A Study on Human Recognition by Gait Cycle

Prof. Snehal Kathale[1] Prof. Chanda Chouhan[2] Prof. Supriya Mandhare[3]
Prof. Supriya Solaskar[4] Prof. Trupti Shah[5]
[1,2,3,4,5]Assistant Professor
[1,2,3,4]Department of Information Technology [5]Department of Computer Engineering
[1,2,3,4,5]Atharva College of Engineering, Mumbai University,Mumbai, India

Abstract— Biometrics has increasing applications in security a system which demands that it is non-contactable, non-invasive and hidden from the subject. This paper proposes model based human recognition using gait. The approach is to first extract the gait features from the image sequences for constructing a locomotion human model. In this paper the model based approach is chosen so that the effect of exterior factors like briefcase clothing, shoes, and environmental context is minimized. Further we propose to apply and evaluate application of advance machine learning algorithms for Gait recognition which should give near real time recognition system.

Key words: Gait, Model based approach, circle dropping, and recognition

I. INTRODUCTION

Biometrics includes technologies that measure and analyze human body characteristics such as, fingerprints, voice patterns, eye retinas and irises, facial patterns and hand measurements, DNA for authentication purposes. Verification is becoming popular in corporate and public security systems, consumer electronics and point of sale (POS) applications. Biometrics refers to the various intrinsic or physical signatures people produce that can be used to uniquely identify them. Some popular established biometrics system uses fingerprints to hand geometry and some more advanced based on face recognition and iris. Fingerprint and hand geometry need contact and face recognition and iris have limitations of controlled environment and distance. Human Gait characterizes the walking style of an individual which is periodic in nature and called as Gait cycle. Human gait recognition and analysis is a promising technology with possible applications in numerous sectors of our society apart from security surveillance applications, clinical rehabilitation of patients, automatic robotic rehabilitation of patients, e.g., for treadmill Training, design of walking biped robots and many applications in medical research.[1] Human gait recognition and analysis is a promising technology with possible applications in numerous sectors of our society apart from security surveillance applications, clinical rehabilitation of patients, automatic robotic rehabilitation of patients, e.g., for treadmill Training, design of walking biped robots and many applications in medical research[3].

The advantages of a model based approach are that evidence gathering techniques can be used across the whole image sequence before making a choice on the model fitting. Models can handle occlusion and noise better and offer the ability to derive gait signatures directly from model parameters i.e. variation in the inclination of the thigh. They also help to reduce the dimensionality needed to represent the data. Fig. 1b- A model based approach Gait refers to the style of walking of an individual. Often in surveillance applications; it is difficult to obtain face or iris information at a resolution that is sufficient for recognition. Studies in psychophysics reveal that humans have the capability of recognizing people from even impoverished displays of gait, indicating the presence of identity information in the gait signature.

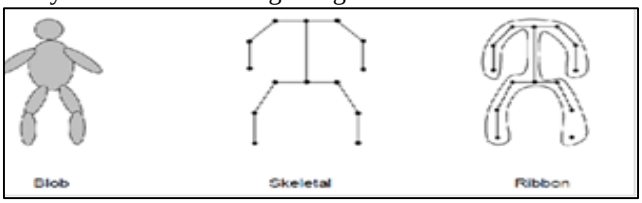

Fig. 1: A model based approach

II. PROBLEM FORMULATION

As gait databases continue to grow in size, it is conceivable that identifying a person only by gait may be difficult. However, gait can still serve as a useful filtering tool that allows us to narrow the search down to a considerably smaller set of potential candidates. Approaches in computer vision to the gait recognition problem can be broadly classified as being either model-based or model-free. Both methodologies follow the general framework of feature extraction, feature correspondence and high-level processing. The major difference is with regard to feature correspondence between two consecutive frames. Methods which assume a priori models match the two-dimensional (2-D) image sequences to the model data. Feature correspondence is automatically achieved once matching between the images and the model data is established.[3]

The main objective of this project is to:

1) Develop a method capable of performing recognition of individuals derived from a video sequence of a person walking which is near real time.

2) Automatic extraction of relevant gait feature points should be available from a video sequence in order to automate the classification process.
3) The Project can be broken down in three main section.

A closer examination of the physical process behind the generation of gait signature reveals that, during a gait cycle, it is possible to identify certain distinct phases or stances. In Fig.3, shows five frames that we have picked from a gait cycle for two individuals. In the first stance, the person is at rest. In the second stance, he is just about to start and his hand is slightly raised. In the third stance, the hands and the feet are separated, while in the fourth stance, the hands and feet are displaced to a maximum. Finally, in the fifth stance, the person is returning to the rest state. Clearly, every person transits among these successive stances as he/she walks. Although these stances are generic, there exist differences not only in their image appearance based on the physical build of an individual, but also in the way an individual transits across these stances as he/she walks which represents the gait dynamics of the individual.

