Volume 3, Issue 10, October 2013 ISSN: 2277 128X

International Journal of Advanced Research in Computer Science and Software Engineering

Research Paper

Available online at: www.ijarcsse.com

An Efficient Approach of Human Recognition Using Tumiitkgp Database

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Abstract— Human recognition is always been an important task for various scenario like wide area monitoring, asset protection, security etc. Here a new dataset for gait recognition is presented. The presented database overcomes a crucial limitation of other gait recognition databases. This dataset offers four new kinds of gait variations include hands in pocket, wearing backpack and wearing a gown which allow for challenging evaluation of recognition algorithms. In addition to presenting the database we present algorithm like Gait Energy Image and PCA to perform person identification using gait.

Keywords— Principal Component Analysis (PCA), gait energy image, K Nearest Neighbour (KNN), TUMIITKGP Database.

I. INTRODUCTION

The use of biometrics has caught the imagination of the public eye. Using a measurable characteristic of a human, it has become feasible to use automated means of authentication. In a certain sense this is not new, as older "analogue" recognition technologies have been used for a long time. Thus we had handwritten signatures, thumbprints. What is different now is the use of computer technology to measure the feature. Some examples are; face and facial features, fingerprints, hand geometry, handwriting, iris, retina, voice, gait and so on. More formally, biometrics is the science of identifying a person based on their behavioural or physical traits. These are usually biological features such as face, fingerprints or gait. In a more popular context, a biometric is a measurement of a biological feature that allows one to distinguish a person from another. In a broader sense, it also involves the analysing of such data and being able to derive patterns in such data.

Many aspects of life require a way of recognizing individuals or verifying their identity. Examples range from financial transactions to border crossing. There are many situations in which identity needs to be determined at a distance, without the subject's cooperation or knowledge. The way a person walks (or runs) combined with their posture is known as gait. Recognizing individuals by their particular gait using automated vision based algorithms is known as Gait Recognition [1]. In controlled environments such as airports, banks, and car parks; it is desirable to quickly detect threats. Recent events such as the September 11th attack have brought biometrics to the frontline of attention. Biometric recognition such as gait has the potential to enable a surveillance system to automatically track, recognize and verify subject of interest in real-time without their cooperation or knowledge.

References to gait can be found in: literature, medical research, biomechanics, literature, psycho physiological studies etc.

Shakespeare made several references to the individuality of gait, e.g. in The Tempest [Act 4 Scene 1], Cares observes "Highest Queen of state, Great Juno comes; I know her by her gait", in Henry IV Part II [Act 2, Scene 3] "To seem like him: so that, in speech, in gait, in diet, in affections of delight, in military rules, humors of blood, he was the mark and glass, copy and book".

The aim of medical research has been to classify the components of gait for the treatment of pathologically abnormal patients. Murray et al. created standard movement patterns for pathologically normal people. Those patterns were then used to identify pathologically abnormal patients. The biomechanics literature makes observations concerning identity: "A given person will perform his or her walking pattern in a fairly repeatable and characteristic way, sufficiently unique that it is possible to recognize a person at a distance by their gait". Psycho-physiological studies shown that humans can recognize friends and the sex of a person solely by their gait with 70-80% accuracy. These and similar studies have inspired the use of gait as a biometric trait. Recognition by gait is one of the newest biometrics, since its development only started when computer memory and processing speed became sufficient to process sequences of image data with reasonable performance. Although gait recognition is not sufficiently mature to be deployed in real word applications such as visual surveillance it has the potential to overcome most of the limitations of other biometrics and hence has attracted a vast interest in computer vision research.

The following characteristics are required for the human trait to be deemed to be a biometric [2]:

- Universality - all users possess this biometric
- Uniqueness - varies across users
- Permanence - does not change over time
- Collectability - can be measured quantitatively
- Performance - low error rates and processing time

- Acceptability - is it acceptable to the users?
- Circumvention - can it be easily fooled?

