International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

Review on Gait Recognition Using Artificial Intelligence

Drishty[1], Jasmeen Gill[2]

[1]Research scholar at RIMT-IET, Mandi Gobindgarh

[2]Assistant Professor at RIMT-IET, Mandi Gobindgarh

Abstract: ***Human identification by means of gait recognition has proved to be a boon to forensic science as well as to medical field. Since it offers the benefit of recognizing a person from a far distance and even with covered face, this technique has changed the vision of community. Gait recognition aims at identifying a person, purely by analysis of the way he or she walks. This article surveys the major milestones in the field of automatic gait recognition. Apart from briefing the major issues, the article also provides description of diverse gait classifiers like artificial neural networks, support vector machines, genetic algorithms, and fuzzy logic.***

Keywords: Gait Recognition, ANN, BPNN, SVM, PCA, ICA

1. Introduction

Recognition of an individual is an important task to the identify people. The identification through biometric is a better way because it associate with individual not with information passing from one place to another. Basically, biometrics is of two types:-

1) Physiological which includes fingerprints, face recognition, iris-scans and hand scans.
2) Behavioral characteristic which includes keystroke-scan, speech recognition and signature.

These both need close interface between user and machine which seems to be difficult sometimes. There are numerous biometric measures which can be used to help derive an individual identity. The Gait recognition is relatively new biometric identification technology which aims to identify people at a distance by the way they walk. This has the advantage of being unobtrusive, difficult to conceal, noninvasive and effective from a distance. The human gait recognition as a new biometric aimed to recognize person via the style of people walking, which contains features of both the physiological or behavioral characteristics of human.

In recent years, there has been an increased attention on effectively identifying individuals for prevention of terrorist attacks. Many biometric technologies have emerged for identifying and verifying individuals by analyzing face, fingerprint, palm print, iris, gait or a combination of these traits. As compared to other biometric methods, gait recognition has many other characteristics, that it is easily understandable. And other advantage of gait recognition is that it can be captured from distance and does not require any feature characteristics of an individual.

Moreover, gait recognition provides great potential for recognition of low-resolution videos, where other biometrics technologies may be invalid because of insufficient pixels to identify the human. The recognition of gait of an individual also recognize with the help of parameters such as classification(distance classifiers) and testing phase which is also be discussed in this paper.

2. Gait Recognition Model

Gait recognition is an emerging biometric technology which could be used from a distance, making it well-suited to identifying perpetrators at a crime scene. But gait recognition technology is not limited to security applications — researchers also envision medical applications for the technology. For example, recognizing changes in walking patterns early on can help to identify conditions such as Parkinson's disease and multiple sclerosis in their earliest stages. There are two main types of gait recognition techniques currently in development.

1) Gait recognition based on the automatic analysis of video imagery, is the more widely studied and attempted of the two. Video samples of the subject's walk are taken and the trajectories of the joints and angles over time are analyzed. A mathematical model of the motion is created, and is subsequently compared against any other samples in order to determine their identity.
2) The second method uses a radar system much like that used by police officers to identify speeding cars. The radar records the *gait cycle* that the various body parts of the subject create as he or she walks. This data is then compared to other samples to identify them.

3. How Gait Recognition Works?

Every model hastheir own step which isto be followed with accurate parameters in a proper sequential order. Similarly, gait recognition has some steps which are shown under fig1.

Step 1 In the gait recognition the individual is asked to walk to capture their gait motion. The gait is then seen by means of video sequence. The videos will be taken from two angles namely 90 and 270 degrees. Thereby, a clear signature of each subject is obtained, and the video is converted into frame by frame pictures stored in an intermediate format (jpg).

Step 2 Image segmentation is the process of partitioning a digital image into multiple segments. The goal of segmentation is to simplify and/or change the representation

of an image into something that is more meaningful and easier to analyze. Here, it used to locate objects and boundaries (lines, curves, etc.) in images to achieve silhouette images. These pictures are loaded by the program for processing. That is to say the indexed image is the input to the segmentation algorithm using appropriate technique.

