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Gait Recognition System Using V2dpca with Manhattan Distance Calssifier

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Abstract- Gait Recognition is the main field of Biometric Authentication System. Gait is a particular way of moving on foot. In this, various approaches has been utilized for the process of Gait Recognition. On the basis of energy and enthalpy level available in different images, these approaches utilized feature extraction from silhouette. Energy and enthalpy does not provide accurate information about gait. Gait Recognition has main issue of the proper feature extraction due to variance in a gait cycle. To remove this issue in the field of Gait Recognition process, the approach has to utilize which extract optimal feature for Gait Recognition process. For the purpose of overcoming this issue , Variable 2-DPCA and Manhattan distance classifier is used.

Keywords- Gait Recognition, Gait Cycle, V2-DPCA, FAR and FRR.

I. INTRODUCTION

Gait Recognition is a developing biometric feature which has attracted many researchers in recent years. While research about the gait recognition is still underway, but it has attracted interest because it offers ability of distance recognition and does not require user's cooperation. Gait is a person's mode of walking or moving on foot. Gait Recognition is a method to identify or verify persons by observing the way in which they walk. Human gait recognition is nothing but identifying a person from its walking style. The first Gait Recognition approach was developed by Niyogi and Adelson in 1994. Gait Recognition is useful to identifying criminals at a crime scene. Gait Recognition is not only useful in security applications; it is also useful for low resolution images. Yet stride distinguishment innovation is not restricted to security applications – analysts additionally imagine medicinal applications for the innovation . Human Gait Detection works from the observation that a person's Gait Cycle is unique and can be used for human identification. Gait Recognition approach identify the gait of the authorized person by comparing it with the stored sequence in the database. Gait Recognition approach will identify the unauthorized person by comparing it with stored sequence in the database and will recognize the unauthorized person .

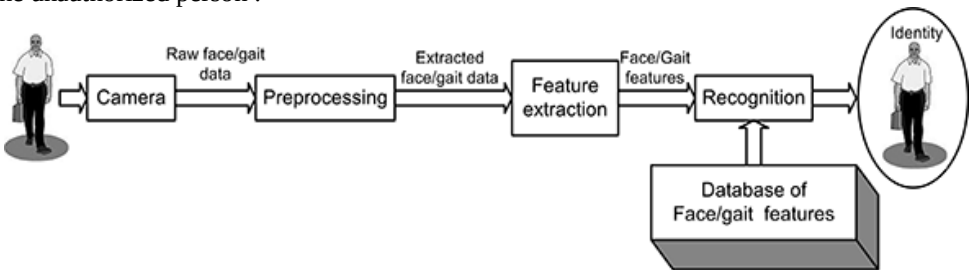

Figure 1: Gait Recognition

For Example:- In bank , only few authorized people are allowed to enter into lockers room, here Gait Recognition approach is used .Using Gait Recognition, gait sequences of those authorized people are stored in bank's database, thus when an unauthorized tries to enter into the lockers room, the person's gait sequences will not match with stored gait sequences and alarm system will be activated for any action.

II. TYPES OF GAIT RECOGNITION

A. Automatic Analysis of Video Imagery

Gait Recognition based on the Automatic Analysis of Video Imagery is more widely examined and studied. 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 subsequently compared against any other samples in order to identify their identity

B. Radar System

Gait Recognition based on the Radar System 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

II. GAIT CYCLE

Gait Cycle is also sometimes known as Walking 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.

III. STEPS IN GAIT CYCLE

There are various steps in the Gait Cycle and these steps are:-

- Registration and activation of the gait command within the central nervous system
- Transmission of the gait systems to the peripheral nervous system
- Contraction of muscles
- Generation of several forces
- Regulation of joint forces and moments across synovial joints and skeletal segments
- Generation of ground reaction forces.

IV. COMPONENTS OF GAIT CYCLE

There are two components of Gait Cycle and these are:-

A. Stance Phase .

B. Swing Phase.

The Stance phase constitutes 60% of a single gait cycle while the swing phase constitutes only 40% of a single Gait Cycle as shown in the below Figure 2 . Gait Cycle involves a combination of both open-chain and close-chain activities.

