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Effect of Multi and Variant Views in Gait Recognition Using PCA

Kshitiz Varma[A], Prof. Anupam Shukla[B]

[A]Research Scholar, Dr. C. V. Raman University, Bilaspur, India
[B]Professor, ICT Department, ABV-IIITM, Gwalior, India

Abstract

In this paper we propose the effect of view variations for gait recognition. Distinct variation is created on the basis of walking in various distinctive angle of person with respect to the particular line. The recognition rate is shown by using training and testing image with multiple views. To improve the performance we are using fusion techniques, Principal Component Analysis algorithm is used for fusion of different viewing images. Here the result of fusion based approach in gait recognition in different view is shown. The proposed approach is evaluated using CASIA gait database. The results of experiments show that the proposed gait recognition approach is affected by view variation. The performance of the proposed work is significantly improved for recognition of people in different view.

Keywords: *Gait Recognition Principal Component analysis, Fusion, View Variation, CASIA.*

I. INTRODUCTION

The user needs a reliable and authentication technique that has rapid advancement in security, networking, communication and mobility. Biometric is a most growing and attracting field in terms of security and authenticity. Biometric system establishing identity in various commercial, civilian and forensic applications. It simply establishing identity by using the physiological and behavioral characteristics. It offers various advantages over traditional authentication approaches. Biometric traits are difficult to copy, share and distribute. It is difficult to forge biometric. Physiological biometric includes face, fingerprint, DNA etc. and Behavioral includes voice, gait, signature etc.

Gait is a new biometric field to determine the person at low resolution. While other traits needs higher resolution. It is defined as: "A particular way or manner of moving on foot". The human gait has generated much interesting in fields such as biomechanical, robotics, computer animation and visual surveillance. As a biometric the most attractive feature of gait is its unobtrusiveness. It can be easily gained at distance and it is difficult to conceal. There are some factors in gait capturing that makes it difficult to identify, one factor is view variation problem because gait changes over time, when we use the gait recognition system to identify people [1].

II. REVIEW OF LITERATURE

Shiqi.Yu. et al. proposed their work to analyze the effect of view angle variation on appearance based gait recognition performance. They used two models, a geometrical and mathematical. Correct classification rate (CCR) is used for the experiment to evaluate the gait recognition performance [2].

In [3], they presented a method for synthesize arbitrary views of objects, and synthesized view is applied for gait recognition. In their method they used a perspective projection model and an optical flow based structure. They also proposed a simple camera calibration scheme.

M. Pushparani et al. described an effective self-similarity system for gait recognition using modified Independent Component Analysis (MICA). To track the moving silhouettes of a walking figure, the morphological skeleton operator is used. They applied preprocessing operation first and then used the silhouette images; the MICA based Eigen-space transformation is trained. They tested their algorithm on a NLPR gait database [4].

In [5], they focused on abnormal gait recognition. They proposed a method for distinguishing normal and abnormal gait. They classified a person which is abnormal as suspicious. The real world data is used for their experiments.

L. Lee et al. described a representation of gait appearance for person identification and classification. They explored two different methods for aggregating features over time; they also demonstrated the effect of the variation of lightning environments [6].

A framework is proposed in this paper, for evaluating view angle, carrying condition and clothing in the gait recognition. To validate the performance of gait, gait energy image (GEI) is used [7].

Yuan Wang et al. presented a gait recognition scheme which is based on the fusion of multi-view gait sequences. They also found that the Dempster-shafer fusion method is effective in this type of recognition system. The fusion of gait sequences with an angle difference greater than or equal to 90 degree can give better improvement as compare to an acute angle difference. They used the CASIA multi-view gait database for their experiment [8].

After studying various related works, there are various challenges which can decrease the performance of gait recognition. In this research work, a new fusion based approach is developed, which can decrease the effect of view variation in gait recognition.

The rest of paper is organized as follows: Section II presents a review of literature on gait recognition. The

preprocessing operation is presented in section III, which gives the description of database of different viewing angles, and the explanation of feature extraction process. The fusion strategy and the gait recognition system are described in section IV. Experimental results and discussion are presented in section V; section VI concludes the proposed research work.

