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Human Identification using GAIT Recognition Technique with PAL and PAL entropy, SVM And k-means with LDA

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***Abstract*: - Gait recognition is one kind of biometric technology that can be used to monitor people without their cooperation. The controlled environments such as banks; military installations and even airports need to be able to quickly detect threats and provide differing levels of access to different user groups. The Gait shows a particular way or manner of moving on foot and gait recognition is the process of identifying an individual by the manner in which they walk. And Gait is less unobtrusive biometric; which offers the possibility to identify people at a distance; without any interaction or co-operation from the subject; this is the property which makes it so attractive [2]. This paper proposed new method for gait recognition. In this, firstly binary silhouette of a walking person is detected from each frame of an image. Then secondly, the features from each frame are extracted using the image processing operation. The step size length; centre of mass and cycle length are talking as key feature. In the end, SVM, K-means and LDA are used for training and testing purpose. Here, every experiments and tests are done on gait database. At last in this paper, the result shows that the better improvement from the previous result by using SVM, K-means and LDA.**

Keywords: - Gait Recognition, Gait Pal and Pal Entropy Image (GPPE), SVM, K-means, LDA and identification.

I. INTRODUCTION

Recognition of an individual is an important task to the identify people. The identification through biometric is a better way because it associate with individual not with information passing from one place to another. Biometrics is a physiological or behavioural characteristic; which can be used to identify and verify the identity of an individual. There are numerous biometric measures which can be used to help derive an individual identity. They are physiological; like fingerprints; face recognition; iris-scans and hand scans and behavioural; like keystroke-scan and speech recognition. The Gait recognition is relatively new biometric identification technology which aims to identify people at a distance by the way they walk. This has the advantage of being unobtrusive, difficult to conceal, non invasive and effective from a distance. The human gait recognition as a new biometric aimed to recognize person via the style of people walking, which contain the physiological or behavioural characteristics of human.

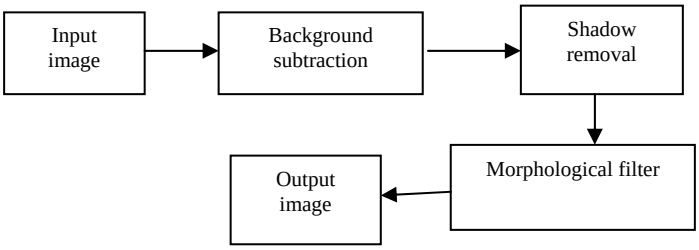

Figure 1: Silhouette extraction

Gait recognition system can be classified depending on the sensors used 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. Then appearance based method can be also subdivided in two types; state space methods and spatial-temporal methods. Human recognition based on gait is relatively recent compared to other biometric approaches such as fingerprint, iris, facial etc [5, 6]. The wearable sensors and floor sensors systems are also able to identify persons but in different conditions compared to motion vision technique. . The sensors may be set up on hip, legs, arms or other parts of the body. The floor sensors are put into the floor or on the floor which enable to detect the required measurement. The most important point is to match up testing dataset with training dataset to identify the subjects. Both systems are useful for access control such as offices, airports, malls and the other restricted places. The motion vision is used for surveillance, access control, detection and other monitoring purposes [1, 3]. In this paper, we focus on two different techniques Principle Component Analysis (PCA) only and PCA with radon transform (RT) on machine vision for gait recognition purposes. In gait recognition, silhouette is defined as a region of pixels of the walking person. The silhouette extraction mainly focuses on segmenting the human body. And silhouette extraction process is shown in “Figure”. Each of the frames in the image sequence is subtracted from a background model of the respective image sequence. If the pixel value of each frame is not the same with the pixel value of the background, the pixel is marked as region of silhouette. To remove noises produced during segmentation of silhouette; morphological filters are used. The main components of morphological filters that are used in the system are morphological opening, morphological closing and area thresholding through connected component labelling [7].

