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Genetic Algorithm Optimized ANN Technique for Gait Recognition

Saima Farooq*, Simranjit Kaur**, Satnam Singh Dub ***

*(Department of ECE, IKGPTU/SSCET, and Badhani)

** (Department of ECE, IKGPTU/SSCET, and Badhani)

*** (Department of ECE, IKGPTU/SSCET, and Badhani)

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Abstract:

Gait recognition aims essentially to address this problem by recognizing people based on the way they walk. The study of human gait has been increased extensive interests in various fields such as clinical analysis, computer animation, athletic performance analysis, visual surveillance, robotics and biometrics. Gait Biometrics is a new powerful tool for reliable human identification and it makes use of human physiology characteristics such as face, iris, finger prints and hand geometry for identification. The Genetic Algorithm based optimization combines computer vision, pattern recognition, statistical inference, and optics. This work employs a gait recognition process with optimization of binary silhouette-based input images using Genetic Algorithm (GA) and Artificial Neural Network (ANN) based recognition i.e. a GA-NN gait feature optimization system. The performance of the recognition method depends significantly on the quality of the extracted and GA-optimized binary silhouettes. The system is implemented in MATLAB.

Keywords — **Genetic Algorithm, ANN, Gait Recognition, MATLAB, CASIA**

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I. INTRODUCTION

The Genetic algorithms are an approach to optimization and learning based loosely on principles of biological evolution, these are simple to construct, and its implementation does not require a large amount of storage, making them a sufficient choice for an optimization problems. Optimal scheduling is a nonlinear problem that cannot be solved easily yet, a GA could serve to find a decent solution in a limited amount of time Genetic algorithms are inspired by the Darwin's theory about the evolution **"survival of fittest"**, it search the solution space of a function through the use of simulated evolution (survival of the fittest) strategy. Generally the fittest individuals of any population have greater chance to reproduce and survive, to the next generation thus it contribute to improving successive generations However inferior individuals can by chance survive and also reproduce.

Genetic algorithms have been shown to solve linear and nonlinear problems by exploring all regions of the state space and exponentially exploiting promising areas through the application of mutation, crossover and selection operations to individuals in the population. The development of new software technology and the new software environments (e.g. MATLAB) provide the platform to solving difficult problems in real time. It integrates numerical analysis, matrix computation and graphics in an easy to use environment. The figure below shows a simple flow chart of genetic algorithm [1] [2].

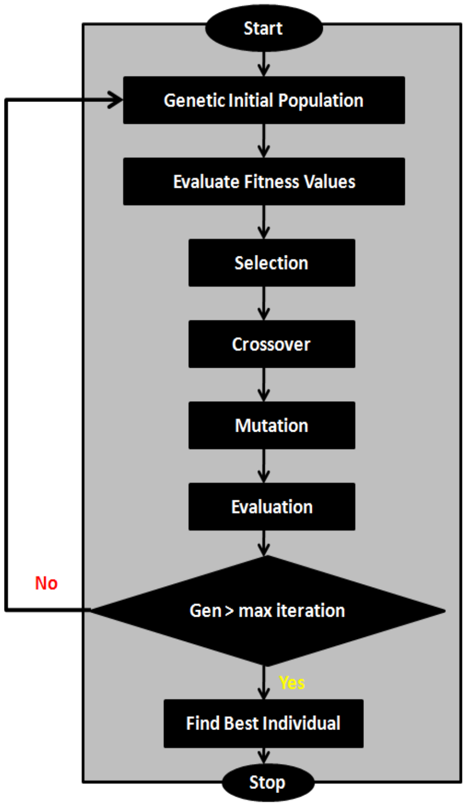

Fig.1 Flowchart Depicting Simple Genetic Algorithm [1]

II. LITERATURE REVIEW

Jiwen Lu et. al. present a simple method for gait recognition on the basis of human silhouettes using multiple feature representations and Independent Component Analysis (ICA) has been proposed by Jiwen Lu and Erhu Zhang. In this they have offered a gait recognition method by fusing the multiple features and views on the basis of Genetic Fuzzy Support Vector Machine (GFSVM). Their proposed method is just recognizing human through three view fusion, i.e. perpendicularly, along and oblique with the direction of human walking, But in the real environment, the angle between the walker's direction and the camera is unpredictable. A useful experiment which can determine the sensitivity of the features from different views ought to be put forward and more multiple views fusion should be performed which can provide us with conviction results [3].

