Features Mapping Based Human Gait Recognition

Prerna Arora
P.G. Student, Department of Electronics and communication Engineering, JCDM College of Engineering, Sirsa, Haryana , India [1]
prerna1993arora@gmail.com

Rajni
Assistant Professor, Department of Electronics and communication Engineering, JCDM College of Engineering, Sirsa, Haryana, India [2]
Er.rajni08@gmail.com

Abstract- Gait recognition is the term used for detection of Human based on the features. The Feature extraction and Feature Mapping is the main aspect to recognize the Gestures from the Database of features. Recognition of any individual is a task to identify people. Human recognition methods such as face, fingerprints, and iris generally require a cooperative subject, physical contact or close proximity. These methods are not able to recognize an individual at a distance therefore recognition using gait is relatively new biometric technique without these disadvantages. Human identification using Gait is method to identify an individual by the way he walk or manner of moving on foot. Gait recognition is a type of biometric recognition and related to the behavioral characteristics of biometric recognition. Gait offers ability of distance recognition or at low resolution. This project aims to recognize an individual using his gait features. However the majority of current approaches are model free which is simple and fast but we will use model based approach for feature extraction and for matching of parameters with database sequences. After matching of Features, the Images have been identified and show the dataset from it matched. The Results are accurate and shows efficiency. 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. In the end SVM, K-MEANS and LDA are used for training and testing purpose. Every experiment and test is done on CASIA database. The results in this paper are better and improved from previous results by using SVM , K MEANS.

Keywords- *Biometrics, gait, gait recognition approaches[1],PCA,SVM, LDA[6],CASIA Database, CMU MoBo database.*

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I. INTRODUCTION

One of the first most important step towards preventing unauthorized access is user authentication. User authentication is the process of verifying claimed identity. Conventionally user authentication is grouped into three classes:

- Knowledge based
- Object(token) based
- Biometric based

The knowledge based authentication is based on something one knows and is characterized by secrecy. The knowledge based basically includes passwords and pin codes. The object based relies on something one has and is characterized by possession. Traditional keys to the doors can be assigned to be object based authentication .Biometric based authentication is based on something one IS. In knowledge based and object based approaches, passwords and tokens can be forgotten, lost or stolen .There are also usability limitations associated with them. Biometric based authentication [3] lacks above mentioned difficulties. Biometrics refers to the metrics related to human characteristics and traits. The identification through biometrics is a better way because it associates with individual not with information passing from one place to another. The term biometric is derived from a Greek word "BIO" means life and "METRICS" means measure. Thus biometric is science and technology of measuring and analyzing biological data.

Biometrics is classified into two categories:

❖ Physiological :
Fingerprint recognition
Iris recognition
Face recognition
DNA recognition

❖ Behavioral :
Typing rhythm
Gait recognition
Voice recognition

Physiological characteristics [13] are related to the shape of body. Behavioral characteristics are related to the pattern of behavior of an individual and pay attention to the actions of a person. Many biometric technologies have emerged for identifying and verifying individuals by analyzing face, fingerprint, palm print, iris, gait or a combination of these traits. Compared to other biometric methods, gait recognition offers several unique characteristics. The most attractive characteristic is its unobtrusiveness, which does not require observed subjects attention and cooperation. Also, human gait can be captured at a far distance without requiring physical information from subjects. This favorable characteristic has great advantages, especially when individual information such as face image is confidential. Moreover, gait recognition offers great potential for recognition of low-resolution videos, where other biometrics technologies may be invalid because of insufficient pixels to identify the human subjects.

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II. GAIT RECOGNITION

The definition of Gait is defined as: "A particular way or manner of moving on foot" .Gait recognition approaches employ both static and dynamic features for recognition. Static features of body are above the waist i.e head , neck and shoulder etc. . Dynamic features parts are below the waist i.e foot, legs etc. Most of the methods adopt both the features and some adopt only dynamic features.

The human walking pattern consists of multiple repeated gait cycles. Each gait cycle contains two steps. During a stance phase the foot is on the ground, during a swing phase it is lifted and moved forward. Starting with a double support phase, where both feet are on the ground, the right foot is lifted and moved forward. Afterwards the left foot is lifted from the left swing phase. The gait cycle ends, when the left foot touches the ground again as shown in figure 1.