Model-based approaches employ models whose parameters are determined by processing of gait sequences (binary silhouettes). Then in these methods; parameters used as features are the height; the distance between head and pelvis; the maximum distance between pelvis and feet and the distance between feet. The silhouette of a walking person is divided in to some regions (generally seven regions). To high quality binary silhouettes; width of outer contour of the silhouette was proposed as a suitable feature. To low quality binary silhouettes, the binary silhouette may be is used as a feature [4, 11].

II. GAIT RECOGNITION

The first important step towards preventing unauthorized access is the user authentication. The user authentication is the process of verifying identity. Traditionally password were set as a string which included integer or special characters and were used for authentication and these password can easily cracked but now Biometric authentications are used. The biometric is a field of technology that uses automated methods for identifying and verifying a person. In real time applications like in banks; airports; authentications and verifications are always required. In such type of applications biometric identification methods are used.
The biometric characteristics are of two types:

A. *Physiological:*
These are biometrics which is derived from a direct measurement of a part of a human body. Then most prominent and successful of these types of measures are Face, fingerprints, iris, palm print, DNA etc. These are related to body.

B. *Behavioural:*
Voice and Gait are related to behaviour of the person. Extract characteristics based on an action performed by an individual; they are an indirect measure of the characteristic of the human form. The main feature of a behavioural biometric is the use of time as a metric. Then established measures include keystroke-scan and speech patterns. Biometric identification should be an automated process. Therefore manual feature extraction would be both undesirable and time consuming; due to the large amount of data that must be acquired and processed in order to produce a biometric signature. And inability to automatically extract the desired characteristics which would render the process infeasible on realistic size data sets in a real-world application.

C. *Gait Analysis:*
Gait analysis is the systematic study of human locomotion; augmented by instrumentation for measuring body movements; body mechanics and the activity of the muscles. Gait based recognition is more suitable in video surveillance applications because of following advantages:
1. Recognition using gait do not need any user cooperation.
2. The gait of an individual can be captured at a distance.
3. Gait recognition does not require images of very high quality and provide good results in low resolution.

D. Approaches for Gait Recognition:
And some basic methods or approaches for gait recognition [10]:
D.1. Moving Video based gait recognition: In this approach, gait is captured using a video-camera from a distance. Image and video processing techniques are employed to extract gait features for recognition purposes such as stride, cadence, and static body parameters extra.
D.2. Floor Sensor based gait recognition: In this approach, a set of sensors/force plates are installed on the floor and such sensors enable to measure gait related features, when a person walks on them, e.g. maximum time value of the heel strike, maximum amplitude value of the heel strike extra.
D.3. Wearable Sensor based gait recognition: In this approach, gait is collected using body worn motion recording sensors. The MR sensors can be worn at different locations on the human body. The acceleration of gait, which is recorded by the MR sensor, is utilized for authentication [7, 8].

E. Steps of Gait Recognition System:
E.1. the Background Subtraction: In this approach moving objects from background in the scene are identified first. Then some of the background subtraction techniques are applied on it .A common approach is to perform background subtraction; which identifies moving objects from the portion of video frame that differs from the background model. The background subtraction generates binary images containing black and white (moving pixels) also known as binary silhouettes. The background subtraction is a class of techniques for segmenting out objects of interest in a scene for applications such as surveillance. There are number of challenges in developing a good background subtraction algorithm. 1st; it must be robust against changes in illumination. 2nd; it should avoid detecting non-stationary background objects such as moving leaves; rain; snow and shadows cast by moving objects. And finally; its internal background model should react quickly to changes in background such as starting and stopping of vehicles.

E.2. Pre-processing: Silhouette segmentation is the first step to gait recognition. Pre-processing is done on video frames to reduce presence of noise then some filters are applied which in turns blur the frames of image, which helps in shadow removal, after pre-processing motion detection is performed. Background subtraction technique uses the difference of current image and background to detect the motion. It delineates the foreground from background in the image. Background subtraction generate binary image containing black (background) and white (moving pixel), then post processing is applied to obtain normalized silhouette images with less noise.