III. PREPROCESSING

For gait recognition system, we proposed a new method .In preprocessing operation the process is as follows:

A. Database Description

The Motion Picture Expert Group (MPEG) files that contained the various folders of image with different view have been converted into frames that are converted into the Joint Picture Expert Group (JPEG) files. The data in this file is called CASIA gait database [9]. These JPEG color images are changed into gray scale images. The available database is in eleven different views. The various viewing angles are (0º, 18º… 180º) as shown in figure 1. It shows the walking path of the person. Here walking direction is represented by the arrow line. The starting point of the arrow line represents the initial point of walking people in the arrow direction.

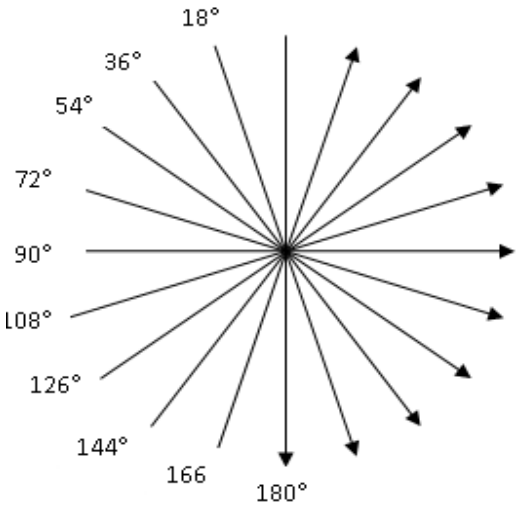

Figure1. Walking Direction

B. Silhouette Extraction

Extraction of silhouette is a key step in gait based human identification process. The complete processes of silhouette extraction are as follows:

- An approximate background image can be obtained from the image sequence through mean of the image computed by taking the average of the gray level at each pixel for whole image sequence as shown in Fig.2 (b).

Figure. 2 Gait Detection Examples. (a) Background Image; (b) Original Image; and (c) Silhouette Image

Suppose $I_m(a, b)$, m=1, 2,…. K, represent sequence of K images. Following equation is used to computed back ground images i(a, b):

$$i(a, b) = \text{med}(I_m(a, b)), m = 1,2,\ldots K \quad (1)$$

To enhance the quality of extracted images and noise reduction, the image processing operations like Dilation, Erosion are applied.

C. Features Extraction

Feature extraction is an important task in gait recognition process. It contains relevant information from the input data for the desired task. Two major approaches for feature extraction in gait recognition are, the first is model-based or feature based and model-free or holistic based [10]. In model based approach the human body shape or motion of the body is modeled. Holistic based approach does not need the prior information of gait model. Holistic approach such as Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA) and Independent Component Analysis (ICA) use appearance information which is extracted from image.

In holistic approach, it finds feature with reduced dimensionality after putting the real data into vectors. These features can improve the classification performance through the reduction of irrelevant feature from the data set. To eliminate irrelevant feature and selecting the important feature and the selection of important features plays a vital role in recognition and computation.

Principal Component Analysis method is widely used to reduce the dimensionality of the data. It is feature extraction and data reduction methods, removes redundant information, highlighting hidden features [11, 12].

Features extraction approach based on PCA

- Construct training data matrix, the size of the matrix is S=M×P. Where, M is product of dimensionality and P is image.
- Calculate the mean using matrix S.
- Centralized the data (subtract the mean).
- Compute the covariance matrix of dimensions.

- Find the Eigen values and Eigen vectors of covariance matrix.
- Sort Eigen vectors in decreasing order of Eigen values which shows the feature vector.
- Calculate the feature vector.
- For recognition use Euclidean distance.

IV. GAIT RECOGNITION SYSTEM

In this research work, we applied a fusion approach for different view [13, 14]. It is described as follows.

Extracted features are more important for the recognition process. Feature is defined as piece of information which is relevant for solving the computational task related to a certain application.

Here the feature of multiple view of gait images are combined [8]. Let us consider two view gait images are $i_1(a, b)$ and $i_2(a, b)$ be a 2-dimensional $C_1 \times C_2$ array of intensity value of 8 bit. Each image can be considered as $C_1 \times C_2$ vector. The size of image is 320×240. So the vector size for one image will be 76800. For calculation of the combined feature, group of images of various views is taken. Using Principal component analysis one feature vector can be represented for two distinct view gait images. In the process of image recognition these two different view gait image is represented in one dimensional vector format and represent one people. Vector size based on fusion is 320x240x2, as dimension of the image is same for face and gait. One dimensional vector is created for each subject, and also matrix is created for n subject, where each column corresponds to the combined feature of various views. Using Principal component analysis these vectors are mapped into subspace. We calculate the feature vector of various view images during the testing faces, and will be projected it with the existing vector. 0º view angle image is combined with all view angles, and then performance is checked. Similarly all other view will be combined.