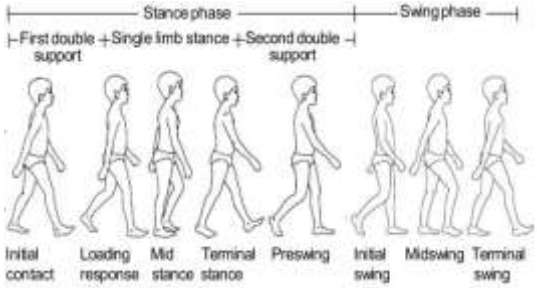
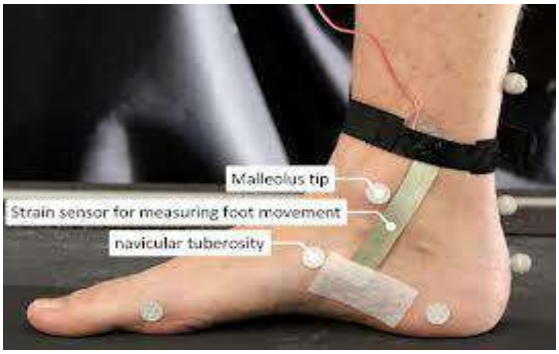


Figure 1: Gait of a child.

A. METHODS

There are some basic methods [1] for gait recognition:

- Moving Video Based gait recognition : In this approach ,gait is captured using a video camera from a distance . Video and image processing techniques are employed to extract gait features for recognition purpose. For example stride, cadence, static body parameters etc.
- Floor Sensor Based gait recognition : In this approach ,a set of floor sensors or 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 heel strike, maximum amplitude value of heel strike, etc.
- 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. Among these, video based approach has unique advantage that it can be captured from a distance without subject's willingness or without any physical contact. Once the video is captured, some distinct gait features are extracted form the video. These features are then saved as templates and used for the identification.



(A)

(B)

Figure 2: (A) person walking with sensor on foot , (B) person with sensor on waist.

B. COVARIATE FACTORS

There are some factors which affects the human gait and consequently on recognition. They can be categorized in two types:

1. External Factors: Such factors mostly impose challenges to the recognition approach (or algorithm). For example, viewing angles(e.g. frontal view, side view), lightning conditions(e.g. sunny day, rainy day etc), clothes, walking surface conditions(e.g. hard/soft, dry/wet, grass/concrete etc), shoe types(e.g. mountain boots, sandals etc), object carrying(e.g. backpack, briefcase etc.).
2. Internal Factors: Such factors cause changes of the natural gait due to sickness(e.g. foot injury, lower limb disorder, Parkinson disease etc) or other physiological changes in the body due to aging , drunkenness, pregnancy, gaining or loosing weight etc.

C. APPROACHES

Basically, gait analysis can be divided into two major categories, namely model-based approach and model-free approach.

- Model-Based Approach

Model-based approach generally models the human body structure or motion and extracts the features to match them to the model components. It incorporates knowledge of the human shape and dynamics of human gait into an extraction

process. The gait dynamics are extracted directly by determining joint positions from model components, rather than inferring dynamics from other. Thus, the effect of background noise can be eliminated. Research examples of this approach are static body parameters, thigh joint trajectories, dual oscillator, articulated model, 2D stick figure and elliptic Fourier descriptors. The advantages of this approach are the ability to derive dynamic gait features directly from model parameters. It is free from background noise as well as effect of different subject's apparel or camera shooting viewpoint. However, it creates many parameters from extracted gait features and hence resulting in a complex model. Due to that reason, the computational time, date storage and cost are high due to its complex searching and matching procedures.

- Model-Free Approach

Model-free approach generally differentiates the whole motion pattern of the human body by a concise representation such as silhouette without considering the underlying structure. Research examples of this approach are self-similarity Eigen gait, key frames analysis, spatial-temporal distribution characterization, kinematic features, unwrapped silhouette, higher order correlation, video oscillations and gait sequences. The advantages of this approach are speedy processing, low computational cost and small data storage. However, the performance of this approach is highly affected by the background noise and the changes of the subject's apparel.

III. RELATED WORK

[1]Gait is an emergent biometric aimed essentially to recognize people by the way they walk. Gait's advantages are that it requires no contact like automatic face recognition, and that it is less likely to be obscured than other biometrics. Gait has allied subjects including medical studies, psychology, human body modeling and motion tracking. These lend support to view that gait has clear potential as a biometric. To identify a person using their distinct Gait, the publicly available database is being taken in the video sequence format. By applying PCA analysis the gait points are extracted and trained. To obtain the false positive points LDA and a combined approach of LDA and Radon is used. The performance of the usage of LDA separately and LDA Radon are being compared and the results are being produced as the graph.