E.3. Feature Extraction: Feature extraction is a special form of dimensionality reduction. And when the input data is too large to be processed and it is suspected to be notoriously redundant (e.g. the same measurement in both feet) then the input data will be transformed into a reduced representation set of features (also named features vector). Then transforming the input data into the set of features is called feature extraction.
E.4. Recognition: This is the final step of human identification using gait. In this step input videos are compared with sequences stored in database. Different types of classifiers are used for the recognition. Such as: MDA (Multi-linear discriminant analysis), LDA (Linear Discriminant Analysis).They use MDA approach to optimize the separability of gait features.

F. Gait Recognition System:

System will identify unauthorized individual and compare his gait with stored sequences and recognize him. The background subtraction is the common approach of gait recognition. Then Background subtraction method is used to subtract moving objects and to obtain binary. Using background subtraction, pre-processing is done to reduce noise. The background subtraction techniques are also classified into two types: non- recursive methods and recursive methods. Non recursive techniques use sliding window approach for background subtraction. The recursive methods use single Gaussian method and Gaussian mixture model. The Gait recognition method contains two parts

1. Training part
2. Testing part

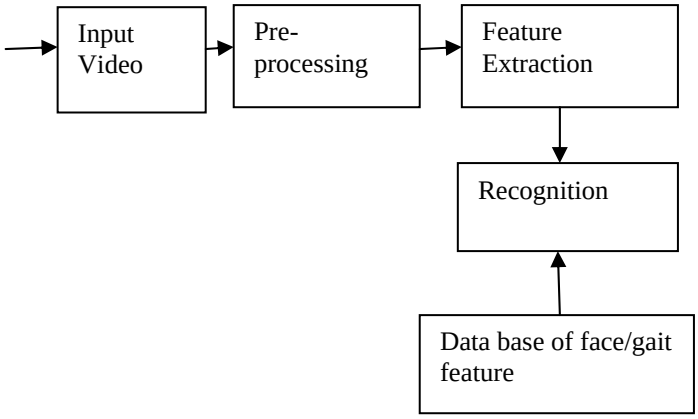

Figure 2: Block diagram of Gait Recognition System.

Gait analysis laboratory has several cameras (video or infrared) placed around treadmill, which are directly linked to a computer. Then person has markers located at various points of body (e.g. spines of the pelvis, ankle malleolus) [10]. When person walks down the treadmill and the computer calculates the trajectory of each marker in three dimensions. And model is applied to calculate the movement of bones.

III. TECHNIQUES FOR GAIT RECOGNITION

Following are the two main techniques for gait recognition algorithm which is based on:

i. SVM.
ii. K-Means.

In the training, after parallel processing of two training processes, spatial and temporal templates are extracted. These templates are used for training by SVM and K-means.

Moving target classification algorithm is used separate human being (i.e., pedestrian) from other foreground objects (viz., vehicles). Shape and boundary information is used for this moving target classification. The Width vector of outer outline of binary silhouette and Gait PAL AND PAL ENTROPY coefficients are taken as the feature vector. Extracted feature vectors are used to recognizing individual. Surf Feature is used for recognizing persons is based on gait. There are various parameters like distance between hand and distances between legs are calculated. Finally SVM and K-means results are calculated which is far better in comparison to previous research paper.

The generated transformation matrices by Support Vector Machine (SVM) and K-means and extended vectors which represent gait sequences of different subjects are retained in the trained data base. Test sequences are pre-processed by template extraction and projection. The projected vectors of spatial and temporal templates are concatenated in to extended vectors before recognition. Then these enlarged vectors are matched to the trained data base according to the accumulated the measured distance.

