

The Research on Shape Context Based on Gait Sequence Image

Rong Wang, People's Public Security University of China, Beijing, China

Yongkang Liu, People's Public Security University of China, Beijing, China

Mengnan Hu, People's Public Security University of China, Beijing, China

ABSTRACT

A gait feature extraction method based on resampling shape context is proposed in this article. First, the moving target detection is carried out to obtain the target area of the human body. Second, the gait cycle is measured, and the contour points and the lower limb joints are selected as sampling points. Then, the different sampling points is placed in the polar coordinates of the origin, the number of sampling points in different cells is counted as the shape context; Finally, the feature vectors are constructed according to the shape context, and the minimum distance is used for classification and recognition. Simulation experiments based on resampling shape context are tested in CASIA gait Database A and Database B. The experimental results show that the method proposed in this article has a lower computational complexity and higher recognition rate when compared with the original shape context method, which can be used for gait recognition.

KEYWORDS

Contour Point, Gait Cycle, Lower Extremity Joint Point, Shape Context

1. INTRODUCTION

In recent years, gait has become a research hotspot in the field of image processing and recognition as a biological feature. Gait recognition is based on the posture of people walking to identify the classification. Gait has the characteristics of non-invasive, unique, easily to collect features, so it can be used for identification (Xiao, Liu, & Dongxu, 2012). Therefore, gait recognition has attracted more and more attention, and has wide application prospects in video tracking, medical care, and so on.

The methods of gait recognition are broadly divided into two types: model-based algorithm and non-model-based algorithm (Zhang, Jiang, Wei, Zhang, & Shi-Jie, 2012; Liu, Jia, & Zhu, 2009). At present, non-model-based methods are more popular, which common are the shape feature, time and space characteristics (Chen, Shi, & Chun-Hai, 2012; Yang & Liu, 2012). Most scholars believe that the shape feature is one of the most effective methods for gait recognition. In addition, the gait image of each frame has different shape features in the process of walking. Therefore, it is very important to describe the shape of the gait image and extract the features of each frame. The common shape feature descriptions are shape signature, invariant moment, Fourier descriptor, and so on. In the (Yu, Wang, Hu, & Tan, 2004), the Fourier descriptor of the key frame is used to express the gait characteristics. In the (Ben, Xu, & Wang, 2012), the Hough transform and the Trace transform are used to obtain the shape features of the gait. In the (Tang, Song, & Jiang, 2008), the static information is obtained by invariant moments, and it can obtain a good recognition rate when combined with the

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dynamic information. However, these methods ignore the local details of the shape and anti-noise performance is poor. In the (Chen, Ma, Huang, & Gao, 2007), the shape context descriptor is proposed to represent the human body contour feature, considering the pixel position vector relations, achieving good recognition rate, and with the increase of the number of sampling points, the recognition rate is improved in a certain range. However, this method only considers the contour points, and does not reflect the joints of the lower limbs with abundant information. With the increase of the sampling points, the calculation becomes larger.

In this paper, based on the shape of the context, combined with the model-based approach, select the contour points and lower limb joints as sampling point, which can better articulate the relationship between the joints and contour points; in order to reduce the computational complexity, do not select the shape context matrix of each point as the feature, but in the polar coordinates, with different sampling point as the origin, the number of statistical sampling points in each sector is counted as the feature after traversing all the sampling points. The final shape context feature is no longer a matrix, but a vector. When the polar coordinates are determined, the dimension of the vector is determined and does not increase as the sampling point increases.

Finally, the computational complexity and recognition rate of the original shape context are improved.

2. FEATURE EXTRACTION

2.1. Shape Context

The method of obtaining the shape context is as follows: Given a shape, a set of discrete sets of points $P, P = \{P_i | i = 1, 2, \dots, n\}$, which can represent the shape of the object, and P is obtained by a certain method. With any point P_i as the center, R as the radius, according to the logarithmic distance draw m mimic circles in the radial direction, then take the P_i as a starting point to draw rays dividing the circle into s parts averagely. Finally, the target concentric circles are divided into $m \times s$ sectors, as shown in Figure 1. The relative position of the point P_i and the other $n - 1$ points determines the number of points distributed in different sectors. Therefore, the shape context of the point P_i can be expressed by the statistical distribution histogram h_i , as shown in Figure 2. The calculation method is as shown in equation (1)

$$h_i(k) = \# \left\{ \rho \neq P_i : (\rho - P_i) \in \text{bin}(k) \right\} \quad (1)$$

Where $\#$ denotes the count, ρ denotes the other points on P other than P_i , and $\text{bin}(k)$ denotes the k -th sector (Huang & Li, 2010).

For a point set P with n points, firstly, calculate the shape context of each point, and then the shape context of all points is combined into the shape context of the whole object, which describes the shape features of the whole object, and there are n histogram distribution as shown in Figure 2.

2.2. Improved Shape Context

The initial shape context method increases the dimension of the eigenvector with the increase of the number of sampling points. In this paper, the contour points and the joint points are selected as the feature point set P , which can better articulate the relationship between the joints and contour points, and a statistical histogram is use to represent the shape of the entire object context. When the number of sectors fixed, the vector dimension also will be fixed. Firstly, in the polar coordinates to draw m concentric circles, to divide the circle into s parts averagely, so it can get $m \times s$ sectors. Secondly,

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