In [2] this paper, proposed a new method for gait recognition, firstly binary silhouette of a walking person is detected from each frame. Secondly, feature from each frame is extracted using image processing operation. Here center of mass, step size length, and cycle length are talking as key feature. At last neural network is used for training and testing purpose Here all experiments are done on CASIA gait database .The recognition rate for method results 96.32%.

[3] In this paper, a simple but effective gait recognition method based on outermost contour is proposed. For each gait image sequence, an adaptive silhouette extraction algorithm is firstly used to segment the frames of the sequence and a series of post processing is applied to obtain the normalized silhouette images with less noise. Then a novel feature extraction method based on outermost contour is performed. Principal Component Analysis (PCA) is adopted to reduce the dimensionality of the distance signals derived from the outermost contours of silhouette images. Then Multiple Discriminant Analysis (MDA) is used to optimize the separability of gait features belonging to different classes. Nearest Neighbor (NN) classifier and Nearest Neighbor classifier with respect to class Exemplars (ENN) are used to classify the final feature vectors produced by MDA. In order to verify the efectiveness and robustness of feature extraction algorithm, two other classifiers – Back propagation Neural Network (BPNN) and Support Vector Machine (SVM) are used for recognition. Experimental results on a gait database of 100 people show the accuracy of using MDA, BPNN and SVM can achieve 97.67%, 94.33% and 94.67%, respectively.

[4] In this paper, Principal Component Analysis (PCA) with and without Radon Transform (RT) are applied for gait recognition purposes. The Radon Transform is used to detect features within an image and PCA is used to the reduce dimension of the images without much loss of information. The side view of slow walk , fast walk and carrying a ball walk have been selected from the CMU MoBo database for experimental purposes. The two techniques experimental result achieved equal recognition rates (EER) of 85.40%, 78.07% and 90.05% for RT with PCA and 85.18%, 80%, and 89.90% for PCA only for slow walk, fast walk and carrying a ball walk respectively.

In [5], the approach was done using angle at intersecting points and Fuzzy inference system. This was tested on a database of video sequence corresponding 17 people. The aim was to increase the matching accuracy using two components i.e. hand and feet. The proposed method increased the accuracy which lies between 75 to 86 percent.

[6] This paper proposed new methods i.e accelerometer-based biometric gait recognition which achieve sufficient low error rates, as well as to demonstrate that their computational effort is low and allows for an execution on current smart phones. Because the basis of existing methods is the extraction of gait cycles.. This method uses raw data of the gait cycles as feature vectors and accomplishes the classification using distance functions. In addition, a further approach was selected, which does not need the time-costly and error-prone gait cycle extraction. Instead, it is using overlapping segments of a fixed time length. Several features are extracted from these segments

and combined to feature vectors. Machine learning algorithms are used for classification. A benchmark of the approaches on a challenging database showed that these methods yield low equal error rates between 6% and 7% and are outperforming the cycle-based methods. These error rates were achieved under the realistic conditions that training and probe data are not collected on the same day. It was shown that five minutes of gait data are sufficient to thoroughly train the modelsTo obtain low false rejection rates, the classification should be based on around three minutes walk data. Two of the developed methods were implemented on a smartphone. It was shown that both methods are able to perform the classification fast enough to allow for an authentication without delay for the user.

[7] This project aims to develop a system capable of automatic gait recognition. A person's gait signature is created using a model based approach. Temporal and spatial metrics extracted from the modal, such as length of torso, shin and variation in angles of the limb or the amplitude of a person's walking pattern can all be used to create a "gait signature" of the individual which are transformed into a self similarity matrix. The use of spacio -temporal correlation method to identify the subject in subsequent video sequences.

[8]This paper proposed new method for gait recognition. . In this they presented the review of gait recognition system, different approaches and classification categories of Gait recognition like model free and model based approach, MDA, ENN, NN.