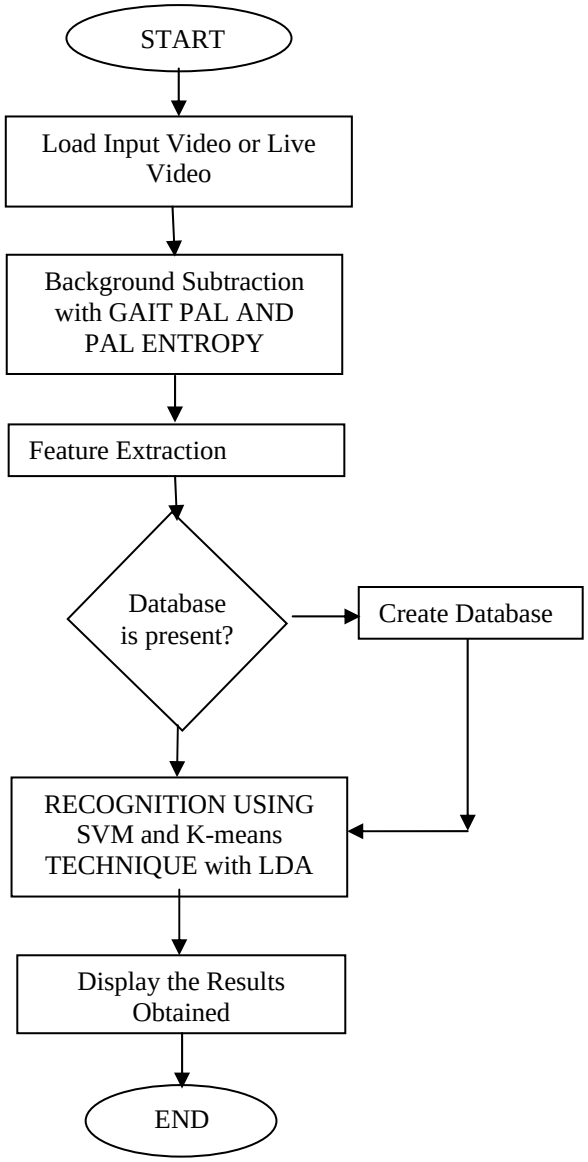

Figure 3: Flow chart of proposed work

IV. LINEAR DISCRIMINANT ANALYSIS

Linear Discriminant Analysis (LDA) is a techniques used for data classification and dimensionality reduction. In PCA, the shape and the location of the original data sets changes when transformed to a different spaces whereas LDA doesn't

change the location but only tries to provide more class reparability and draw decision between the given classes.

In discriminate analysis, the two scatter matrices, called *within-class* (*Sw)* and *between-class* (Sb) matrices are defined to quantify the quality.

$$S_w = \sum_{i=1}^{k} \sum_{x \in \Pi_i} (x - m_i)(x - m_i)^T \text{ and } S_b = \sum_{i=1}^{k} n_i (m_i - m)(m_i - m)^T, \text{ where}$$

$$m_i = \frac{1}{n_i} \sum_{x \in \Pi_i} x \text{ is the mean of the ith class, and } m = \frac{1}{n} \sum_{i=1}^{k} \sum_{x \in \Pi_i} x \text{ is the global mean.}$$

V. Results And Discussion

In the following figures, result of proposed algorithm is highlighted.