II. GAIT AS A BIOMETRIC

With such aphorisms like "what you say reflects who you are", the way we walk is unique and can be considered as an identifying trait. Unlike several other biometrics, gait has desirable properties:

- Can operate at a distance of 10 meters or more
- Non-intrusive as it does not require the cooperation of the subject
- Non-invasive as it does not force the subject to behave in a certain way
- It is hard to disguise: it has been shown that gait does not vary much in an individual unless there is a case of extreme physical change like carrying a load or change in footwear

Any biometric has its strengths and limitations, which often concern application and social issues. Whether a particular biological characteristic is a valid biometric is dependent upon the requirement of a given application. Fingerprint, iris and retinal patterns may enjoy uniqueness across large populations, but can be difficult to collect, as they require substantial co-operation from the subjects. On the other hand, face, ear and signature can be easily acquired, but they may be easily obscured or disguised. Gait may have the potential to overcome these limitations. One of the unique advantages of using gait as a biometric is that it can be perceived from a distance, making acquisition non-invasive and convenient. Biometrics such as the iris and retinal patterns and face require high resolution images but surveillance cameras are often of poor resolution. Gait will not suffer from this shortcoming because the body has a proportionally larger area compared with the eyes or face. Furthermore, gait cannot be easily disguised without impeding one's natural gait (which will only attract attention). Thus, gait appears to be a potential biometric.

III. GAIT RECOGNITION SCENARIO

Human gait is an important and promising biometric resource for identification. The term gait was first demonstrated by Johansson in 1970. Gait recognition is a multistage process as shown in figure 1.

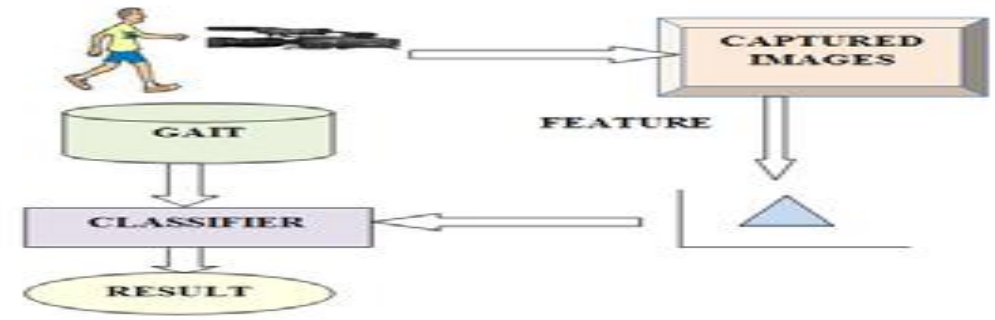

Fig. 1: Block diagram of a gait recognition system.

Using gait as a biometric is a relatively new area of study, within the realms of computer vision. It has been receiving growing interest within the computer vision community and a number of gait metrics have been developed. Early psychological studies into gait suggested that gait was a unique personal characteristic, with cadence and was cyclic in nature [3]. Human recognition based on gait is relatively recent, compared to the traditional approaches such as fingerprint recognition.

IV. RELATED WORK

Gait recognition can be classified into three groups namely; motion vision based, wearable sensor based and floor sensor based. The motion vision can be divided into two groups namely; appearance based methods and model based methods. The appearance based method can be also subdivided in two types; state space methods and spatiotemporal methods. The classification of the recognition system is shown in “Fig 2”, [4-7].