[9] In this paper, a modern gait recognition technique is proposed in Cell Phone-Based Biometrics by testing the technique outside of the laboratory on real users under everyday conditions. They propose how this technique can be applied to create an anti-theft system. The system proposed in this paper shows results as high as 91% for cross-fold accuracy for some users; however, the predictive accuracy for a single day's results ranged from 0.8% accuracy to 92.9% accuracy, showing an unreliability that makes such a system unlikely to be useful under the pressure of real-world conditions.

[10] This paper presents an approach to identify human gait patterns using features extracted from statistical moments. Post background subtraction, silhouette frames of walking subjects were segmented into 9-segments representing different human body parts. Statistical moments, viz., geometric moments, legendre moments and Krawtchouk moments were used individually to extract some distinguishable gait features namely centroid, aspect ratio and orientation from each segment of the silhouettes. In addition to these features, height and width of the person were also included. Each walking person was represented by a gait pattern ora feature vector, generated using 38 features extracted from silhouette. A minimum distance classifier based on Euclidean distance was used to recognize the input image sequence in testing phase. All the experiments were conducted on CASIA database. The performance of geometric moment based representation was the best among the three moments. From the proposed method, an encouraging recognition rate of 92.50% was achieved.

In [11] firstly binary silhouette of a walking person is detected from each frame of an image. Then the features from each frame are extracted using the image processing operation. The step size length, center of mass and cycle length are taken as key features. In end, SVM, K-Means, LDA are used for training and tracking purpose. Here every test is done on gait database. This technique gives recognition accuracy up to 99.79%.

IV. PROPOSED GAIT RECOGNITION METHOD

A) The background subtraction: in this step firstly the moving objects in the video are identified. Then some of the background extraction techniques are applied on it. The background subtraction generates binary image containing black and white (moving pixels) also known as binary silhouettes. There are no. of challenges in developing a good background subtraction algorithm.

1- It must be robust against changes in illumination.
2- It should avoid detecting non-stationary background objects such as moving leaves, rain, snow etc.
3- Its internal background model should react quickly to changes in background such as starting and stopping of vehicles. In my work I m using CASIA database.

B) Pre-processing: silhouette segmentation is the first step towards gait recognition. Pre processing is done to redusce the presence of noise , then some filters are applied which in trun blurr the frame of image, which helps in shadow removal, after pre-processing motion detection is done. Background substraction technique uses the difference of current image and backgfround to detect the motion.

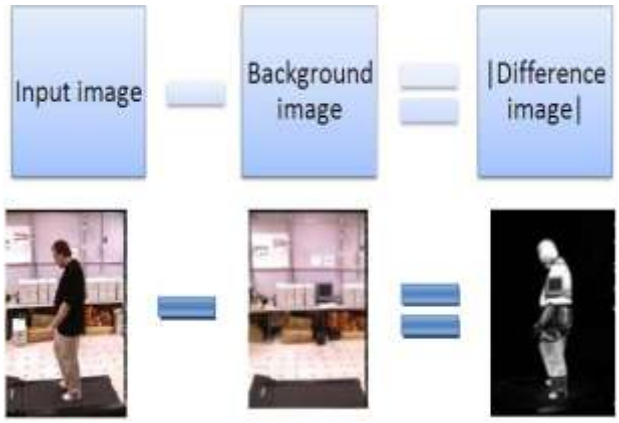


Figure 3: Background Extraction.

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C) Feature extraction: it is special form of dimentionality reduction. And when the input data is too large to be processed and it is suspected to be notoriously redundant(eg same measurement in both feet) then the input data will be transformed into a reduces representation set of features. Then transforming the input data into set of features is called feature extraction.

D) Recognition: this is the final step of human gait recognition. In this step input images are compared with sequence of image stored in database. Different types of classifiers are used for the recognition such as MDA, LDA etc.

