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Human Identification Based On Multi View Gait Recognition

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الخـلاصـة

مشية الإنسان، و هي من القياسات الحيوية الجديدة تهدف إلى التعرف على الأفراد عن طريق المشي وقد لعبت دور متزايد الأهمية في تطبيقات المراقبة البصرية .وعادة ما يستخدم مصطلح التعرف على المشية للدلالة على التعرف على الأشخاص في سلسلة من الصور "بالطريقة التي يمشيون به ا".يتم تحديد المشي من قبل الخصائص الفيزيائية لكل فرد، وهكذا يعتقد أن تكون فريدة من نوعها للشخص كبصمات الأصابع .المشية هي أيضا واحدة من القياسات الحيوية القليلة التي يمكن قياسها على مسافة، دون أي تفاعل أو التعاون من الشخص.وهذا الميزة الذي يجعلها جذابة جدا .اقترحت هذه الرسالة طريقة جديدة للتعرف على المشي .في هذه الطريقة، أولا،الصورة الظلية ثنائية للشخص المشي يتم تحديدها من كل إطار باستخدام طريقة الطرح للخلفية. ثانيا، يتم الكشف عن دورة المشي باستخدام طريقة طول خطوة .ثالثا، يتم استخراج عشر ملامح من كل إطار في دورة المشي باستخدام نهج قاعدة نموذجية . وأخيرا، تستخدم الشبكة العصبية لأغراض التدريب والاختبار . تم تصميم المشروع بواسطة برنامج ماتلابR2014a وحاسبة ذو نظام windows 7 مع 32 بت ومعالج core i5، تم اختبار النظام على 8 اشخاص كل شخص 6 فيديو باتجاهات مختلفة وكانت النتائج ممتازة تصل الى 96% .

الكلمات المفتاحيه: تمييز المشية ، تمييز الانماط ، معالجه الصور ، الشبكات العصبيه.

1. Introduction:

Image recognition is the process of identifying and detecting an object or a feature in a digital image or video. This concept is used in many applications like systems for factory automation, toll booth monitoring, and security surveillance[1]. The present ways of human recognition such as fingerprints, footprints, face features or iris measures shouldhave certain things in general: a helping subject, sights from different sides and physical contact or nearness. If helping individuals are far in real and changing environmental world, these ways won't be able to recognize them. Furthermore, many known measurements are still ambiguous in different applications to identify individuals. One of the important measurement, which doesn't have any disadvantages of the points mentioned above, is gait.Gait is a means to recognize individuals by the walking way[2].

It is people's walking posture which is one of the complicated characteristics of behavior. It can be the best means for feature recognition because its abundant properties and it can be considered as a unique merit as no two people can share the same all gait qualities together like height, weight, muscle, bone,physical profile and sensitivity[3]. Gait is also unique if we consider all its movements. There are 24 different features of human gait as medical studies suggest[4].

Gait properties is an interesting subject in research and documentation recently. Gait recognition is done by shooting and recording an individual gait. The camera take automatic pictures and record the walking posture of an individual when is close, and through matching method, the individual identity is confirmed[5]. The advantages of gait recognition is nowadays included in many fields such as artificial intelligence, computer vision, video processing and features recognition. As a result of the rapid development of technology, a wide range of applications in some fields (like for example health care, intelligent monitoring and gait analysis), will benefit from gait recognition[6].

2. Gait recognition approach:

Gait recognition approaches can be divided into two main categories: Model-Based and Model free[7].

3.1 Model-based Approach:

The model-based approach obtains a series of static and dynamic body parameters by modelling or tracking body components such as limbs, legs and arms. This method aims to derive the movement of the body. Systems based on this approach mainly consist of gait capture, a model, feature extraction scheme, a gait signature and a classifier. This approach has its own advantages such as reliable handling of occlusion, noise, as well as employing the scale and rotation of the model-free

approach, which can be significantly important for practical applications[8]. However, it has disadvantages as well. Model-based approach is sensitive to the quality of gait sequences, and is considered to have high computational time costs. These disadvantages mean the model-free approach is used more[9].

3.2 Model free Approach:

Most of the current analyses of gait recognition are based on the model-free approach. Model-free approaches focus on shapes of silhouettes or the whole motion of bodies by deriving a set of measurements to describe these shapes and motion in a sequence of images. This approach is insensitive to the quality of silhouettes, has low computation costs and is less time-consuming[10].
In this pepar we used model based approach.