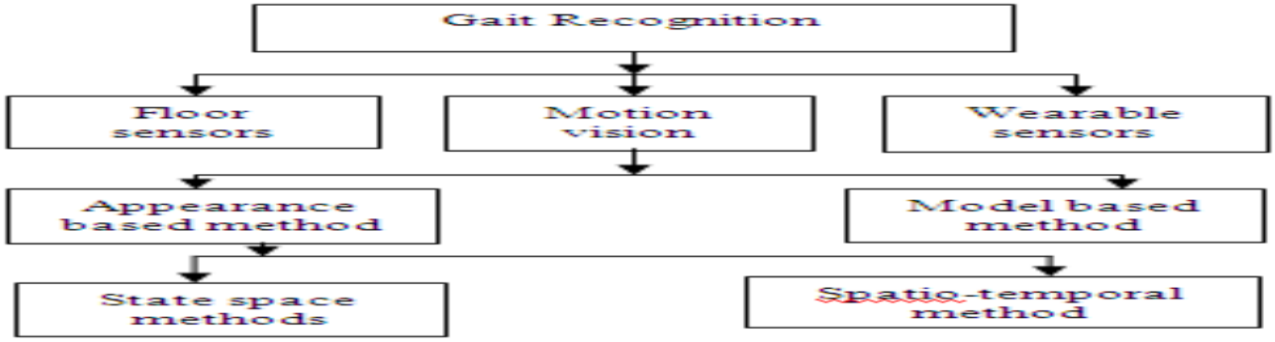

Figure 2: – The classification of gait recognition system

Gait is a person's manner of walking. By this verification process, the system can identify the registered person. There are three different systems which can be categories as knowledge based, object based and biometric based. Knowledge based system is using normally password and pin number. The object base is combination of knowledge based and object based such as smart card with pin code. But both password and smart card system can be steal or lost or forgotten to bring. To overcome these problems, the biometric based may have helped to solve the problems. It can be more reliable and is easy to interface with system. Nowadays biometric is the top research stages for the preventing purposes. Biometric gait recognition refers to verifying or identifying persons using their walking style.

Human recognition based on gait is relatively recent compared to other approach such as fingerprint, iris, facial etc. The biometric gait recognition can be grouped into three categories which are known as machine vision (MV) based, floor sensor (FS) based and wearable sensor (WS) based.