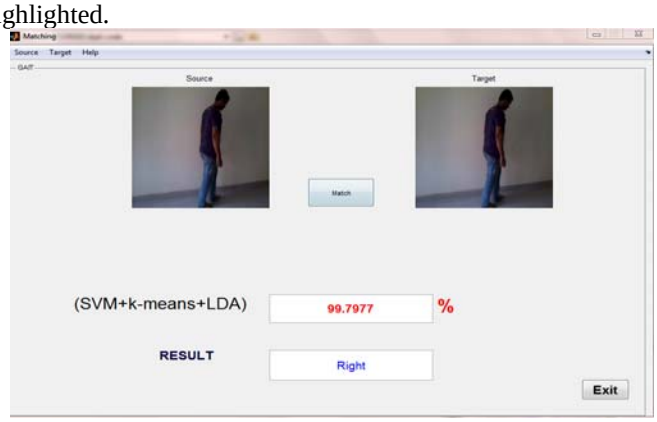

Figure 4: Successful match

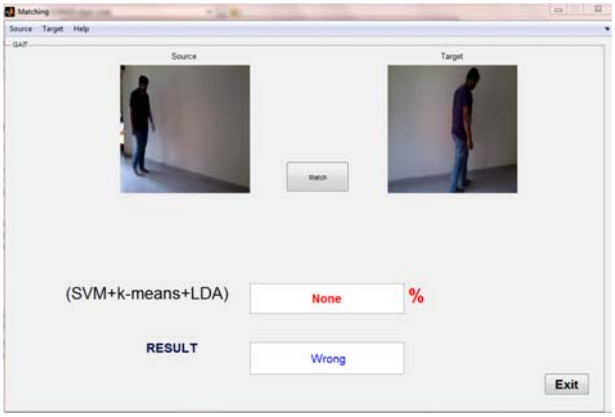

Figure 5: Unsuccessful match

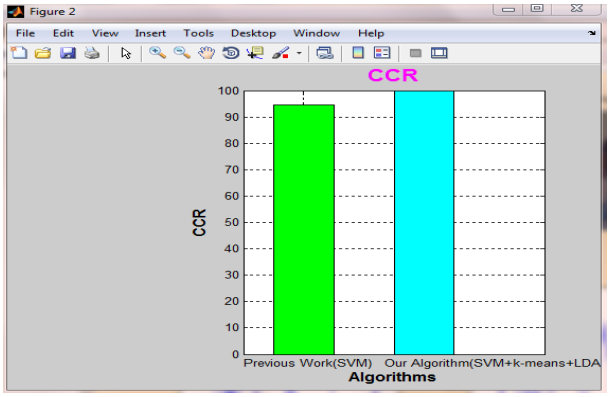

Figure 6: Comparison of CCR value

Following tables are used to show the proposed results:

Table 1: Comparison of CCR between Previous and our algorithm

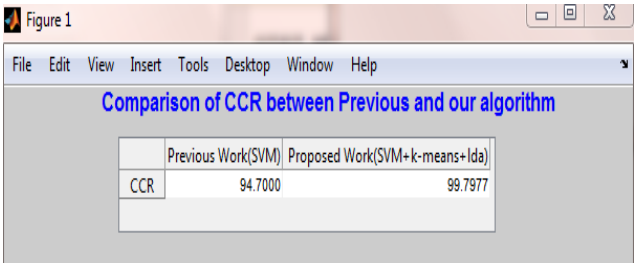

Table 2: Matching Time of our Algorithm

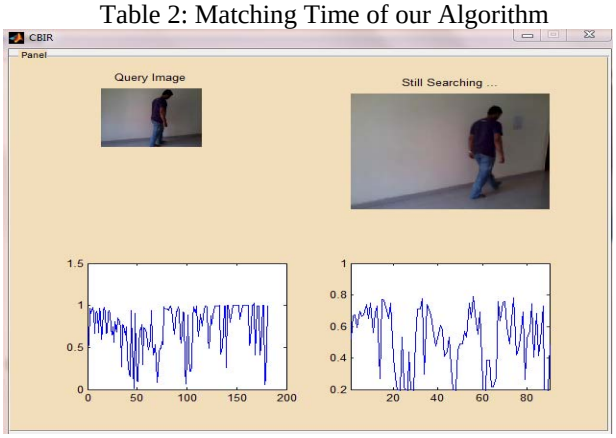

Figure 7: CBIR representation

The above figure shows the result of identity authentication using Gait recognition by using SVM and K-Means. This technique gives better result as compare to previous technique. By use this technique the value accuracy up to 99.79%.

VI. CONCLUSION

Human Identification Using Gait Recognition has been proposed previously but there have been always need for better Gait Recognition Technique. The existing Human Identification Using Gait Recognition doesn't consider some important parameters like distance between right hand and right leg and thus it is poor in quality. The existing Human Identification Using Gait Recognition algorithm is less accurate. Therefore, propose an enhanced Human Identification Using Gait Recognition algorithm which is based on PAL and PAL entropy and SVM (SUPPORT VECTOR MACHINE), LDA and k-means. Our enhanced Human Identification Using Gait Recognition algorithm is more accurate. Our enhanced Human Identification Using Gait Recognition algorithm is fast and thus saves time.

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