Dacheng Tao et. al. have focused on the representation of appearance-based models for human gait sequences. Two important novel representation models are offered, Gabor gait and Tensor gait. Some extensions of them are being made so as to improve upon their abilities for the recognition tasks. In their paper, three different approaches using Gabor functions have been developed to reduce the computational complexities in calculating the representation, in training classifiers, and in testing [4].

Yang et al. have made use of the variation analysis to acquire the dynamic region in Gait Energy Image (GEI), which reflects the walking manner of an individual. On the basis of this analysis, a dynamics weight mask is built in order to improve the dynamic region and suppress the noises on the unimportant regions. As a result a representation called enhanced GEI (EGEI) is obtained. Then, it is represented in low dimensional subspace by Gabor-based discriminative common vectors analysis [5].

Jianyi Liu et. al. have proposed a method called silhouette quality quantification (SQQ) to evaluate the quality of silhouette sequences. The quality of the sequence is examined by the SQQ, which analyzes on the basis of the 1D foreground-sum signal modelling as well as signal processing techniques. A common enhancement framework named silhouette quality weighting (SQW) is designed to enhance most of the current gait recognition algorithms by considering sequence quality and it can be considered as an immediate application of SQQ [6].

Xiaoli Zhou et. al. have presented an approach that utilizes and integrates information from side face and gait at the feature level. The features of face and gait are obtained separately using principal component analysis (PCA) from enhanced side face image (ESFI) and gait energy image (GEI), respectively. Multiple discriminant analysis (MDA) has been made use on the concatenated features of face and gait to attain the discriminating synthetic features. Their process allows the generation of better features and also reduces the curse of dimensionality. It is illustrated from their experimental results that the synthetic features, encoding both sides face and gait information carry more discriminating power when compared to the individual biometrics features [7].

Seungkyu Lee et. al. propose a shape variation-based frieze pattern representation as well as a symmetry map representation for gaits that capture the intra and inter-shape variations respectively is proposed by Seungkyu Lee et al. It works under the assumption that combining features into gait recognition improves recognition performance particularly, when there is a serious silhouette appearance variation between gallery as well as probe sequences. Their test results using only key frames have shown how the shape component contributes to gait recognition [8].

A. Kale et. al. present a view-based approach in order to identify humans from their gait is proposed by Kale *et al*. Two distinct image features have been taken into account: the width of the outer contour of the binary silhouette of the walking person and the entire binary silhouette itself. The first method is referred to as the indirect approach in which the high-dimensional image feature is transformed to a lower dimensional space by means of generating the frame to exemplar (FED) distance. The gait information in the FED vector sequences is captured in a hidden Markov model (HMM) for compact and effective gait representation and recognition. In the second method, direct approach, works with the feature vector directly (as opposed to computing the FED) and trains the HMM [9].

D. Cunado et. al. publish that a model-based moving feature extraction analysis is presented by Cunado *et al*. It automatically extracts and explains human gait for recognition. First, the gait signature is extracted directly using the Fourier series to depict the motion of the upper leg and then temporal evidence gathering techniques were applied in order to extract the moving model from a sequence of images. The potential performance benefits even in the presence of noise are highlighted by the results of the simulation. Classification makes use of the k-nearest neighbor rule applied to the Fourier components of the motion of the upper leg. It is illustrated from the experimental analysis that an enhanced classification rate is provided by the phase-weighted Fourier magnitude information when compared to the usage of the magnitude information [10].