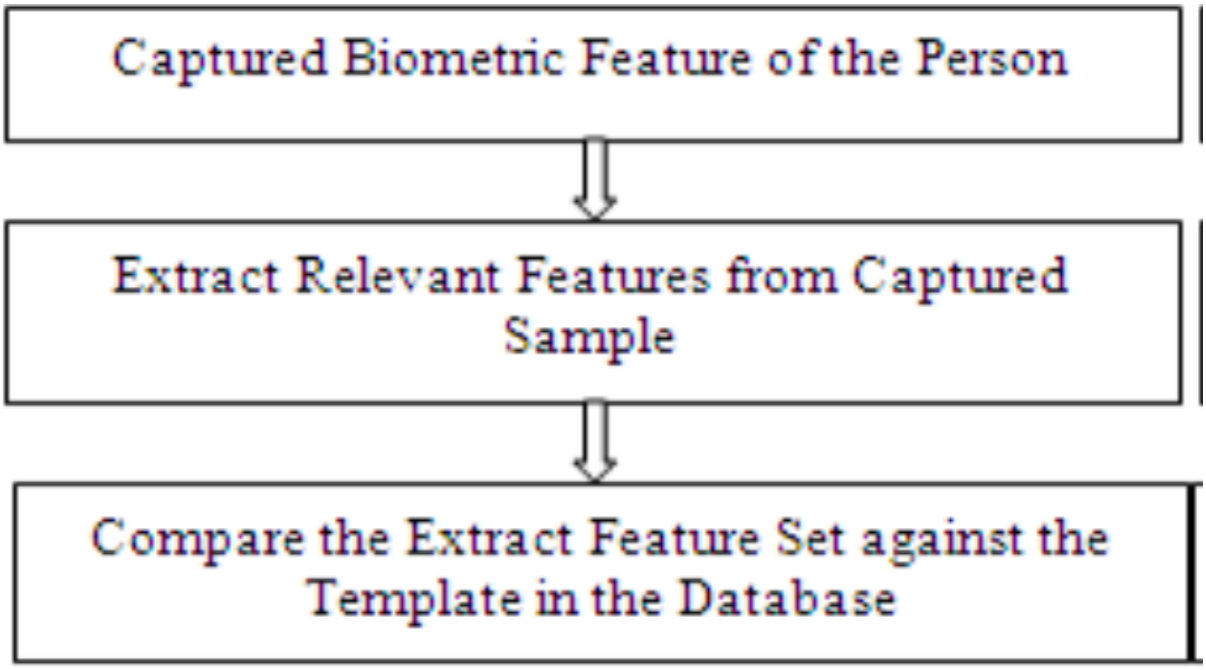

Figure 3 : Motion vision based system flow chart

Honggui and Xingguo [8] proposed dimension reduction technique for gait images. They found that Gaussian technique is better than normal background subtraction technique. They also applied gait alignment technique. The different styles of gait cycle have been applied for gait recognition purposes. They applied CMU MoBo gait database and achieved 92% recognition rate. Qiong et al [9] proposed gait recognition based on PCA and LDA. PCA is mainly used for dimensional reduction technique and LDA is performed to optimize the pattern class. For the experiment, they used their own database and they achieved better recognition rate from PCA compared to LDA. Lee et al [10] proposed for efficient gait recognition with carrying backpack. They have been constructed gait energy image (GEI) to apply recursive principle component analysis technique. This method is aim to remove subject backpack without losing subject original shape and information.

V. RELATED DATABASE

ince the field of gait recognition has been in existence for roughly a decade, the research community has long utilized publicly available databases for comparative evaluation .This table also shows the important features of the particular databases. The most important features of a database are the number of subjects (which should be high), as well as a good set of person variations. These variations include, but are not limited to view angle, clothing, shoe types, surface types, carrying condition, illumination, and time. The first available dataset was the 1998 UCSD Dataset which contains merely 6 subjects. Most of the following early gait recognition databases were published in 2001 from various institutions. Those datasets feature a medium number (about 25) of subjects. It was then found, that for meaningful evaluation, datasets should contain at least 30 subjects and possibly more. The most comprehensive database to date, which features a large set of subjects as well as a substantial set of variations, is probably the Human ID Gait Challenge Other databases such as CASIA (Dataset B) also feature high numbers of subjects and a significant number of variations. CASIA additionally features an exhaustive number of views, which allows for precise 3D reconstruction.

VI. TUMIITKGP DATABASE

The TUMIITKGP Database currently consists of 840 sequences from 35 individuals. The physical setup can be seen in Figure 2. The camera is set up in a rather narrow hallway, reflecting a realistic setup potential real world surveillance application. The camera is positioned at a medium height of 1.85 meters and is oriented perpendicular to the hallway direction.

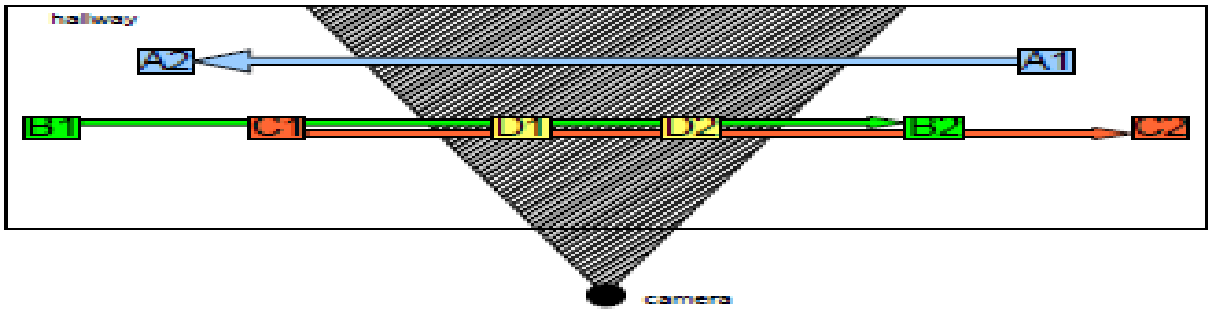

Figure 4: Physical setup of the recording

Thus people are walking from right to left and from left to right in the image. Each person is captured in six different configurations. Furthermore, each of the configurations is repeated two times in a right-to-left motion and two times in a left-to-right motion, resulting in a total of 840 sequences. Table 1and Figure 4 show the six configurations for each person. Each person was primarily recorded in a regular walking configuration, followed by three degenerated configurations including hands in pocket, backpack and gown. These configurations can be used to evaluate recognition methods in the presence of different kinds of gait variation. In all of the four recordings, the person of interest (the subject) is starting to walk at point A1 and ending at point A2.

