

# GAIT RECOGNITION USING V2DPCA (VARIABLE 2D-PCA) – A REVIEW

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## ABSTRACT

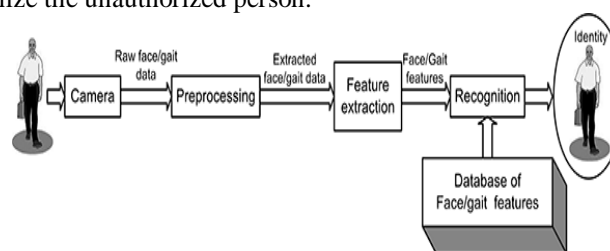
*Gait recognition is the main field of biometric authentication system. Gait is a particular way of moving on foot. In this various approaches has been utilized for the process of gait recognition. On the basis of energy and enthalpy level available in different images these approaches utilized for feature extraction from silhouette Image's. 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 is used.*

**Keywords:-**Gait Recognition, PCA, ICA and SVM.

## 1. INTRODUCTION

### 1.1 Gait recognition

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[1]. 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 [2]. 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[3]. Gait recognition approach will identify the unauthorized person and compare his gait 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 [4] .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.

Gait recognition innovation is, on the other hand, still in its creating stages. No model has, starting yet, been created that is sufficiently precise and attractive. The innovation is pushing forward at a fast pace; nonetheless, with government-supported activities supporting research, for example, that going ahead at the Georgia Institute of Technology, MIT, the Lappeenranta University of Technology, and others scholarly organization [6].

### 1.2 Gait Cycle

Gait cycle can be defined as the time interval between two successive occurrences of one of the repetitive events of walking. Gait cycle starts when one foot touches the ground and terminates when the same foot again touches with the ground[5]. This cycle is also sometimes known as walking cycle.

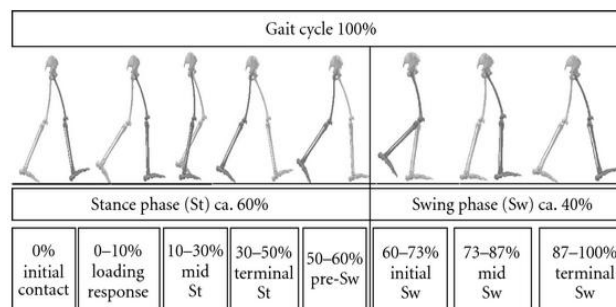
**1.2.1 Components of Gait Cycle**

Classification of the gait cycle involves two main phases:-

(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 Fig-2. Gait involves a combination of open- and close-chain activities.



**Figure 2: Stance Phase & Swing Phase**

**(a) Stance Phase:-** The stance stage is the interval of a gait cycle during which the foot touches with the ground. To determine the gait cycle, one foot is considered as reference and the movements of that reference foot are observed. It constitutes 60 % periods of a gait cycle. In stance stage the reference foot experiences five movements[15]:-

i. Heel Strike ii. Foot Flat iii. Mid- Stance iv. Terminal Stance v. Toe -Off

**I. Heel Strike:-** Heel Strike is also known as Initial Contact. This phase occupies 0 % periods of a gait cycle .This represents the starting of the stance phase. This phase starts when heel which is the first bone of the reference foot touches the ground.

**II. Foot Flat: -** Foot Flat is also known as Loading Response phase. This phase occupies about 0-10 % periods of a gait cycle. During the foot flat phase, the foot comes full touches with the ground and weight of the body is moved onto the referenced leg.

**III. Mid Stance: -** Mid Stance phase occupies about 10-30 % periods of a gait cycle. It involves alignment and balancing of body weight on the reference foot.

**IV. Terminal Stance: -** This phase occupies about 30-50 % periods of the gait cycle. In this phase the heel of reference foot rises while the toe is still touches with the ground[6].

**V. Toe off (Pre Swing):-** Toe Off phase is also known as Pre Swing. This phase occupies about 50-60 % periods of a gait cycle. 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[8].