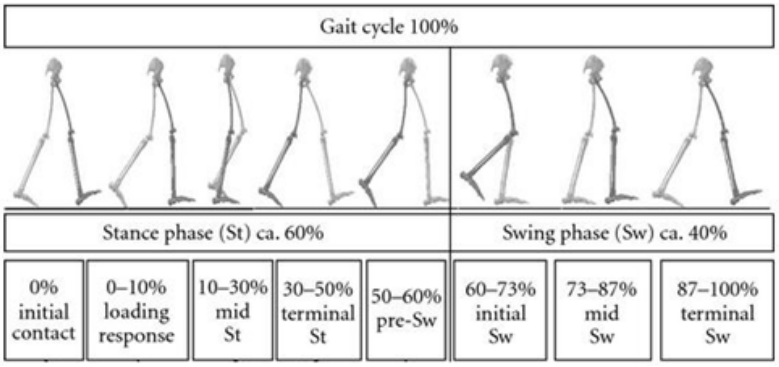

Figure 2: Components Of Gait Cycle

A. Stance Phase

The Stance Phase is that piece of a walk cycle during 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 60 % of the step cycle. In stance stage the reference foot experiences five developments.

1) Initial Contact
2) Loading Response
3) Mid Stance
4) Terminal Stance
5) Toe Off

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

2) Loading Response (Foot Flat): In Loading Response phase, the weight is transferred onto the referenced leg. It is important for weight-bearing, shock-absorption and forward progression.

3) Mid Stance: -It involves alignment and balancing of body weight on the reference foot.

4) Terminal Stance: -In this phase the heel of reference foot rises while the its toe is still in contact with the ground.

5) 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.

B. Swing Phase

The Swing phase is that part of the gait cycle during which the reference foot is not in contact with the ground and swings in the air. It constitutes about 40% of gait cycle. It has three parts:

1) Initial Swing
2) Mid Swing
3) Terminal Swing

1) Initial Swing: - This phase occupies about 60-73 % periods of a single gait cycle. This phase begins when the toe leaves the ground and until maximum knee bending occurs.

2) Mid Swing: - This phase occupies about 73-87 % periods of a gait cycle. Mid swing occurs approximately when the extremity passes directly beneath the body.

3) Terminal Swing: - This phase occupies about 5-100 % periods of a gait cycle. Terminal swing begins at the end of the mid swing and terminates when the same foot touches the floor.

V. OVERVIEW OF FINAL APPROACH

Gait Recognition is a Biometric Authentication System. In the process of Gait Recognition, different gait dataset has been used for Gait Recognition process. In this Final approach , we use two datasets and these two datasets are:-

I. First dataset is Video Samples dataset in which video samples have been used directly for Gait Recognition system. From these videos, frames has been extracted and background has been subtracted so that silhouette can be extracted.

II. Second dataset is provided by CASIA dataset that contain different gait cycle of different persons. This dataset contains silhouette images of the persons at 0°, 45° and 90° angles.

