

# High Speed Image Searching For Human Gait Feature Selection

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**Abstract**—In this paper, a new patch distribution feature (i.e., referred to as Gabor-PDF) is used for human gait recognition. We represent each gait energy image (GEI) as a set of local augmented Gabor features, which concatenate the Gabor features extracted from different scales and different orientations. A global Gaussian mixture model (GMM) (i.e., referred to as the universal back-ground model) with the local augmented Gabor features from all the gallery GEIs; then, each gallery or probe GEI is further expressed as the normalized parameters of an image-specific GMM adapted from the global GMM. Observing that one video is naturally represented as a group of GEIs, also a new classification method called locality-constrained group sparse representation (LGSR) to classify each probe video by minimizing the weighted  $l_{1,2}$  mixed-norm-regularized reconstruction error with respect to the gallery videos. In contrast to the standard group sparse representation method that is a special case of LGSR, the group sparsity and local smooth sparsity constraints are both enforced in LGSR. The same LGSR algorithm is used for both color images and for content based image retrieval (CBIR).

**Index Terms**—Human gait recognition, LGSR, CBIR.

## 1. INTRODUCTION

Computer vision is a field that includes methods for acquiring, processing, analyzing, and understanding images. A theme in the development of this field has been to duplicate the abilities of human vision by electronically perceiving and understanding an image. Computer vision has also been described as the enterprise of automating and integrating a wide range of processes and representations for vision perception. The Gait analysis and recognition is one of the important field in computer vision.

### 1.1 HUMAN IDENTIFICATION

Authentication from an information security point-of-view is the process of confirming the identity of a human being. Biometric authentication uses one of several different biometric features to determine a person's identity. Some of the most

frequently used features today are fingerprints, face, voice and iris.

It is the first type of biometrics came into form in 1890, created by an anthropologist named Alphonse Bertillon. The method consisted of identifying people by taking various body measurements like a person's height, arm length, length and breadth of the head, the length of different fingers, the length of forearms, etc. using calipers. However, the methodology was unreliable as non-unique measurements allowed multiple people to have same results, decreasing the accuracy and hence is no longer used.

Finger print recognition or authentication refers to the automated method of verifying a match between two human fingerprints for identifying and verifying their identity. A problem confronting fingerprint matching is the lack of reliable algorithms for extracting minutiae. Existing algorithms result in spurious minutiae because of an inability to cope with anomalies introduced by factors such as scars, over-inking, and sweat. For this reason human intervention is generally needed in order to check that the fingerprint classification is correct.

A face recognition system is a computer application used for automatically identifying a person from a digital image or digital video frame. One way to do this is by comparing selected facial features from the image and facial database. One of the main problems that must be overcome in face recognition systems is to remove redundant sampling to reduce the dimensionality. Sophisticated preprocessing techniques are required to attain the best results.

The term voice recognition refers to finding the identity of "who" is speaking, rather than what they are saying. Recognizing the speaker can simplify the task of translating speech in systems

that have been trained on specific person's voices or it can be used to authenticate or verify the identity of a speaker as part of a security process. The main problem being acoustic features can be Misspoken or misread phrases, the human voice's tremendous variability, due to colds, aging, and simple tiredness. It can be captured surreptitiously by a third party and replayed.

Iris recognition is an automated method of biometric identification that uses mathematical pattern-recognition techniques on video images of the irides of an individual's eyes, whose complex random patterns are unique and can be seen from some distance.

Retina Recognition technology uses infrared scanning and compares images of the blood vessels in the back of the eye, the choroidal vasculature. The eye's inherent isolation and protection from the external environment as an internal organ of the body is a benefit. No two retinas are the same, even in identical twins. Retina scan is used in high-end security applications like military installations and power plants.

DNA recognition employs Deoxyribo Nucleic Acid, which is the one-dimensional ultimate unique code for ones individuality. Identify information from every cell in the body in a digital form. It is not yet fully automated, not fast and expensive. Theoretical limitation is that Identical twins have the same DNA.

Gait analysis is the systematic study of animal locomotion, more specific as a study of human motion, using the eye and the brain of observers, augmented by instrumentation for measuring body movements, body mechanics, and the activity of the muscles. Gait analysis is used to assess, plan, and treat individuals with conditions affecting their ability to walk. Unlike other biometric features such as iris, faces, palm and fingerprint, the advantages of gait include: 1) gait can be collected in a non-contactable, non-invasive, and hidden manner; 2) gait is the only perceptible biometric at a distance.

