International Journal of Research

International Journal of Research (IJR)

e-ISSN: 2348-6848, p- ISSN: 2348-795X Volume 3, Issue 01, January 2016
Available at http://internationaljournalofresearch.org

Automatic Gait Recognition

[1]Majid Iqbal & [2]Dr. Animoni Nagaraju

[1]Assistant Professor, Department of Mechanical Engineering, Sree Dattha Institute of Engineering & Science

[2]Professor, Department of Computer Science Engineering, Sree Dattha Group of Institutions

***Abstract*—**
Gait is "a manner of walking ". Human gait is a feature of a person that is determined by his weight, limb length, and habitual posture. Gait can be used as a biometric measure to recognize known persons. An Automatic Gait recognition system is a computer application for automatically identifying or verifying a person from a digital image or a video frame from a video source. It is a process where, given still or video images of a scene, identify or verify one or more persons in the scene using a stored database of Silhouettes. It is non- contact, unobtrusive perceivable at a distance and hard to disguise. Automatic Gait recognition system could allow law enforcement agencies and airport security to recognize suspects based on the way they were, their characteristic gait. The gait of individuals checking in at an airport could then be compared with the database, perhaps even before they enter the airport concourse. Such data compared with CCTV footage might also be used to track suspect terrorists or criminals who may otherwise be disguising their features or be carrying forged document.

I. INTRODUCTION

In many applications of person identification many established biometrics is obscured: the face may be hidden or at too coarse a resolution; the ears cannot be seen. However, people need to walk, so their gait is usually apparent. This motivates using gait as a biometric and it has recently attracted interest1. Apart from perceptibility, another attraction of using gait is that its motion can be hard to disguise. Clearly there is a view that gait can be used to recognize individuals. While the examination of gait as a biometric is promising, there are limits to the utility of gait information. Most obviously, gait can be obscured by clothing such as skirts, and can be affected both by footwear and by the walking surface. The physical condition of a walker can also alter their gait. Another apparent limitation to automated gait recognition is computing power but the continuing advance of processing power will mitigate this. Recent research conducted across allied disciplines including medicine, psychology and computer vision has underlined the wealth of information available from gait, and reaffirms its potential as a cue to identification. In the last couple of years, gait has emerged as a potential practical biometric. It poses considerable challenges compared with traditional biometrics such as face, iris or speech in that it is a function of both space and time. The information available from a gait signature is thus tremendous, but this poses new problems due to the overwhelming amount of data. We shall consider gait as a sequence of images of a single subject walking across the plane of view of a stationary camera. To reduce the dimensionality of the data we only compare a sequence of windowed silhouettes of the walker.

II. FEATURES

Gait is an attractive biometric feature for human Identification at a distance, and recently has gained much interest from computer vision researchers. Compared with those traditional biometric features, such as face, iris and fingerprint, gait has many unique advantages such as non-contact, non-invasive and perceivable at a distance. The procedure of gait recognition includes subject segmentation, feature extraction, and classification. Present work on automatic gait recognition has focused on the development of methods for extracting features from the input gait sequences. Gait analysis can be divided mainly into two techniques: model based and feature based. The majority of current model-based approaches are based on 2D methods. A 2D model-based approach in which reliable gait features are extracted by fitting a five-link biped human locomotion model for each image, and subjects are classified based on the frequency components of the trajectories of the relative joint position Model-based methods are often applied to high quality videos. They are less sensitive to the variations of viewpoint, but their computations are rather complex in model matching and tracking stages. Model-free methods extract statistical features from a Subject's silhouette to distinguish different walkers Only the active object in the sequence of images is considered. Sequence of Images of the suspected are recorded using CC cameras. Applying Gait extraction system the silhouette of the person is extracted. From the Silhouette extracted prominent gait features are extracted. They are compared with gaits in data base. Then the person is identified.