V. FLOWCHART OF PROPOSED WORK

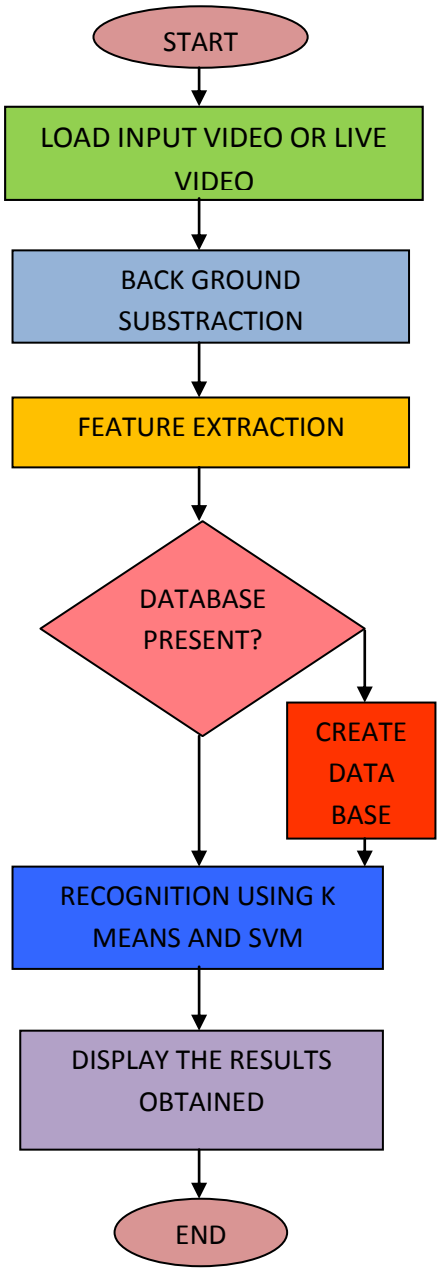

Figure 4:Flowchart of proposed work

VI. SVM AND K-MEANS

The Support Vector Machine (SVM) is a state-of-the-art classification method. The SVM classifier is widely used in bioinformatics (and other disciplines) due to its highly accurate, able to calculate and process the high-dimensional data The theory of SVM is based on the idea of structural risk minimization22. In many applications, SVM has been introduced as a powerful tool for solving classification problems. Consequently, many researchers have used SVM on gait recognition. However, it is to be noted that SVM is fundamentally a two-class classifier. SVM first maps the training samples into a high dimension space (typically much higher than the original data space) and then finds a separating hyperplane that maximizes the margin between two classes in this high-dimension space. KMeans is an iterative refinement heuristic algorithm that works faster. A common method is to run the algorithm several times regain the best clustering found. K-means clustering procedures which can be applied for scalable image retrieval from large databases. K-means clustering algorithms to group the images into clusters based on the color content. Clustering is a mutually exclusive partitioning process of the feature space of feature vectors in a meaningful way for the application domain context. With the clusters, we may perform nearest neighbor search efficiently. The unique aspect of this system is the utilization of hierarchical and k-means clustering techniques. Here we are going to filter most of the images in the hierarchical clustering and then apply the clustered images from the hierarchical clustering to K-Means, so that we can get better favored image results. After clustering and selecting the cluster centers, the given query image is first compared with all the cluster centers. The clusters are ranked according to their similarity with the query. Then the query image is compared directly with the images in these clusters. Thus, the number of comparisons is reduced considerably from comparing the query with all the images in the database. The number of similarity comparisons required depends on the sizes of the clusters and the number of clusters being examined .A user instead of searching through a large database is concerned in only clustered image results. Now, we apply clustered images from the hierarchical clustering to the k-means algorithm which takes the input parameter, k, and partitions a set of n objects into k clusters so that the resulting intra-cluster similarity is high. An object is assigned to the cluster to which it is the most similar one. This object assignment is based on the distance between the object and the center it's closest to. It then computes the new centroid and in this way each center finds the centroid of its own points. This process iterates until the criterion function converges. Thus, the retrieval will be very accurate with the hierarchical and K-Means clustering. It leads to the better performance than by using individual algorithmic methods.