**Swing Phase: -** The swing phase is another phase of the gait cycle in which the reference foot touches with the ground and swings in the air. It constitutes about 40 % periods of a gait cycle. It has three parts[13]:-

I. Initial Swing

II. Mid Swing

III. Terminal Swing

**I. 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.

**II. 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.

**III. Terminal Swing: -** This phase occupies about 5-100 % periods of a gait cycle[10]. Terminal swing begins at the end of the mid swing and terminates when the same foot touches the floor.

**1.3 Steps in Gait Cycle**

- 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.

**1.4 Types of Gait Recognition**

**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[15].

**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, 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 [12].

- Gait is a grouping of pictures. Henceforth spatiotemporal connections must be considered.
- Murray et al. communicated walk as "An aggregate strolling cycle".
- A "Walk Cycle" is the time of mend strike between the same legs [11].
  - We characterize stride to be the facilitated, cyclic blend of developments that outcome in human movement. The developments are composed as in they must happen with a particular transient example for the walk to happen. The developments in a step rehash as a walker cycles between steps with substituting feet. It is both the composed and cyclic nature of the movement that makes walk an extraordinary wonder.
  - Samples of movement that are strides in enlightened strolling, running, running, and climbing stairs. Taking a seat, grabbing an article, and tossing and item are all facilitated movements, yet they are not cyclic. Hopping jacks are composed and cyclic, however don't bring about motion[14]. Thusly, we characterize step distinguishment to be the distinguishment of some notable property, e.g., personality, style of walk, or pathology, in light of the composed, cyclic movements that outcome in human headway. On account of biometric walk distinguishment, the striking property is character.

## **2. REVIEW OF SOME RESEARCH WORK**

**Some of the researches work is as follows:-**

**Shirke, S. et al (2014) [1]** "Model Free Human Gait Recognition" Author proposed that Human walk distinguishment is a separation based second era biometrics, which is subtle. In this paper, author proposed two methodologies of stride distinguishment, which are model based and model free methodologies. In this paper author gives an overview of model free stride distinguishment approach. This review concentrates on movement free stride picture representation, dimensionality decrease of separated gimmick and grouping. The paper is finished up by posting the examination challenges and by giving future bearing in model free walk distinguishment approach.

**Yanan Li et al (2012) [2]** "Semi-supervised Gait Recognition Based on Self-Training" Author investigate that Customary stride distinguishment investigates concentrate on administered learning systems that utilization just a predetermined number of marked arrangements to prepare. In the interim, preparing with more ordinary stride arrangements can enhance the speculation capacity of walk distinguishment framework and inevitably accomplish better distinguishment exactness. it is troublesome, extravagant, lengthy and exhausting to catch enough walk groupings contrasting and catching other biometric attributes, To address the issue, a semi-regulated step distinguishment calculation in light of get ready toward oneself is proposed to enhance the execution of walk distinguishment framework with both a couple of named successions and a lot of unlabeled groupings. Closest Neighbor (NN) classifier and K-Nearest Neighbor (KNN) classifier are done to perceive the diverse subjects.

**Junping Zhang et al (2010) [3]** "Low-Resolution Gait Recognition" Author explained that the execution of walk distinguishment will endure in the low-determination (LR) case. Moreover, when stride groupings are anticipated onto a non ideal low-dimensional subspace to diminish the information unpredictability, the execution of step distinguishment will likewise decay. To manage these issues,author propose another calculation called super determination with complex testing and back projection (SRMS). This calculation takes in the high-determination (HR) partners of LR test pictures from an accumulation of HR/LR preparing stride picture patch sets. At that point, Author consolidates SRMS into another calculation called multi direct tensor-based learning without tuning parameters (MTP) for LR stride distinguishment. Our commitments incorporate the accompanying: 1) with complex inspecting, the excess of stride picture patches is amazingly diminished; in this manner, the super determination method is more productive and sensible. 2) Back projection ensures that the educated HR stride pictures and the relating LR step pictures can be steadier. 3) The ideal subspace measurement for measurement diminishment is naturally decided without presenting additional parameters. 4) Theoretical examination of the calculation demonstrates that MTP joins.