TABLE 1 Result without fusion of various views.

Test / Train	**000**	**018**	**036**	**054**	**072**	**090**	**108**	**126**	**144**	**162**	**180**
000	90.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	3.75
018	2.50	83.75	2.50	2.50	2.50	3.750	2.50	2.50	2.50	2.50	2.50
036	2.50	50	71.25	.50	2.50	1.25	2.50	2.50	2.50	2.50	2.50
054	2.50	2.50	2.50	28.75	3.75	2.50	5.00	3.75	2.50	2.50	2.50
072	2.50	2.50	2.50	1.25	12.50	2.50	2.50	2.50	2.50	2.50	2.50
090	2.50	.50	5.00	7.50	0	8.75	2.50	2.50	2.50	2.50	2.50
108	2.50	2.50	2.5	2.50	3.75	10.00	13.75	5.00	2.50	2.50	2.50
126	2.50	2.50	3.750	2.50	2.50	3.75	5.00	15.00	0	2.50	2.50
144	2.50	2.50	2.50	2.50	2.50	2.5	3.75	0	31.25	5.00	2.50
162	5.00	2.50	2.50	2.50	2.50	2.5	2.50	2.50	2.50	65.00	5.00
180	5.00	2.50	2.50	2.50	2.50	2.5	2.50	2.50	2.50	2.50	88.75

TABLE 2 Result with fusion of various views

Angle 1 / Angle2	000	018	036	054	072	090	108	126	144	162	180
000	90.00	95.00	92.50	87.50	77.50	65.00	80.00	85.00	92.50	97.50	97.50
018	95.00	92.50	95.00	92.50	82.50	70.00	87.50	95.00	92.50	97.50	97.50
036	92.50	95.00	92.50	90.00	80.00	77.50	92.50	92.50	92.50	97.50	97.50
054	87.50	92.50	90.00	57.50	77.50	77.50	85.00	92.50	90.00	99.50	95.00
072	77.50	82.50	80.00	77.50	25.00	47.50	82.50	90.00	85.00	97.50	90.00
090	65.00	70.00	77.50	77.50	47.50	20.00	77.50	80.00	80.00	77.50	75.00
108	80.00	87.50	92.50	85.00	82.50	77.50	30.00	90.00	85.00	90.00	77.50
126	85.00	95.00	92.50	92.50	90.00	80.00	90.00	50.00	82.50	97.50	95.00
144	92.50	92.5	92.50	90.00	85.00	80.00	85.00	82.50	67.50	99.50	97.50
162	97.50	97.50	97.50	99.5	97.50	77.50	90.00	97.50	99.50	97.50	97.50
180	97.50	97.50	97.50	95.00	90.00	75.00	77.50	95.00	97.50	97.50	95.00

V. EXPERIMENTS AND RESULTS

We have divided our analysis into two parts. Table 1 shows the first part , which is for gait recognition of without fusion and table 2 shows the second part, which is improved gait recognition after fusing different views. In these tables 1st row has the value of angle 1, 2nd row has the value of angle 2 and so on.

From the table 1 we can say that the result of gait recognition is affected by the view of training and testing data. By using similar view for training and testing highest results are obtained.

The improved results are shown in table 2 after fusing the different views. As the result shows that the fusion based approach gives better recognition rate. So we can say that gait recognition technique using fusion is less affected from view variation in gait recognition.

A. DISCUSSION

Table 1 and Table 2 show the results of our research work. Results show the impact of view variation in gait recognition. Without fusion of various views the recognition rate is not good, as it gives the recognition rate of 2.64, which is not useful for recognition system. After fusion, the recognition rate is improved better than the previous one. The recognition rate 87 after fusion of various views.

VI. CONCLUSION AND FUTURE WORK

Gait is a new biometric field to determine the person at low resolution. It can recognize the person from distance. Through view angle of training and testing data the biometric recognition is always affected. We present the novel approach of gait recognition using Principal Component Analysis (PCA). The experimental results show that the proposed method has better recognition performance.

There are some factors in gait capturing that makes difficult to identify and record all parameter. The numerous factors that affect the gait feature, these factors are: Gait change over time, clothes, footwear, walking speed and emotional condition, some internal factors such as foot injury, lower limb disorder can also affect the recognition performance [5].

Future work can be done to develop new method for gait recognition which should less affect from these abnormal conditions

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