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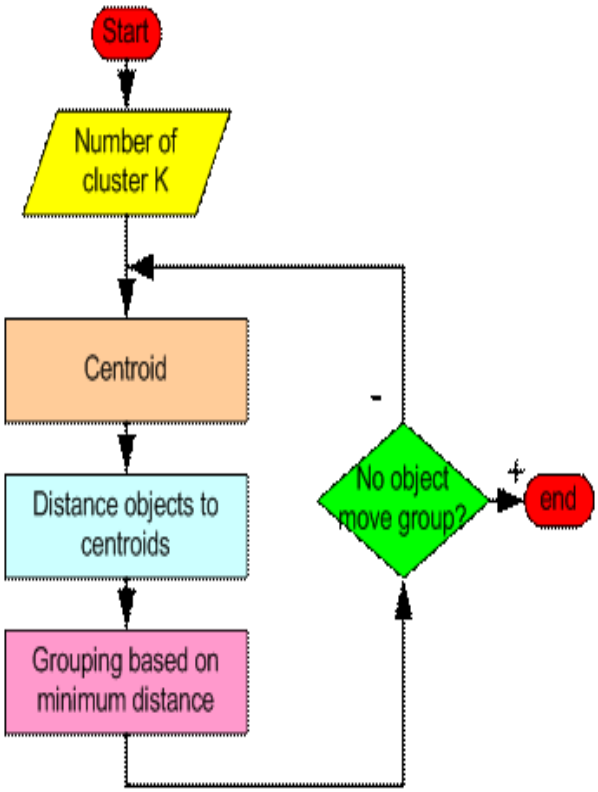
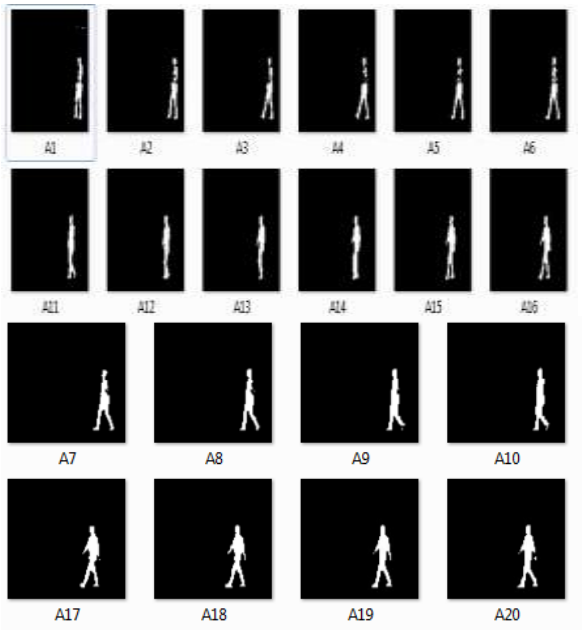


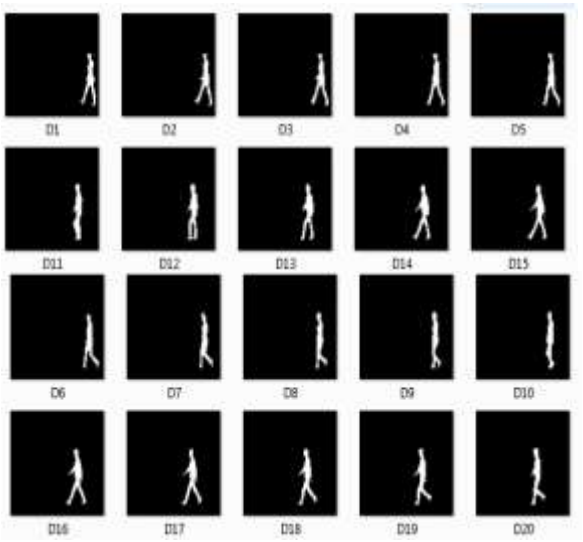
Figure 5 : Flowchart of k means

VII. Data Collection

The experiment requires the video based images and has been collected publicly. The experimentation of the proposed gait recognition system is performed with images publicly available and generated the database.



(A) (B)



(C) (D)

Figure6: (A) (B)Training Dataset 1 , (C) (D) Training Dataset 2

VIII. TESTING IMAGES

The text file has been created which shows the dataset to which the testing image relates. After execute the Code, the algorithm shows that it relates to Data1 and Image which actually relates. If feature not mapped and not found, then it shows that the image not found.

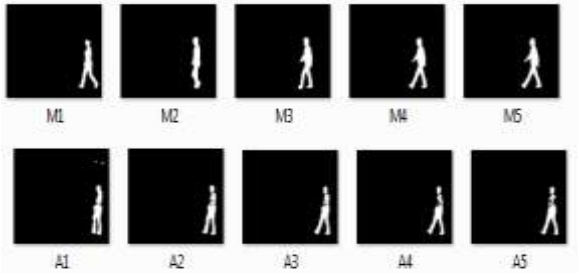


Figure7: Testing Dataset

IX. CONCLUSION AND RESULT

Human identification using gait recognition method has been proposed previously also but there is always a need for better gait recognition technique. Various existing method does not consider parameters like distance between the hands and thus it is poor in quality. Various existing methods are less accurate. Method used in this paper for recognition is based on SVM methods and K-means clustering. Detection and tracking of human from a video sequence is the first step in gait recognition. The proposed system works with the assumption that the video sequence to be processed is captured by a static camera, and the only moving object in video sequence is the subject (person).

