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A Survey of Gait Recognition Approaches Using PCA & ICA

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Abstract

Human identification by gait has created a great deal of interest in computer vision community due to its advantage of inconspicuous recognition at a relatively far distance. Biometric systems are becoming increasingly important, since they provide more reliable and efficient means of identity verification. Biometric gait Analysis (i.e. recognizing people from the way they walk) is one of the recent attractive topics in biometric research. It has been receiving wide attention in the area of Biometric. In Gait biometric research there are various gait recognition approaches are available. In this paper, the gait recognition approaches such as ?Wavelet Descriptor with ICA?, and ?Hough transform with PCA? are compared and discussed.

Index terms— Biometrics, Survey, Gait Recognition approaches.

1 Introduction

he first and foremost important steps towards preventing unauthorized access are user authentication. User authentication is the process of verifying identity. Biometric authentication is based on something one's physiological and behavioral characteristics. In traditional approaches, passwords and tokens were used and it can be forgotten, lost or stolen. There is also usability limitations associated with them. Recently, biometric is attracting more and more attentions. Generally, biometric is a field of technology that uses automated methods for identifying or verifying a person based on a physiological or behavioral trait. [1] These traits are always measured in different systems are the face, fingerprints, palm print, handwriting, iris, gait, and voice etc. Among them, gait recognition, as a relatively new biometric technique, aims to recognize individuals by the way they walk. The advantages of gait recognition are that it can be applied inconspicuously and it offers an ability to recognize at a distance or at low resolution.

2 II.

3 Related work

The Gait recognition approaches for human identification plays an important role in many applications especially in security systems. The first gait recognition approach was developed by **??**iyogi and Author ? : Dr. M. Pushpa Rani, Professor & Head, Dept. of Computer Science, Mother Teresa Women's University, Kodaikanal, India. E-mail : pushpa_john@yahoo.com Author ? : Mrs.D.Sasikala, Research Scholar, M.Phil(CS), Mother Teresa Women's University, Kodaikanal, India. E-mail : ashwathiram.sasi@yahoo.com Adelson on a small gait database in 1994 [2]. Consequently, the HumanID program sponsored by Defense Advanced Research Projects Agency (DARPA) [3] assists greatly in advancing automatic gait recognition. Spurred by the HumanID program, many international famous universities and research institutes, such as the University of Southampton, the Massachusetts Institute of Technology (MIT), Carnegie Mellon University (CMU), Institute of Automation Chinese Academy of Sciences, etc, have made a lot of researches on gait recognition. There are various approaches available for gait recognition which can be divided into two broad categories such as Model based and Model free approaches. Zhang et al. [4] proposed a novel two-step, model-based approach to recognize gait by employing

a five-link biped locomotion human model. . Meyer et al. [5] extracted and tracked the contours of different parts of the human body. Lee et al. [6] fitted seven ellipses in the human body area, and used their locations, orientations, and aspect ratios as features to represent the gait. In general, the features used in model-based approaches are insensitive to background cluttering and noise. Model based approaches has high computational complexity and more difficult in low resolution images. However, Modelbased approaches are somewhat difficult in real environment because feature extraction process and matching is very difficult. The Model-free approaches are well suitable for real time systems because it is easy to extract the feature and computational complexity is low.

4 III.

5 Techniques used a) Wavelet Descriptors with ICA for Feature Extraction

In this approach, the automatic Gait recognition has been accomplished based on wavelet descriptors and independent component analysis (ICA) for the purpose of human identification at a distance. The background extraction method is applied to subtract the moving human figures accurately and to obtain binary silhouettes. The binary silhouettes are described with wavelet descriptors and convert it into ID signals to get Independent Components (ICs) of these signals using ICA. The fixing point algorithm is used for calculating the Independent Component adoption and selection. Finally using Nearest Neighbor and SVM classifiers are used for recognition. For efficient gait recognition, the information of straight lines in gait silhouettes is very important. In spatio-temporal gait representation based on the Hough transform contains more straight lines information, and is more insensitive to image noise. Hough Transform is a feature extraction technique which was proposed by Paul Hough who patented the method in 1962. This technique can be used to isolate features of a particular shape within an image [8]. Using some mathematical functions, it is possible to find imperfect instances of objects to describe the boundary curves. Since its computational complexity, Hough Transform is normally restricted to first and second order equation. Commonly, the classical Hough Transform is used for the detection of regular curves such as lines, circles, and ellipses, etc. PCA Principal component analysis (PCA) is a mathematical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components. [9] Principal Component Analysis (PCA) is widely utilized to reduce the dimensionality of the data. The goal of PCA is to reduce the dimensionality of the data while retaining as much as possible of the variation present in the original dataset. PCA allows us to compute a linear transformation that maps data from a high dimensional space to a lower dimensional space. Based on these two methods the gait recognition approach was generated. In this approach, initially the preprocessing works were done as follows. First, the image sequences were aligned using some mathematical approaches. It is used to resize the various sizes of images into same size. The Fig. 4 shows several gait silhouette images after alignment. Fig. **??** : The Silhouette images after alignment Secondly the Gait cycle detection was done. Before constructing the Hough template it is very important to compute the periodicity of walking in a gait sequence. After constructing a Hough Transform the Gait Template was constructed. The Gait template was constructed using Laplacian of Gaussian methods. Using this method the edges in intensity gait images were detected. Finally the PCA technique was applied for Feature extraction.

6 Discussion on analysis

The Gait recognition using Wavelet Descriptor with ICA used two public gait databases, namely Chinese National Laboratory of Pattern Recognition (NLPR) and Chinese Xi'an University of Technology (XAUT) gait database were used to test and evaluate this approach. Here NLPR database having 20 subjects and four sequences for each views angle and have three angles, namely laterally (0 o), obliquely (45 o) and frontally (90 o), XAUT database includes 10 subjects and four sequences for each views angle and have three angles, namely laterally (0 o), obliquely (45 o) and frontally (90 o). The Gait recognition using Hough Transform with PCA used CASIA-A gait database for the analysis purpose [10]. All subjects walk on a straight line under normal conditions. Similar to the Wavelet Descriptors with ICA the three different view angles were [11] used to capture every subject. The database consists of 20 different persons. Each person has 4 sequences per view. The database thus includes a total of 240 (20×4×3) sequences. The length of each collected sequence varies with the pace of the walker, but the average is about 90 frames [11].

7 Conclusion

The wavelet descriptor with ICA uses SVM and Nearest Neighbour classifier for classification and recognition. The second approach uses Cumulative Match Scores (CMS) for gait recognition. Both the techniques were compared with different kinds of databases and the results were shown. [1]

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Figure 1: Fig. 1 :Fig. 2 :

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Figure 2: Fig. 4 :

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Figure 3: Fig 5 :

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View Angles & Ranks	Performance Analysis (Accuracy %) Wavelet Descriptor with ICA (SVM -NN)	Hough Transform with PCA (CMS)
Laterally (0 o)		
Rank 5	97.5%	98.5%
Rank 10	100%	97.5%
Obliquely (45 o)		
Rank 5	92.5%	100%
Rank 10	100%	98.5%
Frontally (90 o)		
Rank 5	90%	100%
Rank 10	100%	100%

Figure 4: Table 1 :

[Database] , Casia-A Gait Database . http://www.cbsr.ia.ac.cn/ (OL/DB)

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