International Journal of Latest Engineering Research and Applications (IJLERA) ISSN: 2455-7137

Volume – 01, Issue – 04, July – 2016, PP – 59-63

Biometric Authentication system using gait features as Biometric Trait

[1]Vinay Bajaj, [2]Kamna Mahajan
[1]*Research Scholar*
Rayat and Bahra Institute of Engg. & Bio Technology, Mohali.
[2]*Assistant Professor*
Rayat and Bahra Institute of Engg. & Bio Technology, Mohali.

Abstract: The style or manner of walking on foot is called gait. Now these days it becomes the one of the most popular research area. Its main purpose to identify the individual walk. Previous gait reorganization captures both motion and appearance information as carrying and clothing. In this paper, we propose a novel temporal representation of Gait using Pal and Pal Entropy (GPPE) for each cycle of the silhouettes. The Principal component analysis is applied to each of the features extracted to create a feature matrix. Support Vector Machine (SVM) is used for training and testing of individuals by the proposed method. Extensive experiments on the Treadmill dataset and the CASIA. We will implement this by using MATLAB.
Keywords: Gait Reorganization, GPPE, SVM.

1. INTRODUCTION

1.1 Gait Reorganization

Gait is a particular way of moving on foot. Compared with the conventional biometric features, such as face, iris, palm print and finger print, Gait has many unique features such as non-contact, non-invasive and perceivable at a distance. The genesis of the idea of person identification from Gait can be traced back to perception experiments of Cutting and Kozlowski based on light point displays. The first efforts towards recognition from Gait in computer vision were attempted by Niyogi and Adelson in the early 1990's. In the recent years the behavioral biometrics has become an active area of research (Yu et al., 2009). It finds applications in diverse systems ranging from simple access control to demographic analysis of population. Though Gait has some benefits over its physiological biometrics, it suffers from some drawbacks.

Fig: 1.1: Gait Reorganization [10]

The Gait gets modified with age, emotional changes, variations in clothing and footwear, distortions in Gait pattern produced by carrying objects or walking speed could make its implementation for recognition systems a heinous task. Existing methods on Gait recognition can be classified into model based methods which model the human body with appropriate geometric curves and Holistic based methods that extract spatiotemporal and statistical features.

1.2 Types of Gait Reorganization

1.2.1 Automatic analysis of video imagery- This 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.

1.2.2 Radar system –This is 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. Efforts are being made to make gait recognition as accurate and usable as possible, and while it may never be as reliable as other biometrics such as fingerprint or iris recognition, it is predicted that gait recognition technology will be released in a functional state within the next five years, and will be used in conjunction with other biometrics as a method of identification and authentication [4]. Gait is a sequence of images. Hence spatiotemporal correlations must be taken into account.

• Murray et al. expressed gait as "A total walking cycle".

• A "Gait Cycle" is the time of heal strike between the same leg.

We define gait to be the coordinated, cyclic combination of movements that result in human locomotion. The movements are coordinated in the sense that they must occur with a specific temporal pattern for the gait to occur. The movements in a gait repeat as a walker cycles between steps with alternating feet. It is both the coordinated and cyclic nature of the motion that makes gait a unique phenomenon.

1.3 Gait Cycle:

A Gait Cycle is the time period or sequence of events or movements during locomotion in which one foot contacts the ground to when that same foot again contacts the ground, and involves forward propulsion of the centre of gravity of human body consisting alternate sinuous moments of different segments of the body with least expenditure of energy. A single gait cycle is also known as a stride.

1.4 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

1.5 Components of Gait Cycle

Stance Phase: The stance phase is that part of a gait cycle during which the foot remains in contact with the ground. For analyzing gait cycle one foot is taken as reference and the movements of the reference foot are studied. It constitutes of 60 percent of the gait cycle. In stance phase the reference foot undergoes five movements:

- 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 response 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 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.

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

2. RELATED WORK

M.jeevan et al [1] "gait recognition based on gait pal and pal entropy image" Human Gait recognition is one of the most promising research areas at the moment. Gait is the style or manner of walking on foot. Gait recognition aims to identify individuals by the manner in which they walk. Existing Gait representations which

capture both motion and appearance information are sensitive to changes in various covariate conditions such as carrying and clothing. In this paper, author proposes a novel temporal representation of Gait using Pal and Pal Entropy (GPPE) for each cycle of the silhouettes. The
Principal component analysis is applied to each of the features extracted to create a feature matrix. Support Vector Machine (SVM) is used for training and testing of individuals by the proposed method. Extensive experiments on the Treadmill dataset and the CASIA datasets A, B, C have been carried out to demonstrate the effectiveness of the proposed representation of Gait.