3. The proposed Gait Recognition System :

Gait identification is one of the biometric techniques. This section gives a global view of the proposed approach for human identification using multi-view gait features. Gait recognition system can be divided into six major steps (video Acquisition, image preprocessing, gait cycle detection, features extraction, recognition using ANN). **Figure.1** show the steps for the gait recognition system

As a behavioral biometric, gait recognition aims to identify the person by the way he or she walks. The main idea of this paper is to build a gait recognition system.

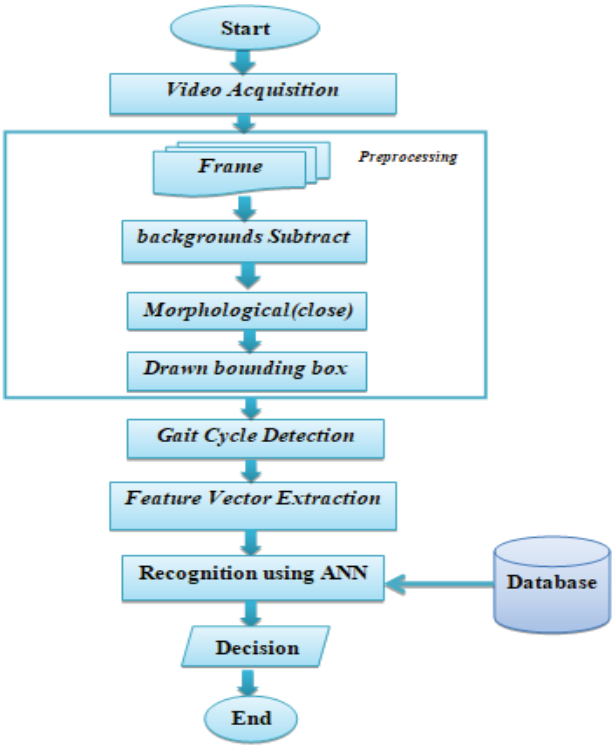

Figure.1 : The block diagram of the proposed algorithm.

3.1 Pre-processing:

image preprocessing procedures concerning authentic gait images should necessarily be implemented at the first hand so as to create solid condition in every image. The result behind these procedures can be used in extracting features. Before extracting features, the gait is processed at the first step so that noise is excluded and features that will be used in the following step are promoted. Such steps generally include(convert video, image enhancement, background subtraction, morphological operation, edge extraction, draw bounding box).

A. Convert Video:

For an additional practice of gait recognition process, the conversion of the input video into frames is a premier procedure to be done. It extracts the detailed data of this video and takes up each sequent frame as colorful image. **Table.1 and Figure.2** show the information of video1- CASIA gait database, frame sequence of video1 respectively.

1. **Table.1:** Information of video 1 - CASIA gait database.

Property	Value
Duration	00.04
Resolution	320 x 240
Number of frames	116
Frame rate	24
Video format	AVI

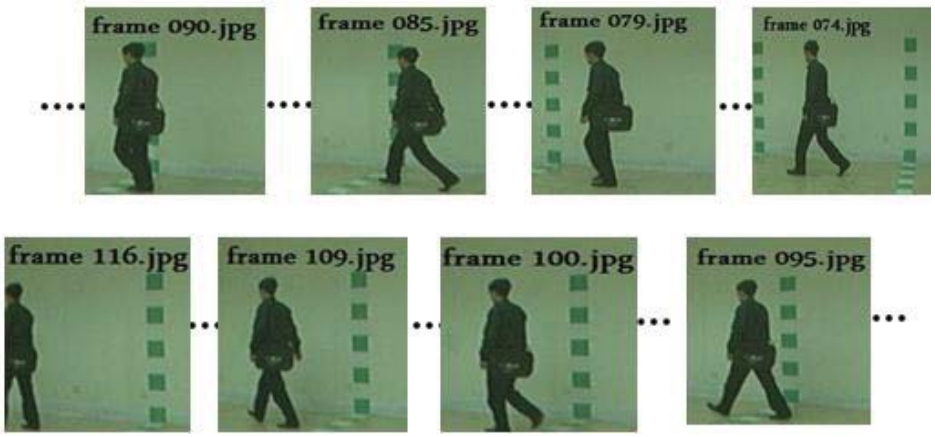

Figure.2: Frames sequenceof video 1 - CASIA gait database.

B. Background Subtraction:

One of the gait recognition approaches is called feedback subtraction. The use of this approach is to detect the moving things that are different from their background model. The other use of this approach is to remove the unwanted piece from the background to get binary images which contain white and black pixels that are moving. The binary images are also known as binary silhouette. See **Figure.3**.

Figure.3: Background Subtraction.

C. Morphological Operations:

Several gray level images are resulted from the former procedure. The images may have small holes and gaps,closing these holes by use morphological operation closing and structuring element with size (5*5) by the equation ($A \bullet B = (A \oplus B) \ominus B$).

