

Gait Recognition technique using SVM and BPNN Classifiers-Review

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Abstract- Gait recognition is the biometric method to identify people without their co-operation. In this paper we discuss different types of classifiers for gait recognition. It is better technique than previous like fingerprint, face detection which needs human co-operation. Gait shows a particular way or manner of moving on foot and gait recognition is the process to identify an individual by the manner in which they walk. Controlled environments such as banks, military installations and even airports need to be able to quickly detect threats and provide differing levels of access to different user groups.

Keywords- Gait recognition, feature extraction, Outermost Contour, Multiple Discriminate Analysis, Back Propagation Neural Network, Support Vector Machine.

I. INTRODUCTION

Traditionally password were set as a string which included integer or special characters and were used for authentication and these password can easily cracked but now Biometric authentications are used. Biometric is a field of technology that uses automated methods for identifying and verifying a person based on physiological and behavioural traits. Biometric characteristics are of two types physiological and behavioural. Physiological characteristics are face, fingerprints, iris, palm print, DNA etc.[1] And behavioural characteristics are voice and gait. As these physiological characteristics does not provide good results in low resolution and need user cooperation therefore recognition using Gait is more attractive. Recognition using gait means to identify a person by the way he move or walk. Gait recognition is relatively new biometric identification technology which aims to identify people at a distance by the way they walk. It has the advantage of being unobtrusive, difficult to conceal, non-invasive and effective from a distance System will identify unauthorized individual and Compare his gait with stored sequences and recognize him. Background subtraction is the common approach of gait recognition. Background subtraction method is used to subtract moving objects and to obtain binary Silhouette. Using background subtraction, pre-processing is done to reduce noise. Background subtraction techniques are also classified into two types: non- recursive methods and recursive methods.[2] Non recursive technique uses sliding

window approach for background subtraction. Recursive methods use single Gaussian method and Gaussian mixture model.

Gait recognition method contains two parts-

- Training part
- Testing part.

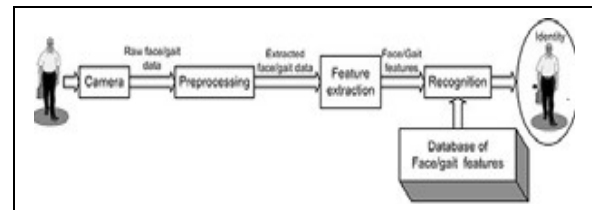


Figure1: The basic Gait Recognition System.

Model based approaches are difficult to follow in low resolution images also they have high computational complexity. Advantage of this approach is the ability to derive gait signature from model parameter and free from the effect of different clothing. Features used in this approach are insensitive to background cluttering and noise. Model based gait recognition system includes motion of thigh and lower leg rotation that describes both walking and running.[3] Model based method construct human model to recover features describing gait dynamics such as stride and kinematics of joint angle. Parameters used in this approach are height, distance between head and pelvis

II. FEATURE EXTRACTION

Feature extraction is the very important tasks in human gait recognition. It must be reasonably robust to the varying conditions, and should be capable of describe the quality of individuals. Intuitively, the silhouette appears to be a good feature to utilize since it captures the motion of most of the body parts and also encodes structural as well as transitional information. Silhouette show most of the body part so we can extract feature from this silhouette.[4] After background subtraction of silhouette image we get the outermost contour of the image. Then PCA method is adapted to reduce the dimensionality of the image. PCA is also useful to remove noise from the images.

A. Silhouette Extraction

After the background subtraction of an image we get the silhouette image.[5] To obtain an approximate background from the image sequence of a walking person first mean image is computed by averaging grey-level at each pixel.

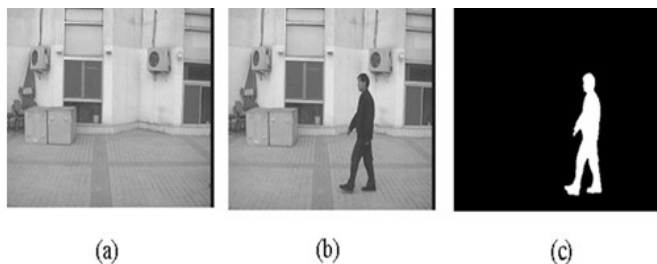


Figure 2: Silhouette Extraction (a) Background image; (b) Original image; and (c) Extracted silhouette

Let $I_k(x, y), k=1, 2, \dots, N$, represent sequence of N images. Background images $b(x, y)$ can be computed by :-
 $b(x, y) = \text{median}(I_k(x, y)), k=1, 2, \dots, N$ (equ 1)

after this the moving object is extracted by background subtraction. Finally erosion and dilation methods are used for noise reduction.

B. Outermost contour- after the silhouette extraction outermost contour is extracted. In each row of a normalized silhouette image, the most right pixel and the most left pixel on the contour belong to outermost contour. contour are used for mathematical calculations like centroid and distance between hands.