III. METHODOLOGY

An identification system recognizes an individual by searching the template database for a match. However, a typical human gait identification system can be divided into ***training and recognition*** modules.

The **training module** is responsible for making a trained database to identify a person. During the training phase, the gait motion video is created by adding image frame sequence. The feature extraction generates Gait feature sequences which are again sorted into optimized feature population using genetic algorithms. Figure 3.1 shows the block diagram of the proposed GA-NN Optimized gait identification system. To train and recognize the gait, a genetic algorithm optimized neural network is used. The architecture of a typical biometric system also consists of same components.

The step length of the person is calculated by estimating extrema points of the silhouette of the person. Extreme points of the silhouette are shown in Fig. 2.

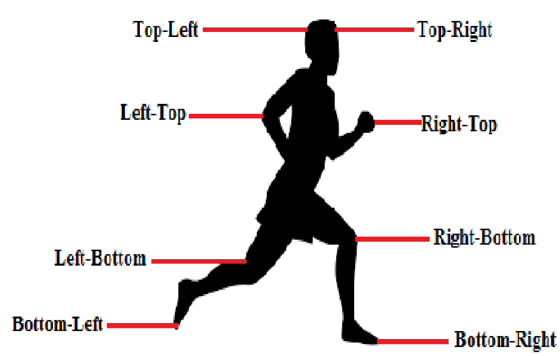

Fig.2. Extrema Points

Two extrema points are used for calculating the step distance which is bottom left and bottom right. These points are found by scanning each and every pixel from the bottom and right side of the frame.

The procedure involves moving upward and sideward while scanning first black pixel from the bottom as well as right side, which will define the bottom rightmost extreme point of the silhouette. Similarly, find the bottom leftmost extreme point. Then calculate the Euclidean Distance; between the point which amounts to the step length of the person. The proposed framework is illustrated in figure below.

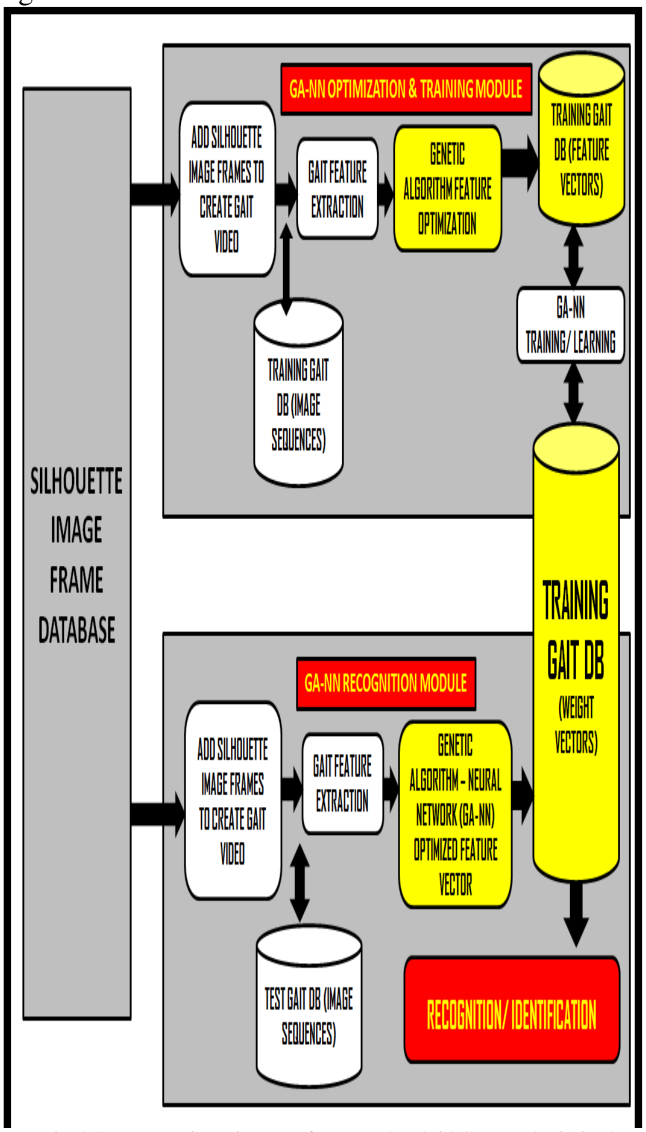

Fig. 3 System Design Diagram of Proposed Hybrid GA-NN Optimized Human Gait Recognition