1 1 1 1 1

1 1 1 1 1

1 1 1 1 1

1 1 1 1 1

1 1 1 1 1

Complete the gaps and expand every image with composing component.

0 1 0

1 1 1

0 1 0

After that we remove noise with median filter with size mask (3*3).

D. Detection:

The process of detecting takes place, following the procedure of splitting the front from the background, by the process of elements link, and drawing the square to the fluid which detects by the way of labeling elements,as shown in **Figure.4.**

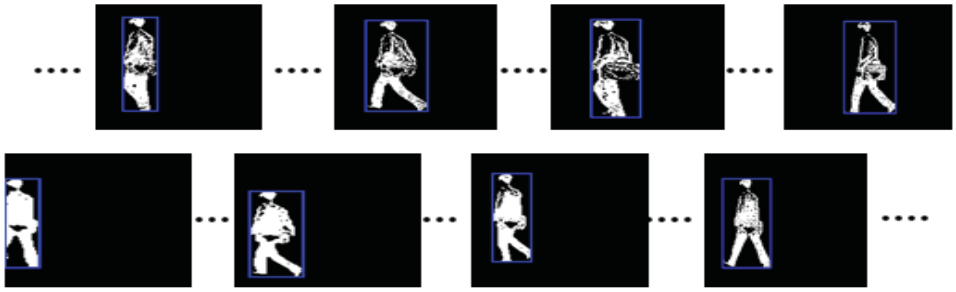

Figure.4: Person walking detection .

4.2Gait Cycle Detection:

The detection of gait cycle is second procedure. The normal process of walking begins when we lift one of the feet, for example the right one and step forward. When it hits the ground (heel hit), the other foot, the left one folds and lifts from the ground (heel-off).The result of feet lifting and hitting respectively is body movement, forming recurrent gait cycle. Human walking is repetitive phenomenon at all times. Therefore, walking is one of the prominent features of a person's human recognition. Thus, a research is not based on the whole video but only on a portion of it, and we can extract features from it by having one cycle starting from heel hit to another heel hit. The direction of gait cycle by counting the length of the stride is the target of this thought. The length of the stride is the approximate distance between the first touch of left heel and the first touch of right heel or vise versa. The length of one stride equals two steps (of left foot and right foot). By detecting the number of structures in a step or a stride[11], the lengths of steps and strides are computed, see **Figure.5.**

Figure.5: Gait cycle detection .

4.3Feature Extraction:

In order to extract dynamic gait qualities, frames of a range of silhouette are processed. The most important procedure in gait recognition system is feature or quality extraction. The qualities are functioned as various original biometrics which are useful for classifying and recognizing patterns. Extracting features actually means defining a range of features or individual features. Feature extraction is importantly required for analysis and classification, in our work, we extract geometry features from gait cycle images, geometry features represent by average width, average height of bounding box, Heel height on earth,leg height and torso height to the person walking at time and angle between two line, the first from elbow to the shoulder, the second form elbow to hand and other distance from body of person,see **Figure.6**.

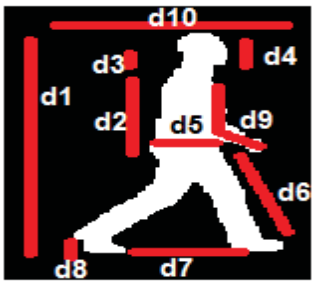

Figure (6): Feature Extraction .

4.4 Recognition using Artificial neural networks:

The designed ANN which is used in process consists of three layers: Input layer, one hidden layer and output layer, the activation function was selected for the hidden and output layers [12]. After features extraction, we divided the samples into two groups. The first group is used to learn ANN (training phase) we used 8 person for training. The second group is used to calculate or test the efficiency of the ANN to distinguish different samples from that used in the learning phase (testing phase) we used 8 person for testing.

The number of nodes in the input layer depends on the number of features extracted from each sample. In this study, the number of nodes in the input layer=10. For this specific problem, the number of output neurons equals the number of bits that represent the number of persons. In this study, the number of nodes in the output layer=3 because the number of persons is 8. The number of nodes in the hidden layer in this study is 10. As shown in **Figure.7.**