III. THE APPROACH

We assume that our walking subjects are viewed in the canonical direction, that which is perpendicular to the direction of walk.This assumption can be overcome using multiple calibrated cameras to synthesize the desired view.We also assume that the silhouette of the walker is segmented from the background using a background subtraction algorithm. To make our gait representation

Silhouette Extraction

Given a sequence of images obtained from a static camera, the algorithms developed before detect and track the moving person, then compute the corresponding sequence of motion regions in each frame. In order to detect motion objects, First a background scene model is statistically learned using the redundancy of the pixel intensities in a training stage; even the background is not completely stationary. This redundancy information of each pixel is separately stored in a history map, which shows how the pixel intensity values changes over time. Then the highest ratio of the redundancy of the pixel intensity values in the history map in the training sequence is determined to create the initial background model of the scene. A background maintenance model is also proposed for preventing any kind of false information, such as illumination changes, or physical changes. Based on the background modeling, candidate foreground regions are detected by using thresholding, noise cleaning, and morphological altering; more. Once a silhouette is generated, a bounding box is first placed around it. Silhouettes across a motion sequence are automatically aligned by scaling and cropping, based on the bounding box. If we consider a flat surface on which people are walking, the centroid is pretty much fixed. Using centroid we unwrap the silhouette clockwise around the centroid using Euclidian distance from centroid. This gives the representation invariance to insensitive to changes of clothing and distance between the camera and the walking subject; we ignore the color of the foreground walker and use only the scale-normalized binary silhouette. Using the silhouettes of walking person, we compute a set of moment related features on 7 regions of the silhouette, and further compress the features across time. These regions are by no means meant to segment the arms and legs precisely. We are interested in a consistent method to d the silhouette of a walking person into regions that will facilitate the person recognition task. These features are then used to recognize individuals by their walking appearances and to predict the gender of an unknown walker.

IV. GAIT FEATURE EXTRACTION

Before training and recognition, the silhouette shape of a human is extracted by detecting and tracking persons in the surveillance area. Each image sequence, including a walking person's silhouette is converted into an associated temporal sequence of distance signals in the pre-processing stage. Before a dynamic signature can be obtained, the silhouette of the subject must be separated from the background. In part of the database, the gait sequences are derived in the laboratory, aiming for near-perfect conditions to obtain the best possible silhouette. Subjects are viewed front to-parallel walking along a track in either direction. The camcorders digital video is turned into individual frames. The original image from which the silhouette is extracted using chroma-key subtraction in conjunction with a connected components algorithm. The silhouette is then windowed to remove those parts of the background away from the chroma-key, constrained to walking normal to the camera's plane of view as we are interested in analyzing the basic properties of gait as a biometric. Future work can concentrate on the consequences of a subject walking at an angle to the camera. Binary silhouettes remove information about coloring and interior shape but give invariance to clothing color and most lighting conditions. By normalizing the size of the silhouettes we remove variation due to distance from the camera, although we lose information about the subjects height.

Silhouette Representation

Silhouette representation is based on the projections of the silhouette, which are generated from a sequence of binary silhouette images bs(t)= bs(x,y,t) indexed spatially by pixel location (x,y) and temporally by time t. There are 4 different image features called distance vectors; top-, bottom-, left- and right-distance vectors. The distance vectors are the differences between the bounding box and the outer contour of the silhouette. The distance vectors are separately represented by four 1D signals. The size of 1D signals for left and right-distance vectors is the height of the bounding box.

The values in the signals are data produced from differences between the bounding box and silhouette, which is the number of columns between the bounding box and silhouette at each row. The size of the 1D signals for top- and bottom-distance vectors is the width of the bounding box.

The values of the 1D signals are the number of rows between the box and silhouette at each column. Form a new 2D image *FT* (*x; t*) = P*y* *bs*(*x; y; t*), where each column (indexed by time *t*) is the top projections(row sum) of silhouette image *bs(t)*, top-left. Each value *FT* (*x; t*) is then a count of the number of the row pixels between the top side of the bounding box and the outer contours in that column *x* of the silhouette image *bs(t)*.

