УДК 316.42

OBJECT RECOGNITION BASED ON SKELETON

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Summary. *Object recognition is one of the heated topics discussed in the computer vision, which is a field of artificial intelligence. The skeleton has been proved as a compact and intuitive descriptor that facilitates object recognition. In this paper, the key processes of the object recognition based on skeleton will been presented.*

Suppose there is an original grayscale image and there is a library that consists of a lot of distinct skeletons that are ready for comparison. The idea of object recognition based on the skeleton is very simple, transferring input images to a stable skeleton and comparing it with the library, and finding the most similar skeleton, and then you can recognize the object in the image. The key algorithm used in this process is including image segmentation, image binarization, skeletonization, skeleton pruning and skeleton matching.

The function of image segmentation (image binarization) is to filter out the background and highlight the interesting object. The input of this procedure is the grayscale image, the output of this procedure is a binary image, in which the white pixels constitute the interesting object. In the past, the watershed algorithm [1] and region growing [2] are always used to extract the foreground image. In the recent year, semantic segmentation [3] that based on the neural network are attracted a lot of attention, however this method is supervised learning method, so it requires a lot of marked training date. Otsu method [4] is based on cluster idea so it is more convenient to use.

The next step is to conduct skeletonization algorithm to extract the skeleton from the white pixels. The foundation of skeletonization was originally introduced by Blum [5] through an analogy with grassfires. Skeletonization methods can be divided into three major approaches, geometric, curve propagation and digital approaches [6]. These methods have different properties. However, a good skeletonization algorithm should have the following important properties: the skeleton results must be one pixel thick; the skeleton results must approximate the medial axis of the original image; the thin curves and endpoints of the original image must be preserved; the connectivity of the original image must be preserved; the parallel speed should be as fast as possible; and slight noise appearing near the boundary should not greatly affect the resulting skeleton. As a result, when we choose a skeletonization, we need to take it into consideration.

The technique of skeleton pruning is generally deployed after the skeletonization of the binary image for filtering unwanted branches caused by the boundary noise, which is a vital pre-processing method before analysis and recognition of the skeleton. It is still a challenging task since there are no standard measurements for distinct noise branches and original structural branches. 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 [7] and pruning based with bending potential ratio [8] are recommended for use.

The last step is to compare our clean and stable skeleton with the one store in the library. However, this last step is also very challenging, many methods have been proposed by people. Some of them are based on attributed relation graph such as shock graph [9]. others are based on hierarchy graph.

However, in my opinion, the method based on a similar path [10] that proposed by Bai is good to use.

Till now, we have briefly introduced each key step in object recognition based on skeleton and recommend some famous and useful methods for implementing. The next figure has shown the overall structure in which includes all the necessary steps. (we take a horse as an example).

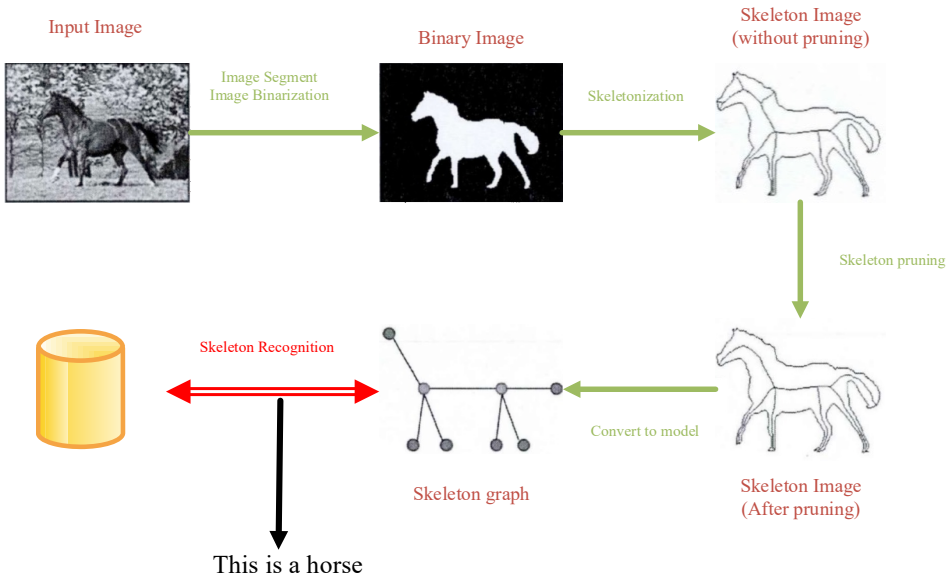

Fig.1. The whole procedure to recognize a horse

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