Advances in data storage and image acquisition technologies have enabled the creation of large

image datasets. In order to deal with these data, it is necessary to develop appropriate information systems to efficiently manage these collections In Content-Based Image Retrieval (CBIR) systems image processing algorithms (usually automatic) are used to extract feature vectors that represent image properties such as color, texture, and shape. In this approach, it is possible to retrieve images similar to one chosen by the user (query-by-example). One of the main advantages of this approach is the possibility of an automatic retrieval process, contrasting to the effort needed to annotate images.

## 2. LITERATURE SURVEY

Biometrics research is a hot topic because of the demanding requirements for automatic human authentication and authorization in computer systems. Gait recognition is a subfield of biometrics which depends upon the walking style of the human individual. It has the advantage (over other biometrics) of being unobtrusive and distance recognition.

Psychological research says that human can identify persons by locomotion from other patterns, based on genders, direction of motion and weight carrying condition. The baseline algorithm considers some covariates such as viewing angle, shoe type, walking surface, carrying condition and time [12]. Some problems such as shadow removal, moving background, walking surface, clothing etc cannot be removed using the baseline algorithm.

The Gait recognition is divided into two categories as model free approach and model based approach. Model free approach does not follow any model scheme. It is based on body shape. Model based approach is based on static parameters (e.g., size ratio of different body parts) and dynamic parameters (e.g., stride length and speed) [2]. The shadow effect in images is removed by finding the quadrant in which shadow falls and sampling the intensity and categorize the colour characteristics [2]. Still moving background, walking surface, clothing problem cannot be removed. A Gait-recognition technique that recovers static body and stride parameters of subjects as they walk is presented. A simplest neighboring algorithm is

proposed for analyzing the joint trajectory on time analysis for dynamic parameters [3]. Gait recognition using only the trajectories of lower body joint angles projected into the walking plane. A simple method given by Collins et al uses 2D silhouettes extraction for human gait to avoid clothing colour and texture problem. Gait cycle analysis serves two important functions. First, it determines the frequency and phase of each observed gait sequence, allowing us to perform dynamic time warping to align sequences before matching. Secondly, it provides data reduction by summarizing the sequence with a small number of prototypical key frames [4]. Several temporal alignment techniques (e.g., the simple temporal correlation, Fourier analysis dynamic time wrapping and Hidden Markov Models (HMMs)) have been proposed to exploit the dynamic information [4]. The drawback being it is sensitive to view point dependency.

To address the problem of the lack of training templates, a novel approach for human recognition by combining statistical gait features from real and synthetic templates [16]. It directly compute the real templates from training silhouette sequences, and generate the synthetic templates from training sequences by simulating silhouette distortion. A statistical approach for learning effective features from real and synthetic templates was proposed. Mismatch in identifying male and female individuals are seen in this method. Spatio-temporal gait representation called gait energy images [GEI] is proposed by Han et al uses principal component analysis for dimensional reduction, [5]. This leads to appearance based approach which has better performance than model based approach. In the common approaches that only employ the silhouette shape similarity, the binary silhouettes over one Gait cycle are averaged such that each gait video containing a number of Gait cycles is represented by a set of gray-level average silhouette images [i.e., gait energy images (GEIs)] [5]. Chen, Yunhong [5] proposed a new method for gender recognition via gait silhouettes. For this they used radon transform and Relevant Component Analysis (RCA). Radon Transform is applied to obtain gait templates and RCA is employed on the radon transformed templates to

get a maximum likelihood estimation of the within class covariance matrix. They calculated Mahalanobis distances and measured gender dissimilarity in recognition. The Nearest Neighbor (NN) classifier is adopted to determine whether a sample in the Probe Set is male or female [14]. The classical dimension-reduction techniques Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA) [5], [6] have also been applied to acquire an efficient and discriminant representation before formally conducting classification, in which each GEI is represented as a lengthy vector in the high-dimensional space. The purpose of PCA training is to obtain several principal components to rerepresent the original gait features from a high-dimensional measurement space to a low-dimensional eigenspace. In General tensor discriminant analysis the averaged gait image is decomposed by Gabor filter to give a new representation, which is suitable for recognition. [6].

By representing each GEI as a set of local Gabor features, Huang et al. [7] have recently proposed an image-to-class distance for human gait recognition by directly calculating the distance from one probe GEI to all the gallery images belonging to a certain class. To improve the scalability, researchers aim at obtaining nonlinear feature representations that work better with linear classifiers. In particular, Yang et al proposed a method where sparse coding (SC) was used instead of VQ to obtain nonlinear codes. dimensional signals [8]. While these successes in classical signal processing applications are inspiring, in computer vision. However, the reference samples are treated as independent data points in the above SR-based methods. When the reference samples and the query samples are organized as groups, group sparse representation (GSR)-based methods [8].