TABLE 1: WALKING CONFIGURATIONS

	Short Name	Description
Configuration 1	Regular	Regular walking
Configuration 2	Pocket	Walk with hands in pocket
Configuration 3	Backpack	Walk with backpack
Configuration 4	Gown	Walk with gown

VII. APPROACHES

GAIT ENERGY IMAGE (GEI)

Unlike other gait representations which consider gait as a sequence of templates (poses), GEI represents human motion sequence in a single image while preserving temporal information. In comparison to the gait representation by binary silhouette sequence, GEI not only saves storage space and computation time but also it is less sensitive to silhouette noise in individual frames and we do not need to consider the time moment of each frame. GEIs reflect major shapes of silhouettes and their changes over the gait cycle. It accounts for human walking at different speeds. It is referred as the gait energy image because

(a) Each silhouette image is the space-normalized energy image of human walking at this moment

(b) GEI is time-normalized accumulative energy image of human walking in the complete cycle

(c) A pixel with higher intensity value in GEI means that human walking occurs more frequently at this position (i.e., with higher energy).

PCA Technique Only

Recognition process is depends on the extracted features. Two basic feature extraction techniques are classified as feature based and holistic method. Feature based method select individual features and characterization of geometrical relationship. Holistic method such as principal component, linear discriminant analysis and independent component analysis used appearance information extracted from entire image. Holistic feature extraction methods find feature with reduced dimensionality by projecting and original data onto the basic vectors. These extracted features can improve classification performance by reducing irrelevant feature from the data set. Selection of important features and eliminate irrelevant features play important role in recognition and computation process.

Principal component analysis is one method to reduce the dimensionality of variable. It is a feature extraction and data reduction methods which extract data, remove redundant information, highlighting hidden feature, and show the relationship that exist between observations.

PCA based features extraction approach

- Represent the M images as P point vector where P is the product of dimensionality of image. And constructs the training data matrix, size of training data matrix is T=PxM.
- Calculate the mean image using training data matrix T.
- subtract the mean from each of the data dimension of T.
- Calculate the covariance matrix.
- Calculate the Eigen value and Eigen vector for covariance matrix and put them in decreasing order. these show feature vector.
- Calculate the feature vector
- Use equielean distance for recognition.

