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Automatic Gait Recognition using Hybrid Neural Network

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GJCST-E Classification: *F.1.1*

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Automatic Gait Recognition using Hybrid Neural Network

Drishty [α] & Jasmeen Gil [σ]

Abstract- Gait is a biometric trait that has been used for user authentication or verification on the basis of various attributes of gait. Gait of an individual get affected due to variation in mood, emotions, age and weight, due to these variation a perfect model is not possible that can be developed so that these all factors can be eliminated. In the proposed work, CASIA dataset has been used as standard dataset. This dataset contains samples of 16 different individuals that have been taken at 0, 45, 90 degrees of angles. Afterwards, silhouette images have been taken for feature extraction from the gait samples using variable2-dimenssiaonl principal component analysis with neural network classifier.

Along with this, validation of the proposed work has been done using two performance evaluation parameters, namely, FAR and FRR through confusion matrix.

Keywords: gait recognition, VI-2DPCA, FAR, FRR.

I. Introduction

a) Gait Recognition

Gait recognition is a developing biometric innovation which includes individuals being distinguished absolutely through the investigation of the way they walk. While exploration is still in progress, it has pulled in enthusiasm as a technique for recognizable proof on the grounds that it is non-obtrusive and does not oblige the subject's collaboration. Step distinguishment could likewise be utilized from a separation, making it appropriate to recognizing culprits at a wrongdoing scene. Yet stride distinguishment innovation is not restricted to security applications –analysts additionally imagine medicinal applications for the innovation. For instance, perceiving changes in strolling examples right off the bat can help to recognize conditions, for example, Parkinson's infection and numerous sclerosis in their most punctual stages.

b) Types of Gait Reorganization

i. *Automatic analysis of video imagery*

This is the all the more generally examined and endeavored of the two. Feature examples of the subject's walk are taken and the directions of the joints and edges over the long haul are examined. A numerical model of the movement is made, and is therefore looked at against whatever other examples to focus their character.

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ii. *Radar system*

This is utilized by cops to recognize speeding autos. The radar records the step cycle that the different body parts of the subject make as he or she strolls. This information is then contrasted with different examples to distinguish them.

Endeavors are being made to make stride distinguishment as exact and usable as would be prudent, keeping in mind it might never be as solid as different biometrics, for example, unique mark or iris distinguishment, it is anticipated that walk distinguishment innovation will be discharged in a useful state inside the following five years, and will be utilized as a part of conjunction with different biometrics as a technique for ID and verification.

c) Gait Cycle

A Gait Cycle is the time period or succession of occasions or developments amid motion in which one foot contacts the ground to when that same foot again contacts the ground, and includes forward impetus of the inside of gravity of human body comprising exchange crooked snippets of distinctive fragments of the body with minimum consumption of vitality. A solitary step cycle is otherwise called a stride.

i. *Phases of Gait Cycle*

- Stance Phase, the phase during which the foot remains in contact with the ground.
- Swing Phase, the phase during which the foot is not in contact with the ground.

A more detailed classification of gait recognizes six phase.

1. Heel Strike
2. Foot Flat
3. Mid-Stance
4. Heel-Off
5. Toe-Off

ii. *Components of Gait Cycle*

Stance Phase: The stance stage is that piece of a walk cycle amid which the foot stays in contact with the ground. For investigating walk cycle one foot is taken as reference and the developments of the reference foot are contemplated. It constitutes of 60 percent of the step cycle. In stance stage the reference foot experiences five developments.

- Initial Contact (Heel Strike): In initial contact, the heel is the first bone of the reference foot to touch the ground.

- Loading Response(Foot Flat):In loading respo- nse phase, the weight is transferred onto the referenced leg. It is important for weight-bearing, shock-absorption and forward progression.
- Mid Stance: It involves alignment and balancing of body weight on the reference foot.
- Terminal Stance: In this phase the heel of reference foot rises while the its toe is still in contact with the ground.
- Toe Off (Pre Swing): In this phase, the toe of reference foot rises and swings in air. This is the beginning of the swing phase of the gait cycle.

II. Problem Formulation

From the last few decades, technology has been increased day by day but some problems are still there to be solved such as to recognize an individual by his/her walk perfectly.