The drawback being the regularization is not smooth and computationally expensive. Yu et al. empirically observed that SC results tend to be local – nonzero coefficients are often assigned to bases nearby to the encoded data. They suggested a modification to SC, called Local Coordinate Coding (LCC), which explicitly encourages the

coding to be local, and theoretically pointed out that under certain assumptions locality is more essential than sparsity, for successful nonlinear function learning using the obtained codes. Modern databases now a day's having the contents in the form of images and so there is a need for such a system which can retrieve similar image on the basis of content-based search capabilities. These phenomena led to the implementation of many content-based image retrieval systems (CBIR). However, there are many problems faced in designing such a retrieval system. The most basic issue is how to measure the similarity in terms of content. Any one of the following approaches can be adopted to solve the problem (1) Take the global image properties or (2) Take the object level semantics into account. A New approach for image retrieval technique called Coefficient of correlation is proposed to improve retrieval performance, [10] and reduce the extraction search times. The techniques are tested both generally for multi-component images and particularly for isolated color and texture. Finally, matching is performed between the test image and the object image and quality of matching is measured. Histogram [16] is one of the simplest image features. Despite being invariant to translation and rotation about viewing axis, lack of inclusion of spatial information is its major drawback. In a different way of incorporating spatial information into the colour histogram, colour coherence vectors (CCV) [16], was proposed. Each histogram bin is partitioned into two types, i.e., coherent, if it belongs to a large uniformly-colored region, or incoherent, if it does not. Due to its additional spatial information, it has been shown that CCV provides better retrieval results than the histograms. To obtain a Gabor filter bank with orientations and  $S$  scales, the twodimensional gabor function is dilated and rotated appropriately by setting the parameters of the Gabor function [15]. Various techniques based on generalized Hough transform and Fourier descriptors have been reported in the literature for shape and object boundary detection. A review of methods for shape comparison has been reported in. Active contour model called snake has been used in [12] for interactive interpretation, where user imposed constraint forces guide the snake to

feature of interest. Many variations based on active contour methods have been found in literature. The boundary detection precision of active contour based methods is generally sensitive to seed-points or seed-contours, if not provided properly, snakes may not converge to true object boundaries. Many relevance feedback techniques have been proposed in literature to bridge the semantic gap by specifying positive and negative feed backs given by the user for refinement of results. A relevance feedback based interactive image retrieval approach to address issues of semantic-gap and subjectivity of human perception of visual contents was introduced in which showed significant improvement in the results [13]. Dong xu et al [11] recently proposed Marginal Fisher Analysis (MFA) for human gait recognition, first present a direct application of MFA, then inspired by recent advances in matrix and tensor-based dimensionality reduction algorithms, present matrix-based MFA for directly handling 2-D input in the form of gray-level averaged images. For CBIR, it deal with the relevance feedback problem by extending MFA to marginal biased analysis, in which within-class compactness is characterized only by the distances between each positive sample and its neighboring positive samples [11]. A new patch distribution feature (PDF) (i.e., referred to as Gabor-PDF) for human gait recognition. This represent each gait energy image (GEI) as a set of local augmented Gabor features, which concatenate the Gabor features extracted from different scales and different orientations together with the X-Y coordinates. In contrast to the existing PDF (i.e., referred to as Discrete Cosine Transform PDF (DCT-PDF)) for face recognition, in which each face image is represented as a set of DCT features extracted from the local patches, newly proposed Gabor-PDF can achieve much better performance for human gait recognition [1]. Dong xu et al propose a new classification method called locality-constrained group sparse representation (LGSR) to classify each probe video by minimizing the weighted  $l_{1,2}$  mixed-norm-regularized reconstruction error with respect to the gallery videos.

### 3. PROPOSED SYSTEM

In existing system the algorithm is not used for colour images and also for retrieval of data. In the proposed system the gait images for both colour and grey level are obtained from the silhouette images. The norm equalization are done using LGSR algorithm. The same algorithm is used for CBIR process in order to retrieval the required gait image.