Che-Chang Yang et al [2] "Real-time gait cycle parameters recognition using a wearable motion detector" This paper presents the use of an accelerometer-based wearable motion detector for real-time recognizing gaitcycle parameters of Parkinson's disease (PD) patients. The wearable motion detector uses a tri-axial accelerometer to measure trunk accelerations during walking. By using the autocorrelation procedure, several gaitcycle parameters including cadence, gait regularity, and symmetry can be derived in real-time from the measured trunk acceleration data. The gaitcycle parameters derived from 5 elder PD patients and 5 young healthy subjects are also compared. The measures of the gaitcycle parameters between the PD patients and the healthy subjects are distinct and therefore can be quantified and distinguished, which indicates that detection of abnormal gaits of PD patients in real-time is also possible. The wearable motion detector developed in this paper is a practical system that enables quantitative and objective mobility assessment. The possible applications of this system are also discussed.

Tilton, A.K.et. al [3] "Filtering with rhythms: Application to estimation of gait cycle" he aim of this paper is to describe a coupled oscillator model for Bayesian inference. The coupled oscillator model comprises of a large number of oscillators with mean-field coupling. The collective dynamics of the oscillators are used to solve an inference problem: the empirical distribution of the population encodes a `belief state' (posterior distribution) that is continuously updated based on noisy measurements. In effect, the coupled oscillator model works as a particle filter. The framework is described here with the aid of a model problem involving estimation of a walking gaitcycle. For this problem, the coupled oscillator particle filter is developed, and demonstrated on experimental data taken from an Ankle-foot Orthotic (AFO) device.

Jianning Wu et al [4] "A new intelligent model for automated assessment of elder gait changes" This paper addressed a novel intelligent model for automatic evaluation of the change of elder gait function based on kinematic gait data. In order to recognize the change of elderly gait patterns with higher accuracy, the wavelet analysis technique was proposed as a new approach to extract gait features, and then those obtained gait features were initiated the training set of gait classifier such as artificial neural network (ANN). The gait data of two groups including young and old subjects were acquired during normal walking, and were analyzed using the proposed method. The experimental results indicated that the gait features exacted by the wavelet analysis technique, as the input of ANN could provide more discriminating information than the traditional gait features selected such as maximal value or values obtained from the different occurrences based on gait events, and the proposed classification model could identify young and elderly gait patterns with higher accuracy. It is hopeful that the proposed model can be used as an effective tool for diagnosing the change of gait function for old people in clinical application.

Begg, R.K et al [5] "Support vector machines for automated gait classification" Ageing influences gait patterns causing constant threats to control of locomotors balance. Automated recognition of gait changes has many advantages including, early identification of at-risk gait and monitoring the progress of treatment outcomes. In this paper, we apply an artificial intelligence technique [support vector machines (SVM)] for the automatic recognition of young-old gait types from their respective gait-patterns. Minimum foot clearance (MFC) data of 30 young and 28 elderly participants were analyzed using a PEAK-2D motion analysis system during a 20-min continuous walk on a treadmill at self-selected walking speed. Gait features extracted from individual MFC histogram-plot and Poincare´-plot images were used to train the SVM. Cross-validation test results indicate that the generalization performance of the SVM was on average 83.3% (±2.9) to recognize young and elderly gait patterns, compared to a neural network's accuracy of 75.0±5.0. A "hill-climbing" feature selection algorithm demonstrated that a small subset (3-5) of gait features extracted from MFC plots could differentiate the gait patterns with 90% accuracy. Performance of the gait classifier was evaluated using areas under the receiver operating characteristic plots.

Huifeng Zhang et al [6] "Research on healthy subject gait cycle phase at different walking speeds" The human gaitcycle phase is an important parameter which is used to reflect the characteristics of human gait. In this paper, the gaitcycle phase was divided into six parts based on clinical manifestations of common abnormal gait. According to the sole's position and orientation during a gaitcycle, flexion and extension angles of the sole were defined. The largest Lyapunov exponent (LE) and average power were introduced to reflect the stability and energy expenditure of human body under different walking speeds. The healthy subjects' gait parameters data under different gait speeds were captured through motion capture system. The experimental results showed that, in order to adapt to different walking speeds, human gaitcycle and other characteristic parameters were adjusted. In this paper, the reason why the stance time changed was pointed out. The body's stability decreased with the increase of walking speed, however, the average power value increased. The results provided a basis for gait evaluation and gait planning of lower limb rehabilitation training robot.

