmed Mostayed, Mohammad Mynuddin Gani Mazumder," Abnormal Gait Detection Using Discrete Fourier Transform" International Journal of Hybrid Information Technology Vol.3, No.2, April, 2010.
[6]. Murat EKINC," Human Identification Using Gait" Turk J Elec Engin, VOL.14, NO.2 2006, c T¨UB_ITAK.
[7]. Mohamed Rafi, Md. Ekramul Hamid," A Parametric Approach to Gait Signature Extraction for Human Motion Identification" International Journal of Image Processing (IJIP), Volume (5) : Issue (2) : 2011.
[8]. Nikolaos V. Boulgouris, Member, IEEE, and Zhiwei X. Chi," Gait Recognition Using Radon Transform and Linear Discriminant Analysis" IEEE transactions on image processing, vol. 16, no. 3, march 2007.