In this paper Gait features are extracted and searched in the CBIR database for getting the Matched Gait images using LGSR .This proposal not only work for GEI images but also for natural human images. The accuracy is improved by using Gabor PDF. In this paper silhouettes images are obtained for both colour and GEI images, segmented and features are extracted and classification is done to get a higher ranking in which it get matched for getting the matched images. Gait Energy Image (GEI) is the sum of images of the walking silhouette divided by the number of images. GEI is a useful representation with superior selective power and strength against segmental errors. The GEI that are

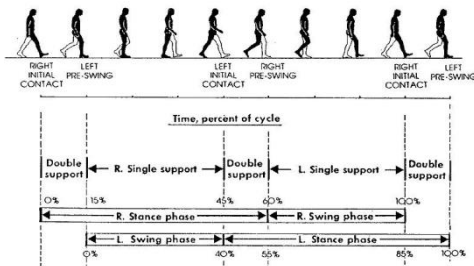
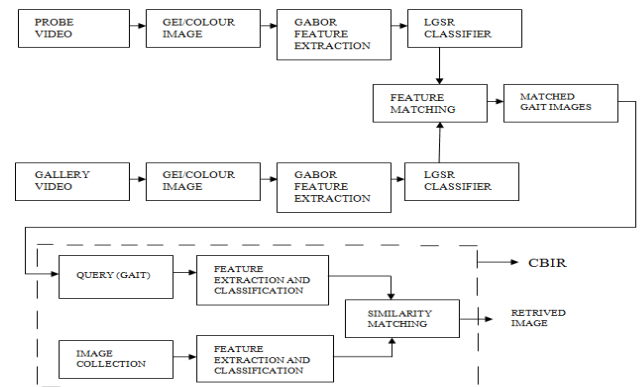


Figure: Block Diagram

got from a video that has been converted into frames or already in frame format are taken and edge detection and thersholding are applied in order to get the segmented image with good boundary. The edging technique can be any one of the edging format as a result it should give a clear and fine edge detected image from the given input image. The matched gait images are given to large database in order to retrieve them and can be used for analysis. As shown in the block diagram whenever a probe video is entered for extraction it is compared with the gallery video.

Once the features are matched the matched gait images that are obtained are given to CBIR database in which the input image is compares with

the database images and similarity is obtained. Once a match if found the image is retrieved and displayed. The most important data for gait analysis is its gait cycles. From that individual gait images called the silhouette images for colour and GEI images are got. This is done by edge detection .The obtained images are analysed using its Gait cycle



includes from start of walking position to ending of the walking position(it may be jumping, running etc) including the height, hand swings, leg movement, carrying condition, stride length and view angles of the gait images. This gives the segmented images.

Figure : Gait cycle

The segmentation involves getting the outline of the image from a given video by using different static and dynamic parameter and identifying the gait from the video set. This makes the extraction easier and classification in an accurate way for gaits. After classification the position or ranking in terms of its value are obtained for the gait image. These positions or ranks are compared and when a match happens it stops searching the further sets of gait in the videos. The ranking may depend upon scale and orientation of the gait images.

### 3.1. GABOR FEATURE EXTRACTION

The Gabor wavelet feature has been

demonstrated to be an effective feature for human gait recognition a tensor subspace learning method by representing the Gabor-filtered GEIs as higher order tensors directly calculated the image-to-class distance for human gait recognition by representing each GEI as a set of Gabor features. A new PDF (i.e., referred to as Gabor-PDF) to characterize the distribution of Gabor features extracted from each GEI.

### 3.2. LGSR CLASSIFIER

Most existing human gait recognition methods employ the simplistic nearest neighbor classifier for classification. Inspired by the recent success of SR-based methods for various computer-vision applications, a new classification method called LGSR for human gait recognition is given. The pioneering work to classify face images by minimizing the  $l_1$  norm-regularized reconstruction error, in which it seeks an SR for only a single test image. In the context of human gait recognition, we need to classify each probe video with multiple GEIs. To utilize effectively the intrinsic group information from multiple GEIs within each video, we treat each probe/gallery video as one group of GEIs and propose a new classification method called LGSR. In contrast to the standard GSR method that is a special case of LGSR, Enforcing both the group sparsity and local smooth sparsity constraints in LGSR by minimizing the weighted mixed  $l_{1,2}$  norm-regularized reconstruction error. Once we obtain the optimal reconstruction coefficient, we can use two classification methods based on different criteria to classify the probe video. The LGSR algorithm is given by

**Input:**  $Y$ : probe video,  $X$ : gallery videos.

Initialize  $t = 1$ ,  $S_t = \mathbf{0} \in \mathbb{R}^{n \times n_p}$ ,  $\mathcal{A} = \{\}$ .