Step 3 Preprocessing functions involve those operations that are normally required in the main data analysis and extraction of information. After segmenting of the images, each image is being silhouetted as to subtract the background from the original images (look like as negatives of photographs).

Step 4 Classifier is required to determine the utility of classification using minimum distance classifier to achieve the multi-spectral images as image has been processed to put each pixel into a category. The output from these methods can be combined with other computer-based programs.

Step 5 Feature extraction methods are probably the single most important factor in achieving high recognition performance. In image processing and pattern recognition fields, feature extraction (Hough transform, corner detection etc.) is a type of dimension reduction in which the input data is converted into feature sets which extract the data from database.

Step 6 Gait detection is the study of locomotion (human motion) using eye and brain of observers for measuring the body movements such as movement of body, activities of the body and body mechanism which affect the ability to walk. It includes training and testing phase.

Step 7 Once the training and testing phase has been cleared, the person can easily recognize.

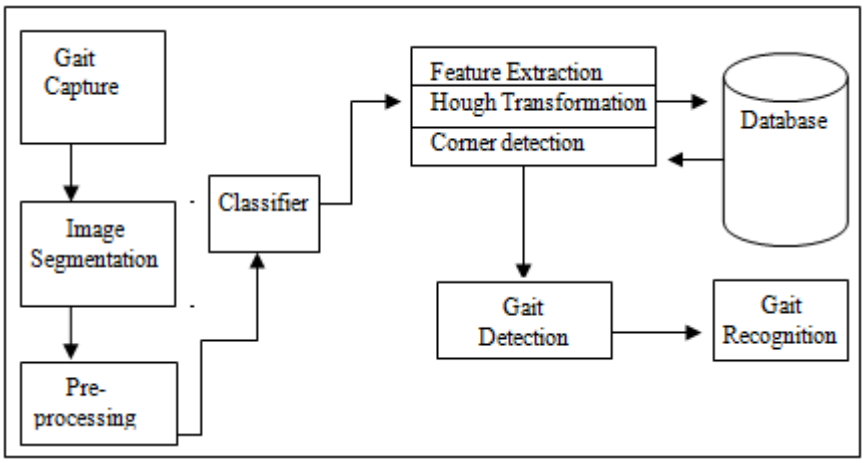

Figure 1: Gait Recognition Model

4. Classification

In classifying features in an image we use the elements of visual interpretation to identify homogeneous groups of pixels which represent various features or land cover classes of interest. Classification is mainly based on three categories which are genetic algorithm, fuzzy theory and artificial neural network.

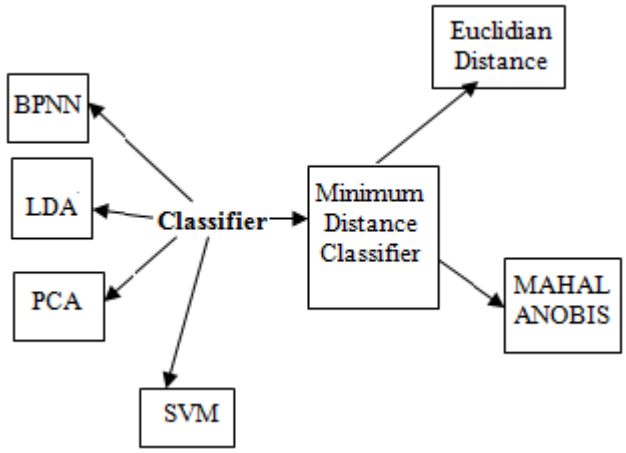

Figure 2: Diagram of Classifiers

Table: Types of different classifiers

S.no.	NAME	DESCRIPTION
1	BPNN(Back propagation Neural Network)	Neural networks give effective results for solving multiple class classification problems. The neural network facilitates gait recognition because of their highly flexible and nonlinear modeling ability. 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. BNPP has an ability to learn how to do tasks based on the data given for training or initial experience. It can create its own organization or representation of the information it receives during learning time.
2	LDA(Linear Discriminant	It is a techniques used for data classification and dimensionality reduction. In PCA, the shape and the location of the original data sets changes when transformed to different spaces whereas LDA doesn't Input Video