The result is a 2D pattern, formed by stacking top-projections together to form a spatio-temporal pattern. A second pattern, which represents the bottom projection FB(x; t) = P−y bs(x; y; t) can be constructed by stacking bottom-projections 3, bottom-left. The third pattern FL(y; t) = Px bs(x; y; t) is then constructed by stacking left-projections and the last pattern FR(y; t) = P−x bs(x; y; t) is initially constructed by stacking right-projections. Top-right and bottom-right 2D patterns, respectively. For simplicity of notation, we write Py , P−y , Px , and P−x as shorthand for P contour of silhouette.

y=Topofthebox, PContourofsilhouette
y=Bottomofthebox, PContourofsilhouette
x=Leftsideofthebox, and Pcontourofsilhouette
x=Rightsideofthebox, respectively.

The variation of each component of each distance vector can be regarded as the gait signature of that object. From the temporal distance vector plots, it is clear that the distance vector is roughly periodic and gives the extent of movement of different part of the subject. The brighter a pixel is in 2D patterns in Figure3, the larger is the value of the distance vector in that position.

V. BASELINE ALGORITHM

Algorithm against which any gait recognition algorithm's performance improvements can be measured. Designed to be simple, fast, yet effective at computing similarity of gait in video sequences, based on both shape and dynamics. The algorithm was not designed to be robust against many well know sources of variations, such as illumination, clothing, 3D viewpoint etc.

1. Background
2. Silhouette Estimation
3. Gait period Estimation
4. Similarity Computation

Background Estimation

Semi-automatically mark bounding Boxes. Find the coordinates of the Super Bounding box. The background is Estimated only for pixels within this Super-bounding box. For each pixel location, use pixel values in the frames when that location is not Within the corresponding bounding box to Estimate the mean and covariance of the RGB or Chromaticity space.

Silhouette Estimation

Compute the distance of each pixel within the bounding from the mean background image. Threshold the smoothed distances Use Expectation Maximization (EM) to estimate the silhouette from the distances. Keep just the largest connected region. Center the silhouette in the horizontal direction by considering the upper half of the silhouette. Size-normalize so that the silhouette occupies the Whole length of box.

Gait Period Estimation

Consider the number of silhouette pixels Mostly from the legs (bottom half of the Silhouettes) vs. time. Detect the local minima in the above plot. Compute the median of the distances between minima, skipping every other Minimum. Take the average of the medians as the gait period.