Compute  $D^c$  between the  $c$ th gallery video and the probe video,  $\forall c \in \{1, \dots, M\}$ .

WHILE  $t < T_{\max}$

    Compute  $L_c = \|\partial R(S)/\partial S^c\|_F|_{S=S_t} \forall c \in \{c|S_t^c = \mathbf{0}\}$ .

    Find  $c^* = \arg \max_c L_c$ . If  $L_{c^*} > \lambda \min(D^c)$  then  $\mathcal{A} = c^* \cup \mathcal{A}$ .

    For each  $c$  in  $\mathcal{A}$  do

        Update  $S_{t+1}^c$  by using (6) with line search.

        If  $S_{t+1}^c = \mathbf{0}$ , then remove  $c$  from  $\mathcal{A}$ .

    End For

    If  $\|S_{t+1} - S_t\|_F < \epsilon$  ( $\epsilon = 0.001$ ), then exit WHILE.

$t = t + 1$ .

End While

Output  $S$ ;

$$SR : s_j^* = \arg_{s_j} \min \frac{1}{2} \|y_j - X s_j\|_2^2 + l \|s_j\|_1$$

$$LLC : s_j^* = \arg_{s_j} \min \frac{1}{2} \|y_j - X s_j\|_2^2 + l \|d_j Q s_j\|_2^2$$

### 3.3 CBIR BLOCK

Once the features are matched in the feature matching comparator the gait image is obtained and given to the control unit. The control unit is nothing but our CBIR systems. In this unit the gait image to be searched is given to the CBIR database. Once the image is given it starts searching the required matched images corresponding to the query image. The same LGSR algorithm is used to retrieve the image. When match occurs it stops the search and displays the result with high accuracy. The time taken for searching the image is greatly reduced by using this algorithm. The accuracy is improved by Gabor PDF. A very few detail is enough to do this action.

## 4. RESULT AND DISCUSSION

The system is tested and implemented using MATLAB software. By using the software source code was developed and input was got and the gait image was obtained which is further given for processing for the retrieval of the images in the CBIR database by using the LGSR algorithm.

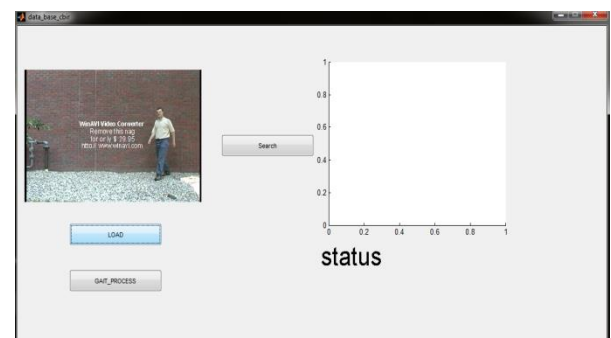


Figure : Loading of the gait video.

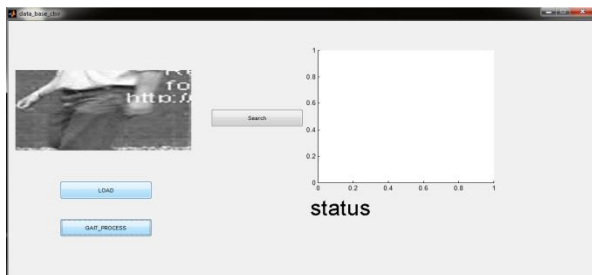


Figure : Gait classifications



Figure : Gait not matched

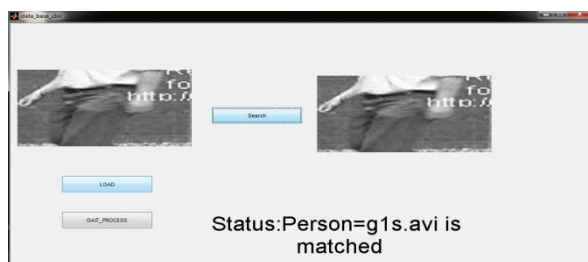


Figure : Matched and Retrieved Gait

## 5. CONCLUSION AND FUTURE ENHANCEMENT

Reduced details requirement which refers by having small requirement of the gait feature it is possible to get the gait of the person. Distance recognition in which there is the possibility that gait feature can be got by distance recognition. In future this can be developed into powerful Biometric systems for the recognition of the persons in controlled environments. It can be integrated into the internet for searching and retrieving of images /videos which can be used in

much application. This work can be extended for the gait analysis of animals also.

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