	Analysis)	Preprocessing Feature Extraction Recognition Data base of face/gait feature START Load Input Video or Live Video Background Subtraction with GAIT PAL AND PAL ENTROPY Feature Extraction Database is present? Create Database Display the Results Obtained RECOGNITION USING SVM and K-means TECHNIQUE with LDA END change the location but only tries to provide more class reparability and draw decision between the given classes.
3	PCA(Principal component analysis)	It is a mathematical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components. It is widely utilized to reduce the dimensionality of the data. The goal of PCA is to reduce the dimensionality of the data while retaining as much as possible of the variation present in the original dataset. PCA allows us to compute a linear transformation that maps data from a high dimensional space to a lower dimensional space.
4	SVM(Supportvector m/c)	The SVM classifier is widely used in bioinformatics (and other disciplines) due to its highly accurate, able to calculate and process the high-dimensional data such as gene expression and edibility in modeling diverse sources of data .SVMs belong to the general category of kernel methods. A kernel method is an algorithm that depends on the data only through dot-products. When this is the case, the dot product can be replaced by a kernel function which computes a dot product in some possibly high dimensional feature space.
5	MINIMUM DISTANCE CLASSIFIER	1)Euclidean distance or Euclidean metric is thedistance between two points in Euclidean space. With this distance, Euclidean space becomes a metric space. 2) Mahalanobis distance is a measure of the distance between a point P and a distribution D. It is a multi-dimensional generalization of the idea of measuring how many standard deviations away P is from the mean of D. This distance is zero if P is at the mean of D, and grows as P moves away from the mean: along each principal component axis, it measures the number of standard deviations from P to the mean of D. If each of these axes is rescaled to have unit variance, then Mahalanobis distance corresponds to standard Euclidean distance in the transformed space. Mahalanobis distance is thus unit less and scale-invariant, and takes into account the correlations of the data set

5. Detailed Survey

Automated human recognition by gait neural network is represented by Jh-Yoo[13]which provides the idea of recognizing of an individual through gait is used by back-propagation neural network with motion parameters. To extract the gait feature vectors SOTON database has been applied to achieve better results.

Gait recognition based on PCA and LDA is proposed by Q Cheng [14] which describes the combinational method of PCA and LDA to obtain the better results. Spatiotemporal correlation and normalized can be used as parameters to measure two different sequences and k-nearest neighbor classification.

Gender Identification in Human Gait Using Neural Network is represented by Richa Shukla [11] in which the gender recognition is successfully obtained from database include 15 female and 15 male image silhouette. Then computer vision based gender classification is observed with the help of standard deviation, center of mass and height from head to toe using Feed Forward Back Propagation Network with TRAINLM as training functions, LEARNGD as adaptation learning function and MSEREG as performance function.

A Survey of Gait Recognition Approaches Using PCA & ICA is given by M.Pushparani[2]which briefly explains Biometric gait Analysis (i.e. recognizing people from the way they walk) is one of the recent attractive topics in biometric research. It has been receiving wide attention in the area of Biometric. In Gait biometric research there are various gait recognition approaches are available. In this paper, the gait recognition approaches such as “Wavelet Descriptor with ICA”, and “Hough transform with PCA” are compared and discussed.

Fuzzy Principal Component Analysis based GaitRecognition is represented by G. Venkata Narasimhulu [19] which proposes gaitrecognition algorithm based on fuzzy principal component analysis (FPCA) for gait energy image (GEI). Initially, gait energy image is obtained by the original gait sequence is preprocessed. Then, the eigen values and eigenvectors are extracted by fuzzy principal component analysis. Then the eigenvectors are projected into lower-dimensional space and the NN classifier is utilized as feature classification. The experiment is done on CASIA database. The experimental results show that this algorithm obtained higher recognition performance.