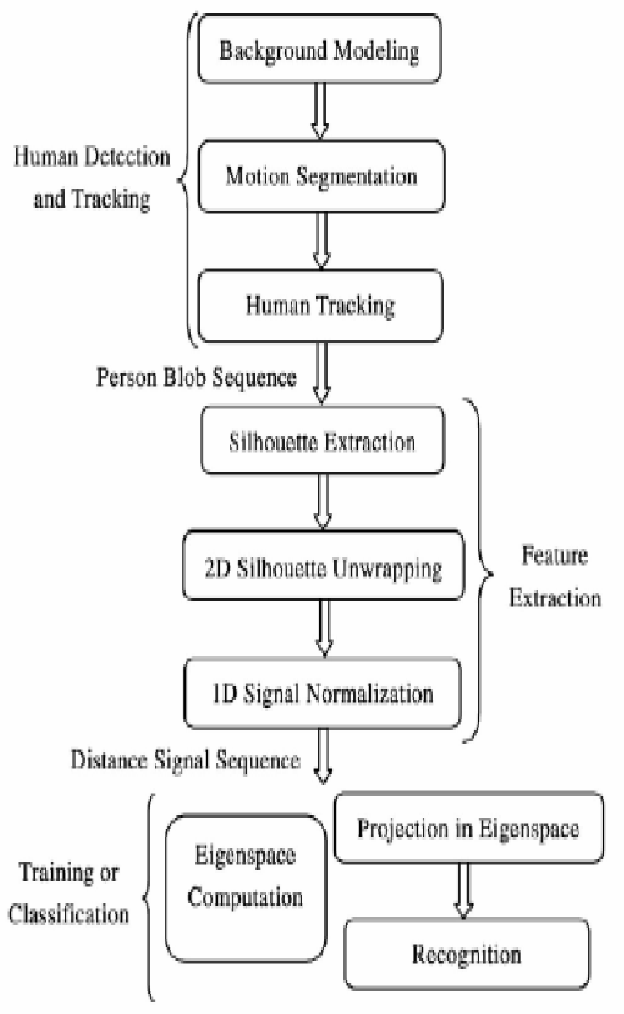
Similarity Computation

Break up probe sequence into K Subsequences of Gait contiguous frames each. For each probe subsequence, estimate the maximum correlation with the gallery Sequence. Pick the median of the maximum correlations of the probe subsequences as the similarity measure.

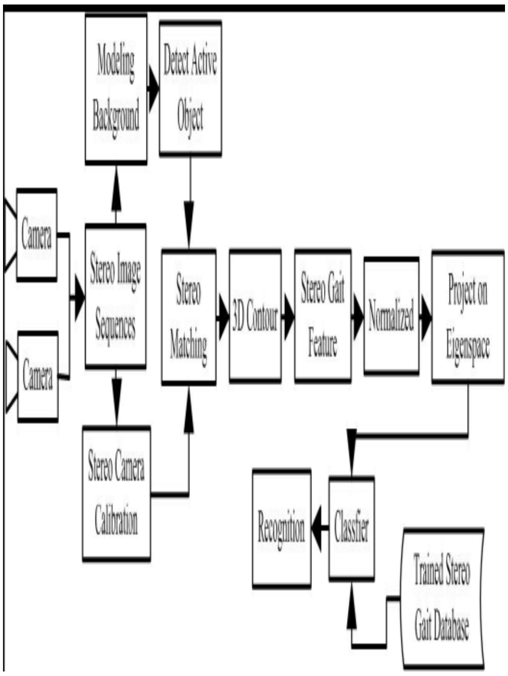
VI. SECURITY STRENGTH OF GAIT BIOMETRIC

Along with uniqueness characteristics, another important requirement for human physiological or behavioral characteristics to be considered as a biometric is its robustness against attacks. In biometric gait recognition, most of the efforts are devoted in the directions of improving recognition accuracy and reducing the effect of influencing factors. The impostors are usually assumed passive and unknowledgeable.

VII. SILHOUETTE ANALYSIS BASED GAIT RECOGNITION



VIII. OVERVIEW OF THE ALGORITHM



K-L Transforms :

Given

1.C training sorts

2.training samples sets T={Sij}, i=1,2,…,C, j=1,2,…,NC

Then the total of training samples is

NT=N1+N2+...+NC.

1. Mean Matrix

μ =1/Nt Σ(i=1 to C) Σ(j=1 to Ni) Sij

2.Covariance Matrix Σ of training samples are

Σ =1/Nt Σ(i=1 to C) Σ(j=1 to Ni) (Sij- μ)(Sij- μ)T

If the rank of Covariance Matrix Σ is N, then we can get N eigen values λ1,λ2,…,λN and the corresponding eigen vectors e1,e2,…,eN according to Matrix Analysis Theroy.

All the vectors above threshold value grouped to make eigen space which reduces the dimensionality of feature.

Thresold -> Σ(i=1 to K) λ / Σ(i=1 to N) Σ(i=i-1 to N) >= μ

Recognition:

A normalized Euclidian distance used for similarity measurement. Finally a simple K-Nearest Neighbor model is used to classify the sequences. The distance metric used is Normalized

The Euclidean Distance is defined as:

D = ||S1-S2||

Where S1 is the probe set, while S2 is gallery set. || . || is the
measure.

The explanation of the measure is: it is length in 1D space,
it is area in 2D spaces, it is volume in 3D spaces and it is
measure in multi-dimensionality spaces.