VIII. GAIT RECOGNITION SYSTEM

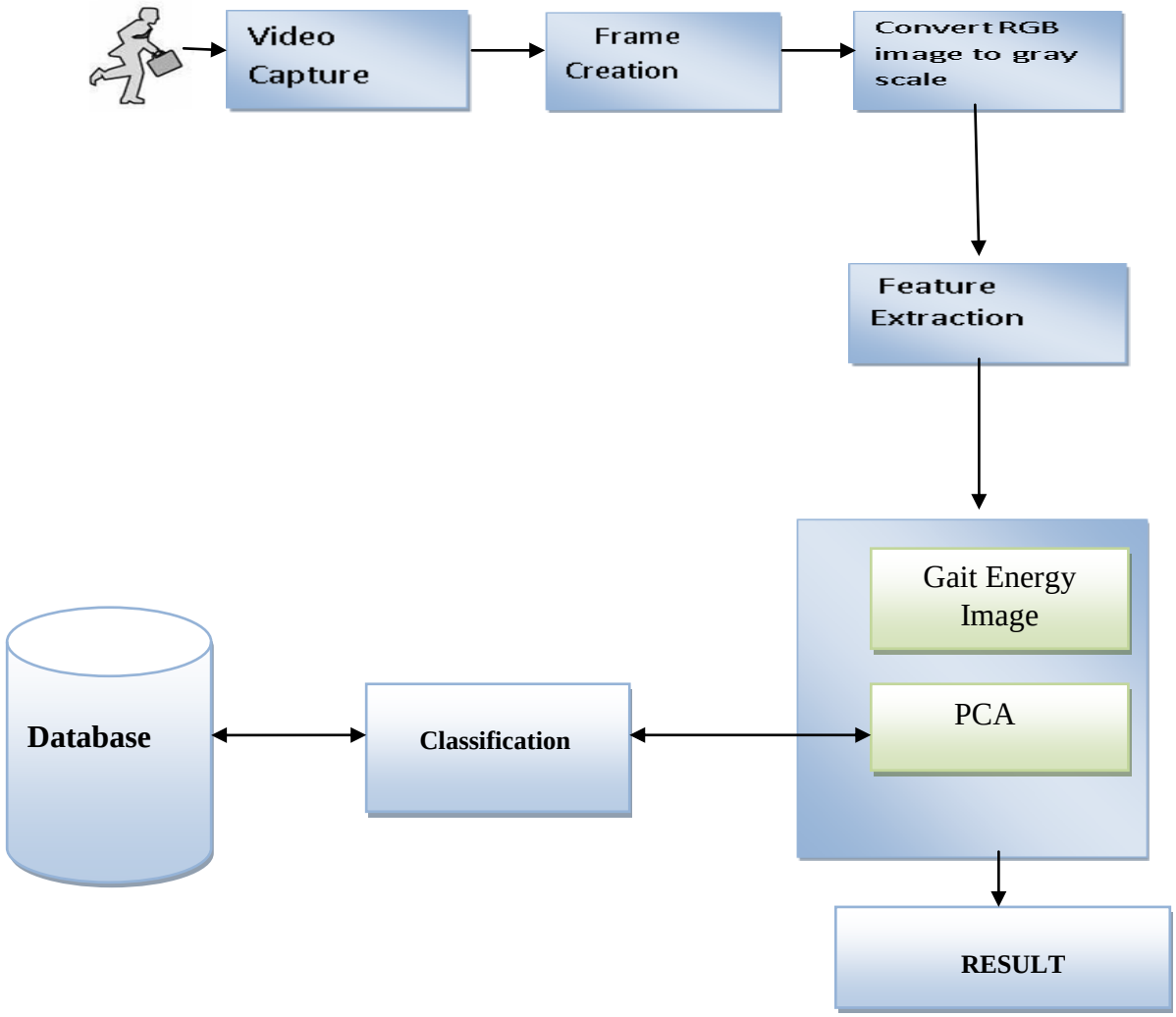

Figure 4: Block Diagram of the Proposed Gait System working

IX. PROPOSED METHODOLOGY

In the proposed work four configuration of TUMIITKGP database is considered. The configurations are Normal Walk, With Gown, with Backpack and Hands in pocket. In this work 10 different persons walk in the manner of four configurations. Designed database software in MATLAB for Gray level images. Database software is used to create gray level images from the video which is present in TUMIITKGP database. The database software takes input as a video and gives images as an output. Selection of 10 images from each configuration and Total no. of images for one person is 40. These images are further use to create Testing and Training Dataset. We have used K fold method to create Testing and Training dataset.Feature extraction using PCA and matching is performed by knn classifier.

A. STEPS

1. Start
2. Database Creation and convert video to frames.
3. Creation of Training and Testing Dataset for k fold approach
4. Input of training dataset
5. Feature extraction using PCA (Principal component analysis) for training Dataset.
6. Select n principal components of images and save it
7. Input of testing dataset
8. Feature extraction using PCA (Principal component analysis) for testing dataset.
9. Select n Principal components of images and save it.
10. Matching the training dataset images with testing dataset images with the help of extracted principal features.
11. Calculate matching accuracy in each k fold situation with k nearest neighbour classifier.
12. End

B. **PROPOSED ALGORITHM**

B.1 DATABASE SOFTWARE GENERATION:

The procedure of this software is as follows:-

1) Load video
2) Extract the frame
3) Total 10 frames are stored per person. Four types normal walk, with backpack, with Gown and hands in pocket is used to store total 40 images per person.
4) Total 400 images are stored in 10 folders person 1, person 2…… person 10 for 10 different person.