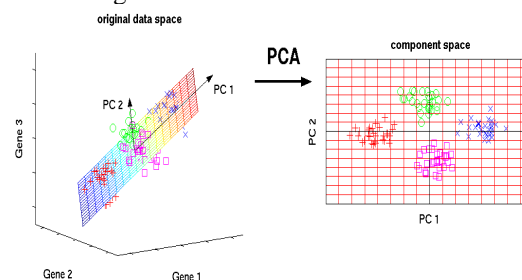
**Cheema, M.S. et al (2012) [4]** "Gait recognition by learning distributed key poses" Author Investigate that Stride distinguishment is getting expanding consideration from PC vision scientists for its relevance in ranges. Most existing exploration endeavors to model individual walk designs as successions of worldly layouts either by deciding step cycles or by conglomerating spatio-fleeting data into a 2D mark. This paper shows a basic yet productive and compelling way to stride distinguishment in light of a shape separation peculiarity and key posture learning. Not at all like existing work, are stride examples demonstrated as a non-transient accumulation of key postures disseminated over step cycles.

Trial results on an extensive multi-view benchmark information set display higher distinguishment precision and vigor against changes in perspective. This paper builds that non-fleeting strategies can finish effective and precise stride distinguishment.

**Afendi, T. et al (2014) [5]** “A frontal view gait recognition based on 3D imaging using a time of flight camera” Author Proposed that In past work, walk successions were caught utilizing either single or stereo RGB cam frameworks or the Kinect 1.0 cam framework. In this examination, we utilized another frontal perspective walk distinguishment system utilizing a laser based Time of Flight (ToF) cam. Notwithstanding the new stride information set, different commitments incorporate improvement of the outline division, walk cycle estimation and step picture representations. We propose four new stride picture representations to be specific Gait Depth Energy Image (GDE), Partial GDE (PGDE), Discrete Cosine Transform GDE (DGDE) and Partial DGDE (PDGDE). The exploratory results demonstrate that all the proposed step picture representations deliver preferred exactness over the past routines. Likewise, we have additionally created Fusion GDEs (FGDEs) which attain to better general precision and beat the past systems.

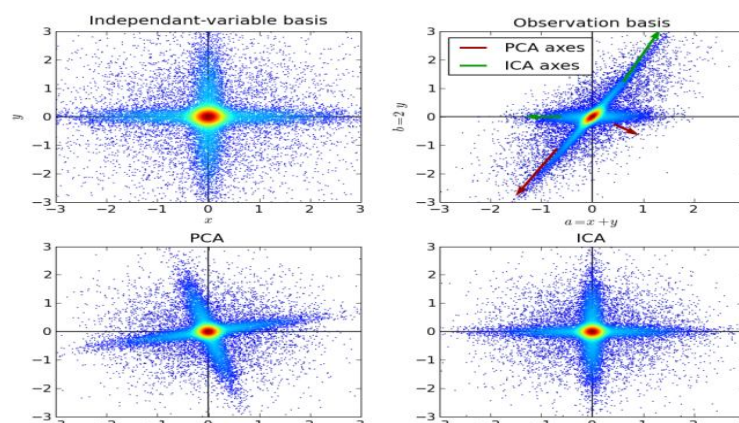
### 3. APPROACHES USED

(a) **PCA** (Principal component analysis): Principal Component Analysis is a scientific methodology that uses an orthogonal change to change over an arrangement of observations of perhaps connected variables into an arrangement of estimations of straightly uncorrelated variables called principal components. Principal Component Analysis (PCA) is generally used to decrease the dimensionality of the information. The objective of PCA is to decrease the dimensionality of the information while holding however much as could reasonably be expected of the variety exhibit in the first dataset. PCA permits us to process a direct change that maps information from a high dimensional space to a lower dimensional space. In light of these two techniques the step acknowledgment methodology was created. In this methodology, at first the preprocessing works were done as takes after. To start with, the picture groupings were adjusted utilizing some numerical methodologies. It is utilized to resize the different sizes of pictures into same size.