Nowadays, automated visual surveillance has been under a big interest. This is mainly due to the vital purpose to provide a safe environment. In result there is a rapid increase in synchronized closed-circuit television (CCTV) cameras, which require an intelligent approach. Thus, these ideal systems should be able to recognize the identity of the subject if they detect a suspicious behavior. Basically, such systems, having monitored the process, should be able to give a warning before the actual event happens, and be able to identify the subject from the crowd immediately. The gait recognition is the most suitable biometric measure for these reasons. Also its unobtrusiveness feature that does not require observed subjects' cooperation makes gait recognition more attractive to study for security reasons. Thus, the gait recognition will be a very useful and powerful tool to identify perpetrators. Apart from this, it is not limited to security applications, a lot of medical applications are based on this technique. For example, the main objective in medicine linked with gate is to identify walking conditions to treat pathologically abnormal patience, to identify different neuromuscular disorders, such as multiple sclerosis and Parkinson's disease, in their early stage. Moreover, gait analysis is in wide use in sports biomechanics applications. It helps people involved in sports to improve performance and reduce injury risks by tracking the walking and running process and identifying posture or movement-related problems that might occur. Also, research on gait recognition is a very challenging task, as there are different gait covariates and variations that can affect the performance of data which depend upon some factors such as mood of a person, fast/slow walk, shoe type, tight/loose cloth etc.

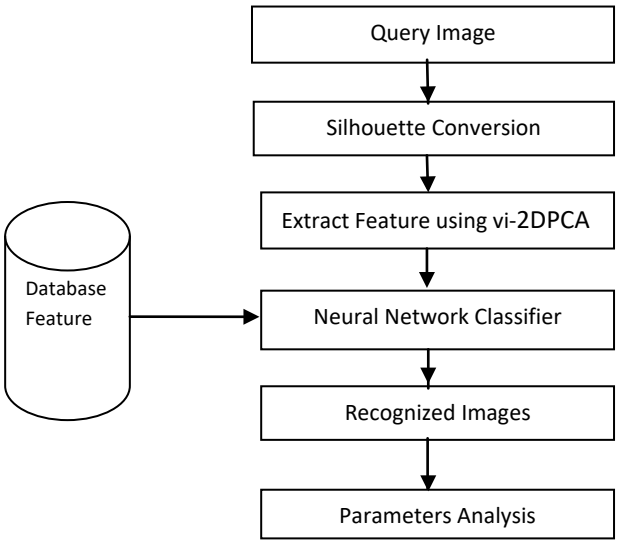
So, there is a need of automatic gait recognition system which will help to solve such issues.

Hence, the motivation of this research work is to develop an automatic gait recognition system which will be based on vi-2DPCA and neural networks.

III. Methodology

In the process of Gait Recognition, different gait dataset has been used for Gait Recognition process. CASIA-A dataset has been used that contain 16 different persons samples with left and right gait samples with different angles that are 0°, 45° and 90°.

In this research work, training and testing gait samples has been used for Gait Recognition.



Step1. In this processing, different frames from video has been extracted and these frames have been used for silhouette conversion by removing back ground from the frames of the video and these frames have been used for silhouette conversion by removing back ground from the frames of the video.

Step2. After silhouette conversion, the region area boundaries have been computed from silhouette samples.

Step3. After computing the left and right region from the gait sample, the Variable Two Dimensional Principal Component Analysis (V 2-DPCA) has been implemented so that feature matrix from a particular gait cycle can be computed.V2DPCA is used for feature calculation that uses a variable factor with Eigen values of the feature matrix where feature matrix has been computed for different gait cycles.

Step4. Neural network classifier is used to Weightings are applied to the signals passing from one unit to another, and it is these weightings which are tuned in the training phase to adapt a neural network to the particular problem at hand. This is the learning phase. Neural networks have found application in a wide variety of problems. After loading the Training set and testing samples, processing of Training samples and Testing samples is performed.

Gait Recognition using vi-2DPCA and Artificial Neural Networks with the existing system i.e. fuzzy logic based model, and then analyze parameter accuracy for FAR & FRR parameters as a performance matrices for the performance evaluation.

Finally, Recognized sample is obtained.

IV. Results And Discussions

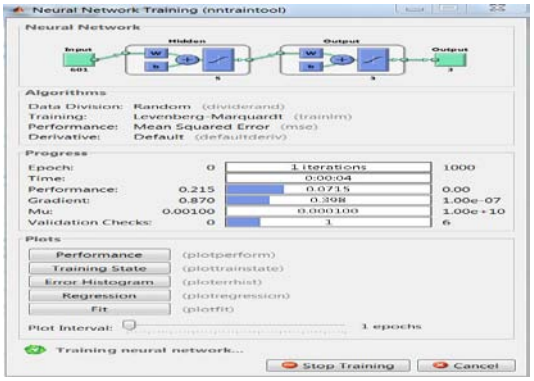


Figure 5.1: GUI for Accuracy Computation of Gait Recognition System

Figure 5.1 represents the Graphic User Interface designed to the accuracy computation of Gait Recognition System. The various buttons, axes and popup menus have been used for designing of the final work.