IX. FIGURES

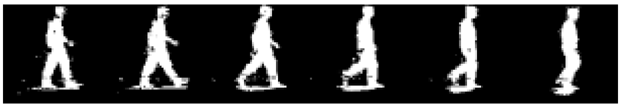


Fig 1

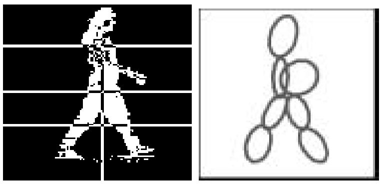


Fig 2

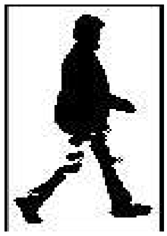


Fig 3

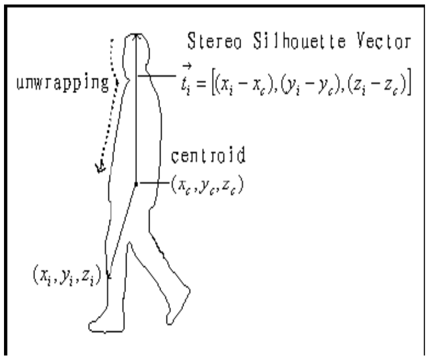


Fig 4

X. APPLICATIONS

Gait recognition is an emerging biometric technology which involves people being identified purely through the analysis of the way they walk. While research is still underway, it has attracted interest as a method of identification because it is non-invasive and does not require the subject's cooperation. Gait recognition could also be used from a distance, making it well-suited to identifying perpetrators at a crime scene. But gait recognition technology is not limited to security applications – researchers also envision medical applications for the technology. For example, recognizing changes in walking patterns early on can help to identify conditions such as Parkinson's disease and multiple sclerosis in their earliest stages.

Advantages:

Low resolution
Effective at a distance
Hard to disguise
No need of physical contact

non-contact,
unobtrusive
perceivable at a distance

XI. CONCLUSION

We firmly believe that by new technique and by results, gait continues to show encouraging potential as a biometric. Large gait data bases have been constructed, specifically designed to investigate the potential of gait as a biometric. The database allows for investigation of the basic capability of gait in a laboratory environment; estimation of the capability of gait in unconstrained outdoor scenarios; and investigation of the integrand intra-class subject variance. The techniques have specifically been designed to provide silhouette based analysis with specificity to gait, by generic formulation tailored to the target application and/or analysis. These techniques describe not only the shape, but also how it moves. This is a model-based approach can be used to recognize people by the way they walk and by the way they run. These studies continue to confirm that gait is a richer study than it originally appeared. There are many avenues by which the already encouraging potential for gait as a biometric can be improved, and deployed.

ACKNOWLEDGMENT

Behind every achievement lies a sea of gratitude to those who actuated it, without whom it would ever have come in to existence. The satisfaction that accompanies the successful completion of any task would be incomplete if i do not mention the people who made this possible and whose constant guidance and encouragement crowned all efforts with success. This acknowledge transcends the reality of formality when I would like to express our deep gratitude and respect to all those people behind the screen who guided, inspired and helped me for the completion of work. I also extend my gratitude to our Principal for their moral support and encouragement through out the tenure of this Technical report. I am happy to express my gratitude to one and all that helped to complete my technical report work successfully.

REFERENCES

[1] Zongyi Liu, Sudeep Sarkar, E_ect of Silhouette Quality on Hard Problems in Gait Recognition. IEEETransaction Systems, Man, and Cybernetics- Part B: Cybernetics, Vol.35, No. 2, April 2005.

[2] M. S. Nixon, J. N. Carter, Advances in Automatic Gait Recognition, Proc. of IEEE International Conference on Automatic Face and Gesture Recognition, 2004.

[3] L. Wang, T. Tan, H. Ning, W. Hu, Silhouette Analysis-Based Gait Recognition for Human Identi_cation, IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol.25, No. 12, December, 2003.

[4] C. BenAbdelkader, R. G. Cutler, L. S. Davis, Gait Recognition Using Image Self-Similarity. EURASIP Journal of Applied Signal Processing, pp. 1-14, April, 2004.