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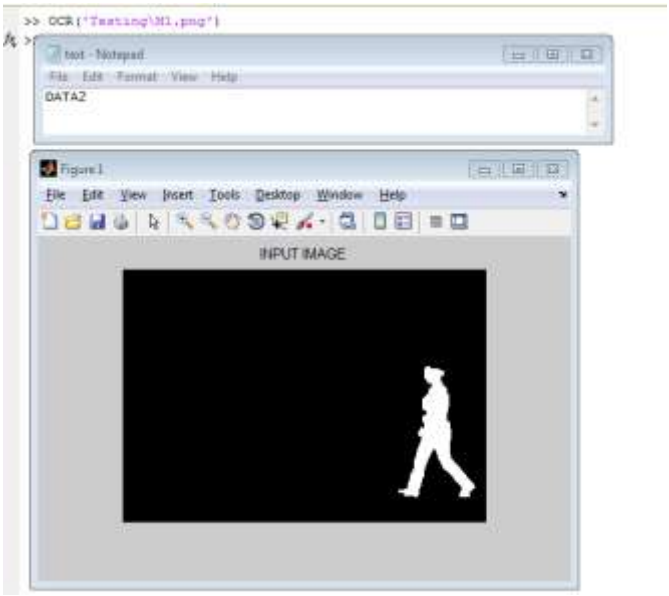
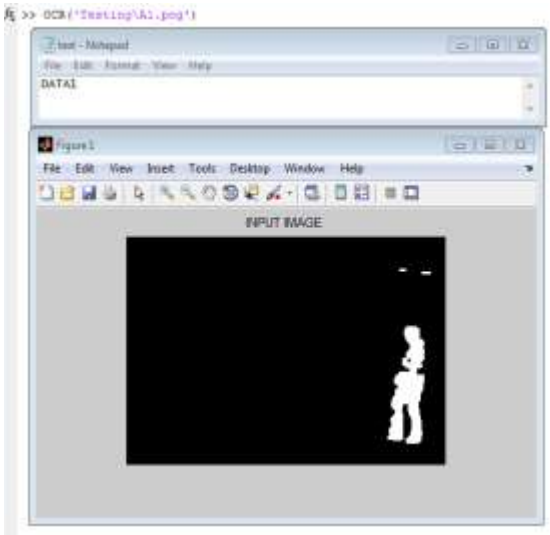


Given a video sequence from a static camera, this module detects and tracks the moving silhouettes. Broad experimentation has been carried out for the effectiveness of the proposed system and a detailed analysis and discussion on the results are presented in the sub-sections below. The M1 image has been taken as testing image and features has been extracted and Feature mapping has been implemented. The results shows that it is mapped to the Dataset 2 because the testing image's features are not available in dataset 1 as in figure 8.



(A)

(B)

Figure 8: (A) Testing Example 1, (B) Testing Example 2

Our results show more accurate recognition. Recognition rate for our proposed method is 95%.

X. CONCLUSION AND FUTURE SCOPE

The Gait Recognition System has been developed based on Features. For Detection human gestures, the dataset has been taken of multiple scenarios. The Training has been provided to the algorithm and Features Mapping concept has been used. Initially the features have been extracted from the training dataset and stored in the templates. The new images have been provided for testing and validate the work, then the new features has been extracted and mapped with the stored features. With mounting demands for visual surveillance systems, human identification at a distance has recently emerged as an area of significant interest. Gait is being considered as an impending behavioral feature and many allied studies have illustrated that it can be used as a valuable biometric feature for human recognition. The development of computer vision techniques has also assured that vision based automatic gait analysis can be gradually achieved. The proposed system has been tested on the gait databases and, the extensive experimental results on outdoor image sequences demonstrated that the proposed system possesses a pleasing recognition performance.

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BIOGRAPHY

Prerna Arora holds a Bachelor degree in electronics and communication from Jan Nayak Ch. Devi Lal College of Engineering affiliated to Kurukshetra university in 2013. She is a Research Scholar in the Electronics and Communication Department, Jan Nayak Ch. Devi Lal College of Engineering. Her present research interests include the biometric and image processing. (Email: prerna1993arora@gmail.com)