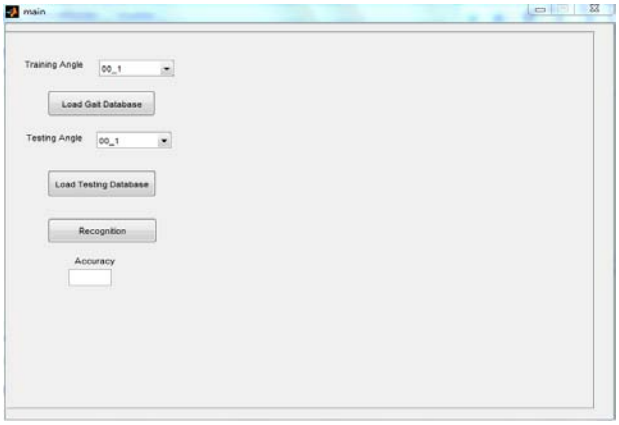


Figure 5.2: Training angel & testing angle

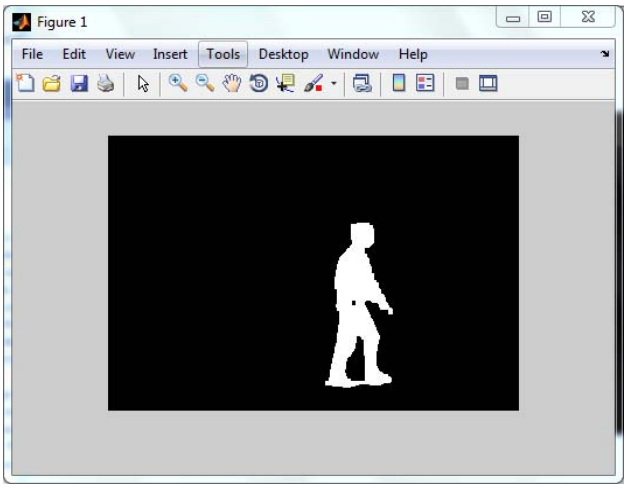


Figure 5.3: Accuracy computation for different training and testing features

Figure 5.3 represents the accuracy computation for different training and testing features. In this thesis work, the accuracy has been measured at 0°, 45° and 90° angles of gait. In the Gait Recognition, different angles data has been used for Gait Recognition. The samples have been used for training of Gait Recognition system and features have been computed. After this, testing samples of same angles has been used for Gait Recognition and the accuracy of final work has to be computed.

Figure 5.4: Representation of Gait Cycle at 45° angle

Figure 5.5: Representation of Gait Cycle at 90° angle

All the above figures represent gait samples at 0°, 45° and 90°. These samples have been taken at different time instances. The 4 samples are available for each degree angle. In the above figures, the gait cycle changes due to variation in the angles.

Table 5.1 Parameters Table for Final System

Gait angle	FAR	FRR	Accuracy rate of proposed system	Accuracy rate of existing system
0°	0%	2%	97.7 %	62.5 %
45°	14%	4%	86 %	50 %
90°	18%	20%	82%	62.5 %

Table 5.1 represents accuracy table for Gait Recognition System. On the basis of these parameters, performance of different approaches can be evaluated. These parameters are essential for performance evaluation of the final system.

V. Conclusion

In this paper, the gait of an individual is recognized through his walk with hybridization of techniques. Gait of an individual get affected due to variation in mood, emotions, age and weight, due to these variation a perfect model is not possible that can be developed so that these all factors can be eliminated. The present research works on the development of an automatic gait recognition system that can be used to provide better recognition accuracy under different circumstances. In the proposed work, CASIA dataset has been used as standard dataset. This dataset contains samples of 16 different individuals that have been taken at 0, 45, 90 degrees of angles. Afterwards, silhouette images have been taken for feature extraction from the gait samples. Gait samples have been loaded to the system and features have been computed using variable2-dimenssiaonl principal component analysis. These approaches compute the covariance matrix and mean matric from the image sample and the features have been computed from these gait sample. These features have been taken as input to the neural networks for recognition. In the neural network architecture, 5 hidden layers have been used for generation and movement of weight age to different samples. These neurons have been used to classify different samples in different classes so that recognition of gait samples can be easily done.

On the basis of these parameters and techniques it is concluded that this work has been proposed for future work. Hence, the automated gait recognition using hybrid neural network can be used as a biometric recognition applications.

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