3. APPROACHES USED

Ankle-foot orthosis (AFO)

An ankle-foot orthosis (AFO) is an orthosis or brace that encumbers the ankle and foot. AFOs are externally applied and intended to control position and motion of the ankle, compensate for weakness, or correct deformities. AFOs can be used to support weak limbs, or to position a limb with contracted muscles into a more normal position. They are also used to immobilize the ankle and lower leg in the presence of arthritis or fracture, and to correct foot drop; an AFO is also known as a foot-drop brace. Ankle-foot orthoses are the most commonly used orthoses, making up about 26% of all orthoses provided in the United States. Provision of an off-the-shelf or prefabricated AFO matched in size to the end user Custom manufacture of an individualized AFO from a positive model, obtained from a negative cast or the use of computer-aided imaging, design, and milling. The plastic used to create a durable AFO must be heated to 400 °F., making direct molding of the material on the end user impossible.

ANN (Artificial Neural Network)

Artificial neural networks are a family of statistical learning algorithms inspired by biological neural networks (the central nervous systems of animals, in particular the brain) and are used to estimate or approximate functions that can depend on a large number of inputs and are generally unknown. Artificial neural networks are generally presented as systems of interconnected "neurons" which can compute values from inputs, and are capable of machine learning as well as pattern recognition thanks to their adaptive nature.

SVM (Support Vector Machine)

Support vector machines (SVMs, also support vector networks) are supervised learning models with associated learning algorithms that analyze data and recognize patterns, used for classification and regression analysis. Given a set of training examples, each marked as belonging to one of two categories, an SVM training algorithm builds a model that assigns new examples into one category or the other, making it a non-probabilistic binary linear classifier. An SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories are divided by a clear gap that is as wide as possible. New examples are then mapped into that same space and predicted to belong to a category based on which side of the gap they fall on.

4. CONCLUSION

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 person utilizes different gait step on different situation. Gait reorganization 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 reorganization process the approach has to utilize which extract optimal feature for gait reorganization process. In this paper we will convert gait image in to S format by subtracting background. implement 2DPCA for feature extraction also implement similar classifier for reorganization process.

REFRENCES

[1] m.jeevan "gait recognition based on gait pal and pal entropy image" *IEEE Conf. on Image Processing (ICIP),* 2013, pp 4195 – 4199.

[2] Ota, L. "Relationship between fractal property of gait cycle and severity of Parkinson's disease", International *conf. on System Integration (SII),* 2010, PP 236 – 239.

[3] Tilton, A.K. "Filtering with rhythms: Application to estimation of gait cycle", *American Control Conference (ACC),* IEEE, 2012, PP 3433 – 3438.

[4] Jianning Wu "A new intelligent model for automated assessment of elder gait change", *International conf. on Biomedical Engineering and Informatics (BMEI)*, 2010, PP 1971 – 1974.

[5] Begg, R.K. "Support vector machines for automated gait classification", *Biomedical Engineering, IEEE Transactions,* IEEE, 2005, PP 828 – 838.

[6] Huifeng Zhang "Research on healthy subject gait cycle phase at different walking speeds*", Robotics and Biomimetics (ROBIO), 2012 IEEE International Conference,* 2012, PP 1349 – 1354.

[7] Agostini, V. "Segmentation and Classification of Gait Cycles", *International conf. on Neural Systems and Rehabilitation Engineering, IEEE* 2014, PP 946 – 952.

[8] Zhiqiang Zhang "Gaussian particle filter for tracking hip angle in gait cycles", *IEEE conf. on e-health Networking, Applications and Services, 2008. Health Com 2008* ISSN 978-1-4244-2280-7, IEEE, 2008, PP 177 – 181,

[9] Gafurov, D "Improved Gait Recognition Performance Using Cycle Matching" *IEEE Conf. on Advanced Information Networking and Applications Workshops,* 2010, pp 836 – 841.

[10] Nickel, C "Does a cycle-based segmentation improve accelerometer-based biometric gait recognition?" *IEEE Conf. on Information Science, Signal Processing and their Applications (ISSPA),* 2012, pp 746 – 751.

[11] http://goo.gl/ItrdmG