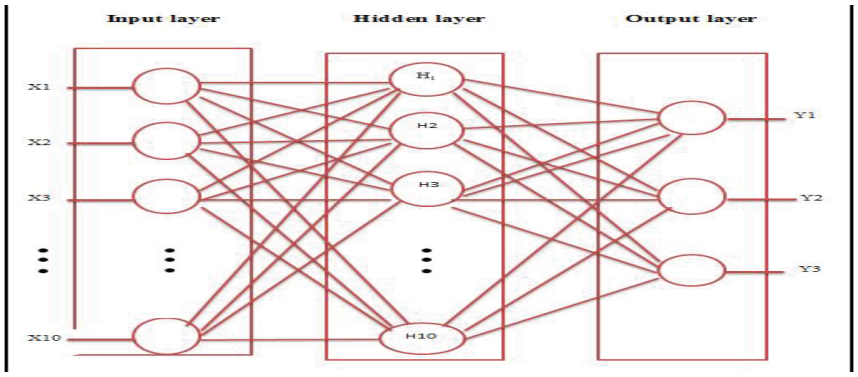

Figure.7: Multi-layered Perceptron artificialneural network architecture

5. Results

5.1 Training Results :

The initial parameters of the neural networks used in these tests are given below:

Type: Feed forward back propagation network-

Number of layers: 3 (input, one hidden, output layer)

- Number of neurons in input layer: Number of features extraction from gait =10
- Number of neurons in hidden layer: 10
- Number of neurons in output layer: 3
- Function of the layer: sigmoid function
- Number of epochs used in training: 500
- Bias learning: 1

For the most part, a network is trained by changing the weights of the connections between nodes.These weights can be randomly chosen or individually chosen. A program randomly generates values for connection weights. Then, the network is given an input, and it is allowed to process the information through its nodes to produce an output. System is trained many times to give the better recognition rate as shown in **Figure.8**,shows mean square error (mse) starts decreasing gradually.

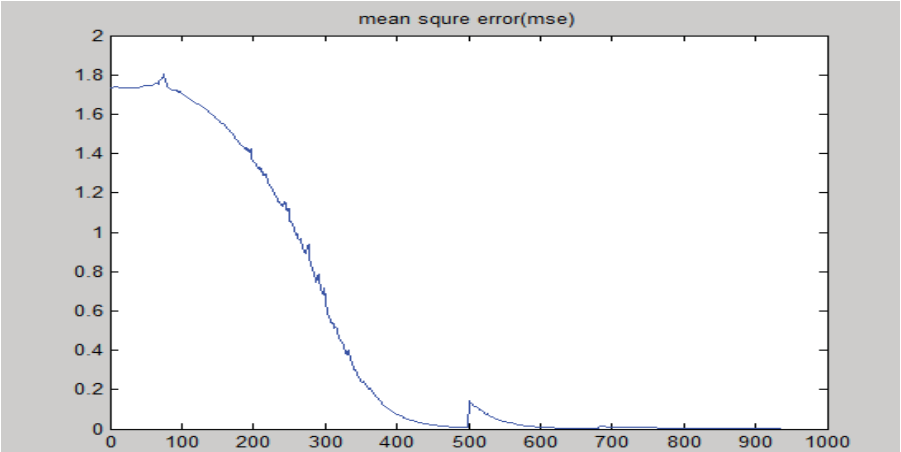

Figure.8: mean square error (mse)

5.2 Testing Results :

Respectively, **Tables.2-3,**show the classification results from**ANN.Tables.4**show evaluation results of all experiment.

Table.2: Classification result from ANN for authorized persons.

Authorized Person	Execution Time(sec)	Classification Result (%)
Person A	1.16253	100
Person B	0.0368042	100
Person C	0.126863	100
Person D	0.044698	100
Person E	0.780907	100
Person F	0.020097	100
Person G	0.0393602	100
Person H	0.0283325	100

When we test the program on eight authorized person by using ANN, all the authorized person are accept, this result not mean matching 100 %,but it mean the person is in data base 100 % .

Table (3): Classification results from ANN for imposter persons.

ImposterPerson	Execution Time(sec)	Classification Result
Person AA	0.019295	0
Person BB	0.0293761	0
Person CC	0.0237176	0

Person DD	0.0650207	0
Person EE	0.0239335	0
Person FF	0.0216875	0
Person GG	0.0842016	0
Person HH	0.0292917	0

When we test the program on eight imposter person by using ANN, all imposter person are rejected.

Table (4): Show evaluation results of all experiment**.**

Data Type	Classifier	FRR	FAR
Authorized	**NN**	**0**	**-**
Imposter	**NN**	**-**	**0**

6.Conclusions

1. The gait is used to identify or verify an individual's identity.
2. Using multi view database is very useful for increasing security.
3. Use geometry features for recognition rate is increasing and arrived to 100%,and better than texture features because texture features need high quality binary image because texture features depended on image nature if contain noise or no or if contain hole or no.
4. The use of artificial neural networks (ANN) is better than traditional method and give results acceptable in pattern recognition and very fast in recognition.
5.

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