The feature extraction and GA optimization processes generate a more compact and expressive representation of features such as gait feature vector. Features encoded are optimized using genetic algorithms for improving recognition rates. Firstly the feature optimization is done using GA. The method incorporates fitness function for feature reduction. In the algorithm, fitness function works to find the best possible solution for the image and stores the value for further comparison and findings. Various functions like mutation function, crossover function etc helps to find the best possible solution of the image. The GA Optimized feature vectors are followed up by ANN training thus creating a hybrid GA-NN structure which trains the system by a pattern recognition algorithm for each person and the trained results will be stored in a gait identification system's database.

In addition, **the recognition module** is responsible for identifying the person. During the recognition phase, the gait motion of the person to be identified is given as input which converts into the same sort of feature vector as in training. After that, the feature vector will be optimized using genetic algorithm and will be submitted to the recognizer, which automatically computes it against the trained database to determine the identity of the individual.

IV. CONCLUSION

This paper has presents an GANN Optimized Gait Recognition system, which was enhanced using Genetic Algorithm Optimization for feature selection resulting is improved recognition time. The system is to be implemented in MATLAB and tested using CASIA Gait Database.

REFERENCES

[1] Kharate G. K., Satone, Manisha P, "Genetic Algorithm to improve Recognition Performance", International Journal on Electrical Engineering and Informatics (IJEEI) 2017, 6, No. 1, pp.39-52.
[2] L. Wang, W.M. Hu, and T.N. Tan, "Recent Developments in Human Motion Analysis", Pattern Recognition, Vol. 36, No. 3, pp. 585-601, 2003.
[3] Jiwen Lu, Erhu Zhang, "Gait recognition for human identification based on ICA and fuzzy SVM through multiple views fusion", Pattern Recognition Letters, Vol. 28, pp. 2401–2411, 2016.
[4] Dacheng Tao, Xuelong Li, Xindong Wu, and Stephen J. Maybank, "General Tensor Discriminant Analysis and Gabor Features for Gait Recognition", IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 29, No. 10, pp. 1700-1715, October 2007.

[5] X. Yang, Y. Zhou, T. Zhang, G. Shu, J. Yang, “Gait Recognition Based on Dynamic Region Analysis,” Signal Processing, Vol. 88, No. 9, pp. 2350–2356, September 2008.

[6] Jianyi Liu, Nanning Zheng, and Lei Xiong, "Silhouette quality quantification for gait sequence analysis ad recognition", Signal Processing, Vol. 89, No. 7, pp. 1417-1427, July 2009.

[7] Xiaoli Zhou and Bir Bhanu, "Feature fusion of side face and gait for video-based human identification", Pattern Recognition, Part Special issue: Feature Generation and Machine Learning.

[8] Seungkyu Lee, Yanxi Liu, Collins, R., "Shape Variation-Based Frieze Pattern for Robust Gait Recognition", IEEE Conference on Computer Vision and Pattern Recognition, CVPR '07, pp. 1-8, 17-22 June 2007.

[9] [9] A. Kale, A. Sundaresan, A. N. Rajagopalan, N. P. Cuntoor, A. K. Roy–Chowdhury, V. Kruger, and R. Chellappa, “Identification of Humans using Gait,” IEEE Trans. Image Processing, vol. 13, no. 9, pp. 1,163–1,173, 2004.

[10] D. Cunado, M. Nixon, and J. Carter, “Automatic Extraction and Description of Human Gait Models for Recognition Purposes,” Computer Vision and Image Understanding, vol. 90, no. 1, pp. 1–41, 2003.