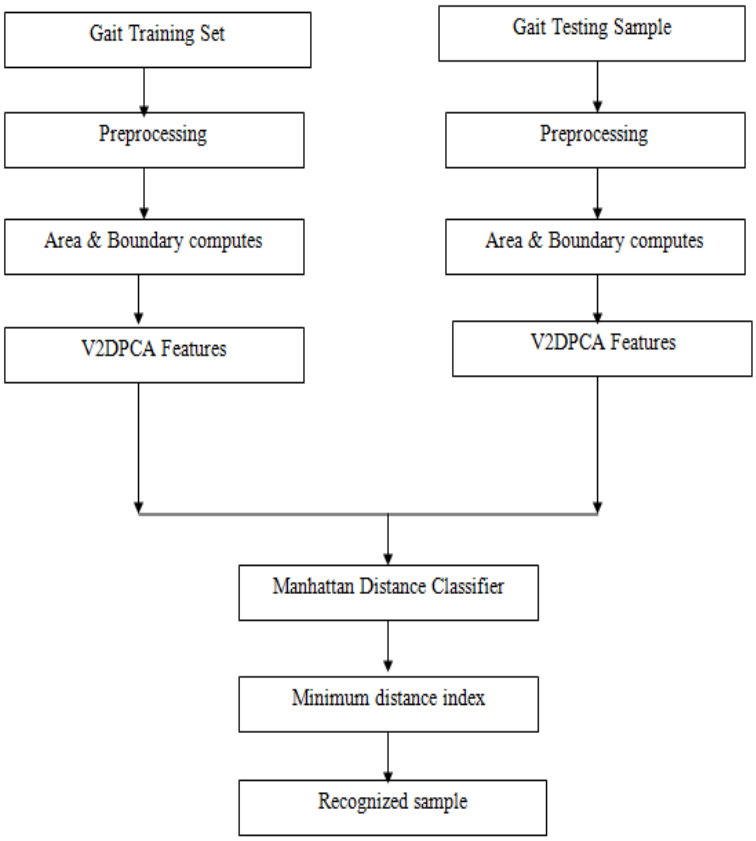

Figure 3: Overview of Final Work

- In this thesis work, Gait Training Set and Testing sample has been used for Gait Recognition.
- After loading the Training set and Testing samples, processing of Training set and Testing samples is performed. 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.
- After silhouette conversion, the region area boundaries have been computed from silhouette samples.
- After computing the left and right region from the gait image, 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.
- After V2DPCA , Manhattan Distance classifier is used to compute the distance between Training set and Testing samples. The minimum distance between Training and Testing samples is the maximum matched cycle.

In this thesis work, we use two approaches to recognize the different gait features of authorized and unauthorized persons and these approaches are:-

A. V2DPCA(Variable 2-Dimensional Principal Component Analysis).

B. Manhattan Distance Classifier.

A. V2DPCA(Variable 2-Dimensional Principal Component Analysis)

Gait Recognition is the process of biometric trait recognition. In this process, the different gait cycles of persons have been used for recognition process. In this process, the features have been evaluated from different gait cycles using different approaches. In the purposed work the gait cycles have been used for extraction of features. Variable 2-Dimenssional Principal Component Analysis(V2DPCA) has been used for extraction of the features from the different gait cycles. V2DPCA generates dimensional covariance matrixes for the gait cycle samples. The co- variance matrix is used for development of Eigen values and Eigen vector. V2DPCA also cover the variable factor that come due to variations available in gait samples.

B. Manhattan Distance Classifier

The Manhattan Distance Classifier computes the distance between test gait cycles and training gait samples .The minimum distance between the testing dataset and training dataset is maximum matched cycle. Manhattan distance for numeric attributes. If an attribute is numeric, then the local distance function can be defined as the absolute difference of the values:

$$distA\ (x.A, q.A) =def\ |x.A - q.A|$$

If the global distance is computed as the sum of these local distances, then we refer to it as the Manhattan distance. Weighted sums and weighted averages are also possible.

VI. PURPOSE OF THESIS WORK

Various approaches has been utilized for the process of Gait Recognition. These approaches utilized feature extraction from silhouette on the basis of energy and enthalpy level available in different gait samples . But energy and enthalpy does not provide accurate information about gait when there are variations in the gait samples. To remove these issue in the field of Gait Recognition process, the approach has to utilize which extract optimal feature for Gait Recognition by using V2DPCA ((Variable 2- Dimensional Principal Component Analysis) for feature extraction and Manhattan Distance classifier for Recognition process and then analyze parameter accuracy for FAR & FRR parameters as a performance matrices for the performance evaluation. On the basis of these parameters ,we conclude that we achieve better results than the previous approaches.