C. Gait feature

Two basic feature extraction techniques are classified as feature based and holistic method. Feature based method select individual features and characterization of geometrical relationship. Holistic method such as principal component, [6] linear discriminant analysis and independent component analysis used appearance information extracted from entire image. Holistic feature extraction methods find feature with reduced dimensionality by projecting and original data onto the basic vectors. These extracted features can improve classification performance by reducing irrelevant feature from the data set.

Selection of important features and eliminate irrelevant features play important role in recognition and computation process. Feature vector is one method to represent feature of image, or part of an image (an object), by carrying out measurements on a set of features. The feature vector is an n dimensional vector that contains these measurements.[7] This vector can be used to classify an object or to provide us with condensed higher-level image information. A feature is robust if it will provide consistent results across the entire application domain.



Figure 3: boundary box to measure width
 In gait feature these 3 things are calculated-

1. Centre of mass- show the brightened average of X and Y .
2. Step size length- calculate the boundary box on silhouette
3. Gait cycle length- calculate by using periodic movement.

III. RECOGNITION

Once we obtain *gait features*, the next step is gait recognition. In this section, we introduce three classification methods – MDA with NN or ENN, BPNN and SVM. Firstly, we present the MDA method in detail as it is the main classification method we adopt. Then, we give a brief description of the BPNN and SVM methods.

MDA method

MDA stands for Multiple Discriminant Analysis. It is a multiple class classifier. It separate data of different classes in least square sense. So it can optimize class separability. After the MDA training process, *gait features* are transformed to a new space where it become easier to classify *gait features* belonging to different classes. we still need classification method to obtain the final recognition results.[8] we choose two simple methods – NN and ENN. In NN test, each gait sequence is classified to the same class with its nearest neighbor. In ENN test, each gait sequence is classified to the same class with its nearest exemplar which is defined as the mean of *final feature vectors* for one given person in training set.

Back-propagation Neural Networks(BPNN)

Artificial neural networks are composed of interconnecting artificial neurons (programming constructs that mimic the properties of biological neurons). Artificial neural networks may either be used to gain an understanding of biological neural networks, or for solving artificial intelligence problems without necessarily creating a model of a real biological system. Neural networks give effective results for solving multiple class classification problems. The neural network facilitates gait recognition because of their highly flexible and non linear modelling ability. [9]

Neural network has three types of layers: input layer, output layers and hidden layers. Hidden layer does intermediate computation before directing the input to output layer. Back propagation can also be considered as a generalization of delta rule. When back propagation network is cycled, an input pattern is propagated forward to the output units through the intervening input to hidden and hidden to output weights.

Neural network have been widely used in image and signal processing.

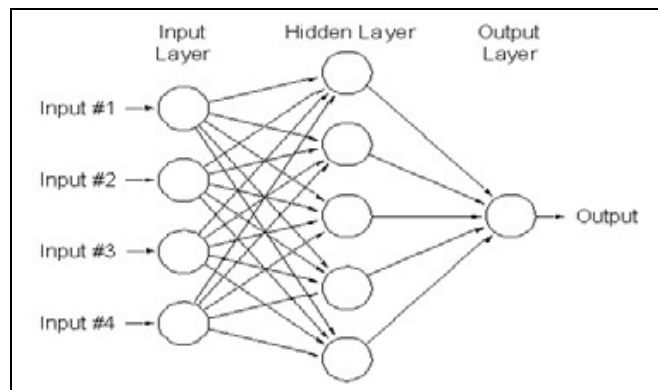


Figure 4: Basic layout of the Neural Networks

Support Vector Machine (SVM)

It is based on the concept of structural risk minimization. It’s a very powerful tool for classification problem. For solving multi-class problems, various methods have been proposed for combining multiple two class. SVM is classified into two classes. First class maps the training samples into a high dimensions space and then finds a separating hyper plane that maximizes the margin between two classes in this high dimension space. Maximizing the margin is a quadratic problem and can be solved by lagrangian multiplier.

SVMs in order to build a multi-class classifier, [10] such as one against one and one-against-rest methods. In this paper, we use the “one-against- one” method in which $k(k-1)/2$ classifiers are constructed and each one trains samples from two different classes. In classification, we use a voting strategy: each two-class SVM is considered as a voter (i.e. $k(k-1)/2$ voters in all), and then each testing sample is classified to the class with maximum number of votes.

IV. COMPARISON

No.	MDA	SVM	BPNN
1	Converts the gait features into matrix form	Divides the features into support vectors.	Use neural networks for classification.
2	Multiple class classifier	2 class classifier	3class classifier: input, output, hidden layer
3	Use nearest neighbour (NN) or ENN further.	First divide the feature in vectors and then separate them using hyperplane.	Hidden layer is used for intermediate computation.
4	Based on the concept of nearest neighbor	Based on the concept of risk minimization.	Network structure is the main concept.

5	Complex method because of different class classification	Its easy method than remaining two methods.	Less complex than MDA. Its proven that BPNN method give best CCR(correct classification result)
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Table 1: comparison among MDA, SVM, BPNN

V. CONCLUSION

In this paper we conclude that there are different types of approaches used for gait recognition with each has its advantages and disadvantages. We cannot say that one approach provide best result upon other but we will use model based approach and achieve better accuracy result for MDA, BPNN and SVM.

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