Face recognition based on 2DPCA and result comparison with different classifiers is proposed by Shilpi Soni[15]which performance recognition using 2D Principal Component Analysis based dimension reduction technique. 2DPCA is the traditional matrix based feature extraction method and work on the facial image matrixes only in one or two direction. The projection vectors based on Eigen values to compared with Euclidean distance, City Block distance, Mahalanobis and Covariance Similarity measures. Here, the method works with two stages – Feature extraction using 2Dprinciple component analysis and recognition using classifiers. For experiment ORL Face database is used which consist of 10 face images of 40 persons and therefore 400 face images are obtained. This database provides images which vary on the basis of pose, illumination, beard, moustaches, and glasses. 2DPCA with City Block distance is giving best result.

Gait recognition of human using SVM and BPNN classifiers represented by Arun Joshi[1]which explains binary silhouette of a walking person is detected from each frame to extract the features using image processing operation with the help of center of mass, step size length, and cycle length. Also, for training and testing purpose BPNN and SVM technique are used. Here the combination of a background subtraction procedure and a simple correspondence method is used to segment and track spatial silhouettes of a walking figure.

Human Gait Recognition Using Multi-SVM Classifier proposed by Saranya Sasidharan [3] which include system for human gait recognition to use a new patch distribution

feature (PDF). It represent each gait energy image (GEI) as a set of local augmented Gabor features, which concatenate the Gabor features extracted from different scales and different orientations together with the X-Y coordinates. Then with the help of local augmented Gabor features it learn a global Gaussian mixture model (GMM) from all the gallery GEIs; to expressed as the normalized parameters of an image-specific GMM adapted from the global GMM. To enhance the accuracy and to reduce the time complexity of this system for achieving a new classification method using multi-SVM classifier which combines with this method?

A Gait Classification System using Optical Flow Features proposed by Chih-Chang Yu [4] in which he proposes a system using optical flow features to recognize human identity. It doesn't consider any shape feature but only adopt optical flow information. By using a Gaussian model the moving object is detected to locate from the flow field. Further, each subject is identified through the established histogram with the help of optical flow features. The proposed system applies and compares three different kinds of optical flow extraction algorithms. Various experiments with two different databases analyzed and discussed the feasibility of the approach.

Human Identification through Gait Recognition is presented by Aliya Amirzhanova [12] which briefly explains the whole concept of gait recognition with the effects of covariates such as change in viewing angle, change in shoe, walking surface, carrying conditions, and elapsed time that make gait recognition problem more challenging for research. Here, the work is done by model-free approach and apply Machine Learning techniques to the gait recognition application system and find an optimal solution for the identification, while the dataset is robust to covariates with PCA.

On Reducing the Effect of Covariate Factors in Gait Recognition: A Classifier Ensemble Method is represented by Y. Guan [9] which deals with the factors of covariate such as carrying condition, clothing, walking surface, etc. Sometimes it is difficult to train one fixed classifier that is robust to a large number of different covariates. To solve this problem, a classifier ensemble method has been proposed which is based on the random subspace Method (RSM) and majority voting (MV). With the further addition of two strategies, i.e., local enhancing (LE) and hybrid decision-level fusion (HDF) to suppress the ratio of false votes to true votes (before MV). The performance of this approach is competitive against the most challenging covariates like clothing, walking surface, and elapsed time. The method is performed on the USF dataset and OU-ISIR-B dataset, which provides much higher performance than other state-of-the-art algorithms.

Gait recognition based on gait energy image and linear discriminant analysis is proposed by X Hongye [16] which processes on silhouette and applies gait energy image method with linear discriminant analysis for achieving low rate of human gait recognition and other issues. To extract the gait feature PCA AND LDA are used with nearest neighbor classifier for classification and identification on CASIA gait database.