VII. PERFORMANCE METRICS

The following parameters are chosen to evaluate the performance of the proposed work:

A. FAR (False Acceptance Rate)

B. FRR (False Rejection Rate)

A. FAR (False Acceptance Rate)

FAR represents the False Acceptance Rate. FAR, is the measure of the likelihood that the biometric security system will incorrectly accept an access attempt by an unauthorized user. A system's FAR typically is stated as the ratio of the number of false acceptances divided by the number of identification attempts.

B. FRR (False Rejection Rate)

FRR represents False Rejection Rate.FRR, is the measure of the likelihood that the biometric security system will incorrectly reject an access attempt by an authorized user. A system's FRR typically is stated as the ratio of the number of false rejections divided by the number of identification attempts.

VIII. COMPARISON BETWEEN FAR & FRR

Table 1: Table representing the comparison between FAR and FRR.

Table I Comparison between FAR and FRR

FAR	FRR
FAR represents False Acceptance Rate.	FRR represents False Rejection Rate.
FAR is a measure of Biometric Security System that measures incorrect acceptances attempt by an unauthorized user.	FRR is a measure of Biometric Security System that measures incorrect rejections attempt by authorized user.
It is stated as the ratio of the number of false acceptances divided by the number of identification attempts.	It is stated as the ratio of the number of false rejections divided by the number of identification attempts.
For best biometric solution, FAR should be 'low', so that an unauthorized person cannot access the biometric system.	For best biometric solution, FRR should be 'high', so that an unauthorized person cannot access the biometric system.

IX. RESULTS AND DISCUSSION

In the process of Gait Recognition, different gait samples have been used for Recognition. In this thesis work , CASIA-A gait database has been used for Gait Recognition in this process different gait images have been used for Gait Recognition process.

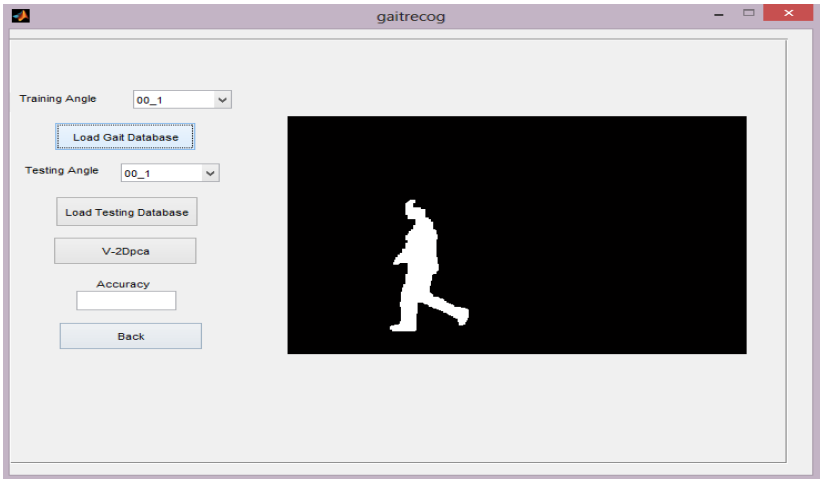

Figure 4: GUI for Accuracy Computation for Gait Recognition System.

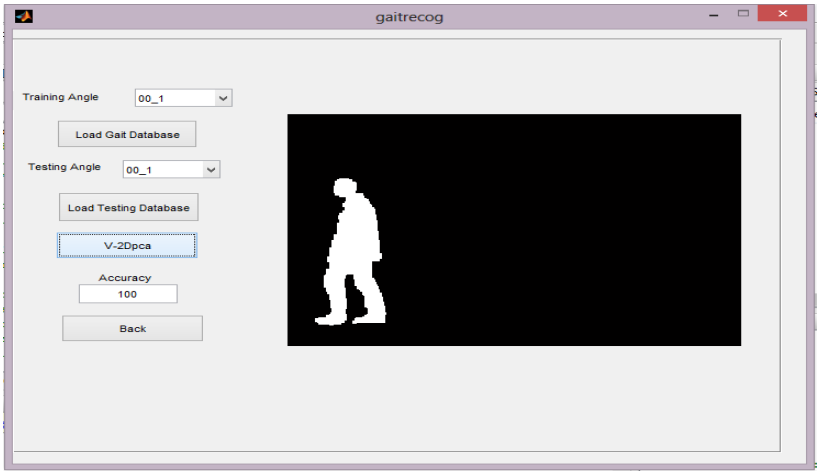

Figure 5: Accuracy Computation on the basis of distance between Training and Testing features.