**Figure 3: PCA**

(b) **ICA**: The automatic Gait recognition has been fulfilled in light of wavelet descriptors and free part investigation (ICA) with the end goal of human ID at a separation. The foundation extraction technique is connected to subtract the moving human figures precisely and to acquire paired outlines. The double outlines are depicted with wavelet descriptors and believer it into ID signs to get Independent Components (ICs) of these signs utilizing ICA.



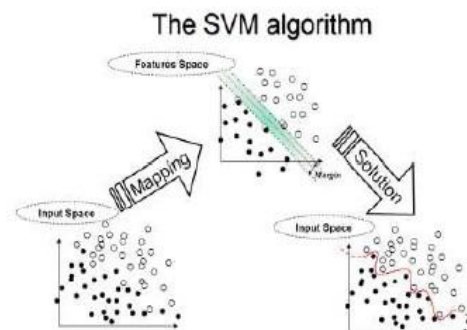
**Figure 4: ICA**

(c) **SVM**: The SVM classifier is generally utilized as a part of bioinformatics (and different orders) because of its exceedingly precise, ready to ascertain and procedure the high-dimensional information, for example, quality statement and edibility in displaying various wellsprings of information. SVMs fit in with the general classification of bit strategies. A part system is a calculation that relies on upon the information just through speck items. At the point when this is the situation, the spot item can be supplanted by a bit capacity which processes a speck item in some perhaps high dimensional highlight space.



#### SVM has advantages

- The capacity to produce non-straight choice limits utilizing strategies intended for direct classifiers.
- Second, the utilization of bit capacities permits the client to apply a classifier to information that has no conspicuous settled dimensional vector space representation.



**Figure 5: SVM**

## IV. CONCLUSION

Gait Recognition aims to identify or verify persons by observing the way in which they walk. To achieve this aim, previously several approaches have been proposed but there is always requirement for better approach to enhance the gait recognition. The existing Gait Recognition approaches do not provide accurate information about feature extraction when there is a variance in a gait cycle. Proposed recognition system implements an enhanced recognition technique which is more accurate because it considers the variance in a gait cycle. Proposed Gait Recognition Technique show enhanced result & result will be obtain using V2DPCA and Manhattan Distance classifier .

**Table 1: Summarized view of Gait Recognition**

APPROACH USED	ADVANTAGES	DISADVANTAGES
<b>PCA</b>	THIS APPROACH IS BENEFICIAL DUE TO ITS LOW NOISE SENSITIVITY. IT REQUIRES LESS MEMORY AND INCREASED EFFICIENCY GIVEN THE PROCESSES TAKING PLACE IN SMALLER DIMENSIONS.	THE COVARIANCE FRAMEWORK IS HARD TO BE ASSESSED IN AN EXACT WAY. EVEN THE LEAST DIFFICULT INVARIANCE COULDN'T BE CAUGHT BY THE PCA UNLESS THE PREPARATION INFORMATION UNEQUIVOCALLY GIVES THIS DATA.
<b>ICA</b>	THIS APPROACH IS USEFUL IN SYSTEMS INVOLVING MULTIVARIABLE DATA. IT ALSO HAS A GOOD PERFORMANCE IN PATTERN RECOGNITION, NOISE REDUCTION AND DATA REDUCTION.	IT CONSUMES VERY MUCH TIME.
<b>SVM</b>	THE CAPACITY TO PRODUCE NON-STRAIGHT CHOICE LIMITS UTILIZING STRATEGIES INTENDED FOR DIRECT CLASSIFIERS.	WHEN MULTI-CLASS CLASSIFICATION HAS TO BE DONE, PAIR-WISE CLASSIFICATIONS CAN BE USED BECAUSE SVM IS A BINARY CLASSIFIER.

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**Prabhsharan Kaur** received the B.Tech. degree in Information Technology from Lala Lajpat Rai Institute of Engineering and Technology, Moga in 2009 and pursuing M.Tech. degrees in Computer Science and Engineering from Guru Nanak Dev Engineering College, Ludhiana in 2013. During 2011-2013, she did research in area of software engineering on medical informatics using HL7 RIM model with the help of digital image processing to study impact of health layer 7 RIM model on health care systems. She is now working with North West Group Of Institutions.