6. Conclusion

This paper has described various methods of identifying a human being from body silhouette and gait. The general model followed by various researchers for gait based recognition has been provided in context of person authentication. It was found during the survey that automatic gait recognition has been done using various classifiers, namely, artificial neural networks, support vector machines, genetic algorithms, and fuzzy logic. Since hybridizing the classifiers may lead to better performance, so, it is concluded that effective hybrid systems can be utilized to develop high potential gait recognition systems.

References

[1] Arun Joshi , Mr. Shashi Bhushan , Ms. Jaspreet Kaur," GAIT RECOGNITION OF HUMAN USING SVM AND BPNN CLASSIFIERS", International Journal of Computer Science and Mobile Computing, Vol. 3 issue 1, pp. 281-290.2014

[2] M.Pushparani & D.Sasikala," A Survey of Gait Recognition Approaches Using PCA & ICA" Global Journal of Computer Science and Technology, Volume 12 Issue 10,pp. 7-10, 2012.

[3] Saranya Sasidharan , Smitha K , Minu Thomas," Human Gait Recognition Using Multisvm Classifier" , Volume 3 Issue 11, pp. 1907-1913, 2014

[4] Chih-chang yu , chien-hung cheng and kuo-chin fan," A Gait Classification System using Optical Flow Features" , Journal of information science and engineering 30, pp.179-193 , 2014.

[5] Dong Xu, Yi Huang, Zinan Zeng, and Xinxing Xu, "Human Gait Recognition Using Patch Distribution Feature and Locality-Constrained Group Sparse Representation", IEEE Transactions on image Processing, vol. 21, no. 1, Jan 2012

[6] P. Chattopadhyay,S. Sural , J. Mukherjee, "Frontal Gait Recognition From Incomplete Sequences Using RGB-D Camera", IEEE Transactions on Information Forensics and Security vol.9,2014,pp. 1843 – 1856.

[7] G. Rogez ,J. Rihan ; J. J. Guerrero ; C. Orrite, "Monocular 3-D Gait Tracking in Surveillance Scenes" IEEE Transactions on Cybernetics (Volume:44 , Issue: 6),2013,pp. 894 – 909.

[8] M. S. Islam, A. Matin; J. Paul; M. Rokanujjaman, "A new effective part selection approach for part-based gait recognition"IEEE International Conference on Computer and Information Technology, 2014, pp. 181 – 184.

[9] Y. Guan ,C. T. Li ; F. Roli, "On Reducing the Effect of Covariate Factors in Gait Recognition: A Classifier Ensemble Method" IEEE Transactions on Pattern Analysis and Machine Intelligence (Volume:37 , Issue: 7) ,2014,pp. 1521 – 1528.

[10] M. Derlatka, M. Bogdan, "Ensemble kNN classifiers for human gait recognition based on ground reaction forces"IEEE International Conference onHuman System Interactions, 2015, pp. 88 – 93.

[11] Richa Shukla, "Gender Identification in Human Gait Using Neural Network" I.J.Modern Education and Computer Science, 2012, pp.70-75.

[12] Aliya Amirzhanova "Human Identification through Gait Recognition" Warwick University , bcur.org,2014
[13] Jang-Hee Yoo "Automated human recognition by gait neural network" IEEEImage Processing Theory, Tools and Applications, 2008. IPTA 2008
[14] Qiong Cheng "Gait recognition based on PCA and LDA" Academy Publisher 2009
[15] Shilpi Soni "Face recognition based on 2DPCA and result comparison with different classifiers" International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, Issue 10, 2013
[16] Xue Hongye "Gait recognition based on gait energy image and linear discriminant analysis" 2015 IEEE International Conference on signal processing , communication and computing
[17] R.Femila Goldy "Genetic algorithm for self-occlusion gait recognition" International Journal of Advanced Research in Computer and Communication Engineering Vol. 1, Issue 10, 2012
[18] Md.Shariful Islam "Extraction of Shape-Invariant Gait Features for Human Gait Recognition" International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, No.12, 2013
[19] G. Venkata Narasimhulu "Fuzzy principal component analysis based on gait recognition" International Journal of Advanced Research in Computer Science and Information Technologies Vol. 3, 2012