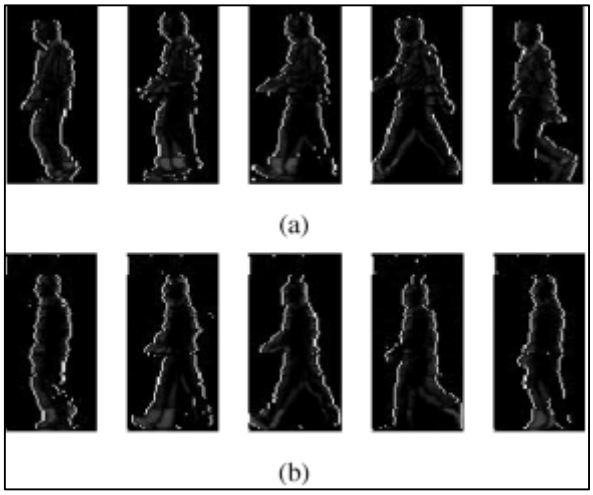

Fig. 3: a) Person 1 b) Person 2 [6]

A reasonable way to build a structural representation for a person is to pick exemplars (or stances) from the pool of images that will minimize the error in representation of all the images of that person. The specifics of choice of exemplars may differ for different approaches [6].

III. PROPOSED APPROACH

Image should be processed before gait feature are extracted in order to make proper work.

A. Human Detection and Tracking

In this approach the human body get detect with their Kinematic parameter by height, mass, motion, shape etc. After this binary silhouetted image get extracted.

B. Feature Extraction

The feature is extracted with 3D model by different arbitrary angles. The Multi view image sequences are extracted and their reconstructions are done with distance and different view direction [1].

C. Circle Doping

The silhouetted binary image of a different arbitrary view angles are extracted after feature extraction. As it is a Model based approach, the setoff circles are doped into silhouetted image. 2D stick figures are used for determining the body points after joining the centre of the circle set of these points are taking into proper data set.

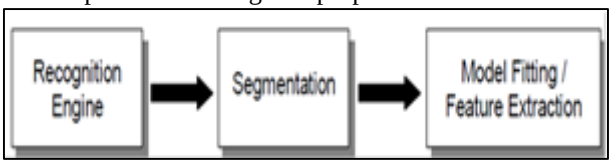

Fig. 2: Model Diagram

D. Training and Classification:

1) Weight adjustment between the input layer and the hidden layer.
2) Weight adjustment between the hidden layer and the output layer

E. Recognition

The recognition engine will take data from either a newly captured subject via the feature extraction module, or a previously stored signature, and perform recognition based on a database of test subjects. The modified CPN model did not require training parameters because it is not an iterative method like back-propagation architecture which took a long time for learning. Rather,

a minimum error value is specified initially and the weights are estimated based on the specified error value and this is what accounts for higher convergence rate of the model since one set of weights are estimated directly.[5][3]

IV. DISCUSSION AND CONCLUSION

Gait recognition is a multistage process. In order to be able to perform analysis on the gait of the individuals caught on video the subject needs to be extracted from the video sequence. It is important that gait capturing is performed in environments where the background is as uniform as possible. Moreover, since gait recognition Semantic nets aim to be as general as possible, so that they can be applicable in many different situations.[3][5]

An important point to note is that semantic nets only store the relational structure of an object, they don't store any size or location information about the individual components, as this would severely limit their usefulness to extract objects from different scenes. Once the gait feature has been extracted from the person, it will be projected into a feature space and it will then have to be classified. This means we have to determine which group in the feature space (i.e. which person) the unknown feature point should belong to. A classifier defines boundaries in a feature space which are used to separate different sample classes from each other in the data.[3]We have presented two approaches to represent and recognize people by their gait. The width of the outer contour of the binarized silhouette as well as the silhouette itself was used as features to represent gait. In one approach, a low-dimensional observation sequence is derived from the silhouettes during a gait cycle and an HMM is trained for each person. Gait identification is performed with machine learning that a given observation sequence was generated by a particular HMM model.[3] In the second approach, the distance between an image feature and exemplar was used to estimate the observation probability. The performance of the methods was illustrated using different gait databases.

Extraction of relevant features from gait patterns is crucial, because recordings of gait patterns are characterized by high dimensionality, time dependence, high variability, and nonlinearity. Gait Recognition is a traditional pattern classification problem which can be solved by calculating the similarities between instances. The neural network approach gives the more accurate output than other method. Neural network requires less input features for each gait samples which might reduce the complication of feature extraction process, in comparison to other methods which gives better performance when more input feature is extracted from the gait sample.

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