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OBJECT RECOGNITION BASED ON SKELETON

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Abstract. In computer vision, representing graphics with important information can reduce the workload of recognition. As an important research content of computer graphics representation, skeleton features are simple in structure, so images can be matched effectively and quickly. Skeleton provides an effective and compact representation of an image object by reducing its dimensionality to a skeleton while preserving the topologic and geometric properties of the object, so using the skeleton to identify the shape has certain advantages. In this paper, we present the key processes of the object recognition based on the skeleton.

Keywords: skeleton, object recognition.

Introduction

With the development of modern technology, the image resources that can be obtained and utilized are increasing rapidly. Using the theory and method of image analysis to quickly recognize the object in the image has an urgent demand in various fields applications. Because the skeleton of object has the characteristics of hierarchy, multi-scale, consistent with the original target topology and adapting to large changes, people begin to pay attention to the object recognition based on skeleton [1].

Assuming that there is a grayscale image and a library containing different skeletons, object recognition based on skeleton is to extract the skeleton from the input image through a series of processes, and then compare the skeleton with the library to realize object recognition.

In this paper, we present the key processes of the object recognition based on skeleton. The whole process can be summarized as follows: image segmentation, skeletonization, skeleton pruning, model transformation and skeleton matching.

Image segmentation

The function of image segmentation is to separate the object from the background. The most commonly used method of gray image binarization is the threshold method. It uses the difference between the object and the background in the image to set the image to two different levels, and selects an appropriate threshold to determine whether a pixel is the object or the background, Mark all pixels in the sub image whose gray value is greater than or equal to the optimal threshold as the object image, and mark all pixels in the sub image whose gray value is less than the optimal threshold as the background image, so as to obtain the binarized image.

Skeletonization

The next step is to conduct skeletonization algorithm. The purpose of skeletonization is to reduce redundant information and leave enough useful information for topology analysis and shape analysis. The foundation of skeletonization was originally introduced by Blum [2] through an analogy with grassfires. Skeletonization methods can be divided into three major approaches, geometric, curve propagation and digital approaches [3]. The quality of skeleton is affected by many factors, including the noise of the image, the thickness of lines, the determination of endpoints and the selection of line

intersections. An excellent skeletonization algorithm should have the following characteristics: ensure the connectivity of the skeleton after skeletonization, maintain the detailed features of the original image well, the result of skeletonization is the center line of the original line, the endpoints of the line are intact, the intersection of the line can't be distorted and the skeletonization time can't be too long. An example of skeletonization is shown in Figure 1.

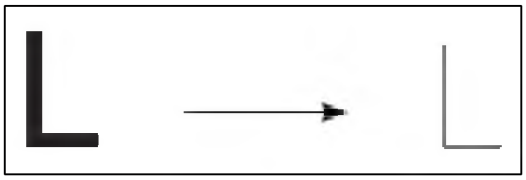

Figure 1. Skeletonization example of a letter of the alphabet

Skeleton pruning

Skeleton pruning is an essential part of the processing and analysis of skeletons. The purpose of this step is to filter out the unnecessary branches caused by boundary noise, which is the preprocessing before skeleton recognition. It is still quite a challenging problem because of the lack of standard measurements for the importance or significance of a branch. The relative significance of the same branches will be different if we see them from different perspectives with different objectives [4]. In the past decade, there are many approaches based on different perspectives have emerged for trying to tackle this problem. Pruning methods based on DCE [5] and pruning based with bending potential ratio [6] are recommended for use. A pruned example is present in Figure 2.

a *b* *c* *d*

Figure 2. Example to illustrate the function of the skeleton pruning: *a* – the input object; *b* – binary object mask; *c* – the initial skeleton; *d* – pruned skeleton

Skeleton recognition

Skeleton recognition is the last step of object recognition. Comparing the processed skeleton with the skeleton in the library, it can retrieve the graphics corresponding to the graphics library by the matching degree of object skeleton. Therefore, the key step of shape retrieval is to perform effective bone matching [7]. At present, there are several common skeleton matching methods, such as skeleton graph matching based on path similarity, skeleton matching based on clustering and affine invariant of image feature matching algorithm.

Conclusion

This paper briefly introduces each key step of object recognition based on skeleton. Skeleton provides an effective and compact representation of an image object by reducing its dimensionality to a

skeleton while preserving the topologic and geometric properties of the object. Therefore, the skeleton based object recognition algorithm has important application significance in image processing.

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