Figure 5 represents the Accuracy Computation on the basis of distance between Training and Testing features. In this thesis work, accuracy between Training and Testing samples is measured at 0º, 45º and 90º angles of gait.

Table II Accuracy table for Final System

Gait angle	Final Value	Previous Value
0º	100 %	62.5 %
45º	100 %	50 %
90º	100%	62.5 %

Table II represents accuracy table for Gait Recognition System. On the basis of this Accuracy table, we conclude that V2DPCA(Variable 2-Dimensional Principal Component Analysis) and Manhattan Distance classifier approaches provide more accuracy than the previous approaches. Accuracy, FAR and FRR parameters are used to check the performance of the this Final System.

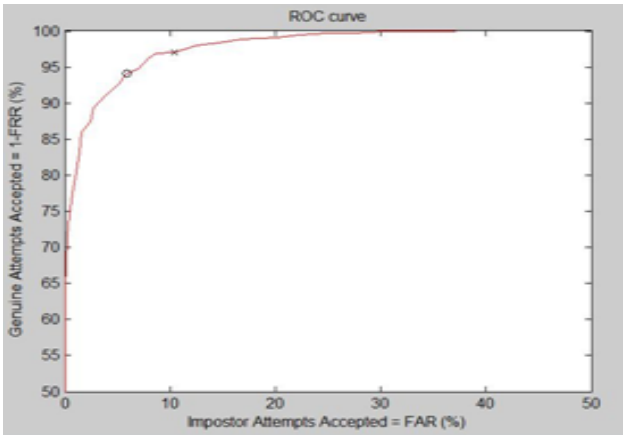

Figure 6: ROC Curve for Gait Recognition

Figure 6 represents ROC (Receiver Operating Characteristic) curve for Gait Recognition system. This curve represents genuine acceptance rate approached by using V2DPCA approach. This graph represents curve with different number of gait samples that has been tried for Gait Recognition System.

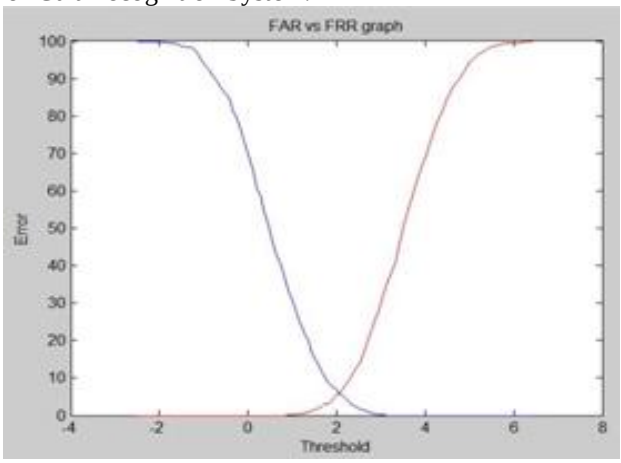

Figure 7: Graphical representation of FAR and FRR for Gait Recognition system under different Threshold Values.

Figure 7 represents graphical representation of FAR and FRR for Gait Recognition system under different threshold values. This figure represents that as the FRR decreases FAR of the particular system get increases. A system with high FRR is best security system used for Gait Recognition.