B.2 TRAINING AND TESTING DATASET:

1) For k fold testing number of training images and testing images has been generated as follows
2) Load the images in a loop for each person
3) For each condition to read the first images for training and stored in a training folder.
4) Remaining (10-n) images are stored in testing folder
5) Loop is continued to store the images of all person.
6) Number of training and testing has been generated for evaluation of recognition system.

B.3 TRAINING DATASET:

1) Load the training images from any of the training folder.
2) Convert the images matrix in to a column
3) Concatenate all image columns to form a matrix.
4) Generate the correlation matrix by pre multiply of this matrix by its transpose.
5) To find the maximum correlation vector the Eigen values and Eigen vector has been extracted from the correlation matrix.
6) The Eigen vectors corresponding to i Eigen value is known as known as principal component.
7) To n principal components from the complete set of Eigen vectors. Principal Eigen vectors are multiplied by database matrix to get Eigen images in the form of vector.
8) The first Eigen image is the mean of all images which may treat as a gait energy image.
9) Total number of feature has been identified for each images of training dataset. This feature and feature number is stored in *.mat file.

B.4 TESTING CLASSIFIER:

1) Load testing image.
2) Convert image in to columns
3) Generate the matrix by concatenate the image columns then load the Eigen images training data features and classify using Eigen vectors.
4) Show the accuracy in graphical user interface.

X. CONCLUSION AND FUTURE WORK

With the increasing demands of visual surveillance systems, human recognition at a distance has recently gained more interest. This paper has described a simple but effective method for automatic person recognition from body silhouette and gait. Simple feature selection and parametric Eigen space representation reduce the computational cost significantly during training and recognition. We can match the images and classify reduced set of feature vector. 10 person for all configurations is considered. We can further used it for more person and analyse the results.

REFERENCES

[1] D.S. Matovski, M.S. Nixon, S. Mahmoodi, J.N. Carter, "The Effect of Time on Gait Recognition Performance", IEEE Transactions on Information Forensics and Security, vol .7, no. 2, April 2012
[2] A.K. Jain, "Biometric Recognition: How Do I Know Who You Are?," LNCS 3540, Springer, 2003, pp.1-5.
[3] Mark Ruane Dawson ,"Gait Recognition Master's thesis", Department of Computing Imperial College of Science London, June 2002
[4] D.Gafurov , "A Survey Of Biometric Gait Recognition: Approaches, Security and Challenges", NIK-2007 conferences, 2007
[5] Thomas B. Moeslund, Adrian Hilton, Volker Kruger; "A Survey of Advances of Vision-Based Human Motion Capture and Analysis", Computer Vision and Image Understanding 104, pp: 90-126., 2006.
[6] Bo Ye, Yumei Wen; "A New Gait Recognition Method Based on Body Contour",Control, Automation, Robotics and Vision, ICARCV International conference, pp: 1-6, 2006
[7] Boulgouris, N.V. Hatzinakos, D. Plataniotis, K.N., "Gait Recognition: A Challenging Signal Processing Technology for Biometric Identification". Signal Processing Magazine, IEEE, pp: 78-90, 2005.
[8] Guangzhou Li, Xingguo Li, SINOBIOMETRICS: Chinese conference on biometric recognition No 5, Chine, vol. 3338, pp. 671- 679, 2010.
[9] Qiong Cheng, Bo Fu, and Hui Chen; "Gait Recognition Based on PCA and LDA", Proceedings of the Second Symposium International Computer Science and Computational Technology, pp: 124-127, 2006.