X. CONCLUSION

Gait Recognition is the main field of Biometric Authentication System. Gait is a particular way of moving on foot. Gait of a person has some drawback that gait of a person modify with age emotion, variation in clothing and footwear's. Gait image has been covered under gait cycle. Different persons utilize different gait step on different situation. Gate recognition is done by using image silhouette. Image silhouette is formed by subtracting background from an image. And formation of different gait cycle from different frames, In this various approaches has been utilized for the process of gait reorganization. These approaches utilized feature extraction from silhouette Image's. On the basis of energy and enthalpy level available in different images. But energy and enthalpy does not provide accurate information about gait. To remove these issue in the field of gait recognition process, the approach has to utilize which extract optimal feature for gait reorganization process. In our work we convert gait image in to S format by subtracting background. Then implement V2-DPCA for feature extraction, similar classifier for reorganization process, analyze parameter accuracy, FAR & FRR for perforation evaluation. On the basis of these parameters, we conclude that our system gives us better results.

XI. FUTURE SCOPE

In the future, Gait Recognition can be used in different organizations for security purposes. Although in Gait Recognition, Features Extraction process consumes too much time, but to overcome this limitation, V2DPCA can be used for feature extraction from a particular gait samples. V2DPCA use different variable for minimization of the features length and computes 2-dimenssional matrix of the features. Due to 2-D matrix, feature vector computation time for overall system get reduces and after Feature Extraction, distance classifier can be used for Gait Recognition.

REFERENCES

[1] M.Jeevan, Neha Jain, "Gait Recognition Based on Gait Pal and Pal Entropy Image" 2013, pp. 4195-4199.

[2] Haifeng Hu "Multi view Gait Recognition Based on Patch Distribution Features and Uncorrelated Multi linear Sparse Local Discriminate Canonical Correlation Analysis" IEEE Transactions on Biometrics Compendium, vol.24,pp. 617 – 630.

[3] Liu, Z.,Sarkar, S. "Improved gait recognition by gait dynamics normalization" *IEEE Transactions on Pattern Analysis and Machine Intelligence,2006*,vol. 28,pp. 863 – 876.

[4] Shirke, S., Pawar, S. S. , Shah, K. "Literature Review: Model Free Human Gait Recognition" *Fourth International Conference on Communication Systems and Network Technologies (CSNT), 2014*, pp. 891 – 895.

[5] Yanan Li, Yilong Yin ,Lili Liu ,Shaohua Pang "Semi-supervised Gait Recognition Based on Self-Training" *Ninth International Conference on Advanced Video and Signal-Based Surveillance (AVSS), 2012* , pp. 288 – 293.

[6] Junping Zhang ,Jian Pu , Changyou Chen ,Fleischer, R. "Low-Resolution Gait Recognition" *IEEE Transactions on Biometrics Compendium Systems, Man, and Cybernetics, Part B: Cybernetics,*vol.40, pp. 986 – 996.

[7] Cheema, M.S., Eweiwi, A. ; Bauckhage, C. "Gait recognition by learning distributed key poses" *19th IEEE International Conference on Image Processing (ICIP), 2012* ,pp. 1393 – 1396.

[8] Afendi, T. , Crookes, D. , Bouridane, A. "A frontal view gait recognition based on 3D imaging using a time of flight camera" *Proceedings of the 22nd European Signal Processing Conference (EUSIPCO)*,2014, pp. 2435 – 243.

[10] Ngo Thanh Trung, Nagahara, H. ; Mukaigawa, Y. "Performance evaluation of gait recognition using the largest inertial sensor-based gait database" *International Conference on Biometrics Compendium, IEEE*, 2012,pp. 360 – 366.

[11] Chunyan Chen, Cong Wang , Wei Zeng "Lab view-based human gait recognition system design via deterministic learning" *Third International Conference on Intelligent Control and Information Processing (ICICIP)*, 2012,pp. 759 – 764 .

[12] Enokida, S, Shimomoto, R. Wada, T. , Ejima, T. "A Predictive Model for Gait Recognition" *Biometrics Symposium: Special Session on Research at the Biometric Consortium Conference, 2006*, pp. 1-6.

[13] Kusakunniran, W, Qiang Wu , Jian Zhang , Yi Ma "A New View-Invariant Feature for Cross-View Gait Recognition" *IEEE Transactions on Biometrics Compendium Information Forensics and Security*, 2013,vol. 8, pp. 1642 – 1653.

