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Crimp Wheel Extraction of Iris Images during Iris Diagnosis

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Annotation. Iris diagnostics is a method based on the recognition of patterns in the eye's iris to identify an individual's health status, genetic information and other relevant characteristics. One of the most distinctive features of the iris is the constrictor, located in the middle of the iris, surrounding the pupil. It is important for iris diagnosis because its shape, size, and other characteristics can reveal an individual's physical health.

Keywords: recognition of patterns, iris diagnosis, constrictor

Crimp wheel extraction based on structural pattern. In pattern recognition, a method that uses basic element structures (primitives) and the structural relationships between primitives to describe patterns and complete the recognition and classification process is called structural pattern recognition [1]. Through a large number of observations of existing iris images, it can be found that there are boundary areas with drastic changes in grayscale in the iris part of the image, and most of these areas with drastic changes in grayscale exist in a few pixels. The study found that the most drastic changes in grayscale The part is around the inner edge of the iris image, which is a boundary in the iris image. However, compared with the pupil boundary edge, the grayscale of the shrink wheel shows a slowly changing trend within a certain pixel range. Compared with the non-border area There are also many pixels with large grayscale changes. As shown in Figure 1, the pupil area is between the 40th pixel and the 95th pixel, and the curling wheel area is between the 20th and 40th pixels. The curve in the figure Reflects the change in grayscale around the constriction wheel and around the pupil. In order to better find the boundary point, this paper approximately defines the center point within the boundary range as the boundary point of the image within the range, that is, using the basic element structure to count the image range with the largest change in the curling wheel texture in the iris image, and at the same time defining Two modes: border mode and non-border mode, and use the sliding window method to count the number of times each of the two modes appears in the window, find the window containing the curling wheel texture through the rules of the number of occurrences of each mode, and complete the curling Round extraction. [2]

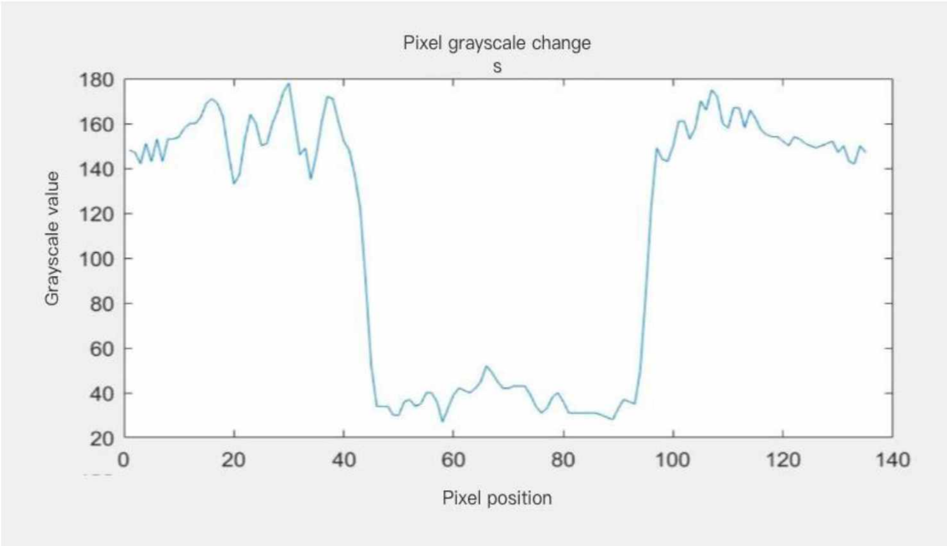

Figure 1 – Boundary area grayscale changes

Define primitives and patterns. The primitive in this article is a basic unit used to describe the degree of grayscale change within a certain pixel range. Through the observation of the curling wheel part in the normalized iris image, combined with the analysis of multiple experimental results, This article defines a primitive as five consecutive pixels in the vertical direction, consisting of a central pixel and two edge pixels at the top and bottom. Its structure is shown in Figure 2, where O represents the center pixel, 1, 2, 3, 4 represent four edge pixels.

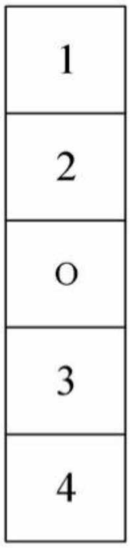

Figure 2 – Primitive diagram

In order to accurately describe the grayscale difference between each edge pixel and the center pixel in the primitive, this paper records the grayscale difference between the edge pixels 1, 2, 3, 4 and the center pixel as q_i=(i=1,2,3, 4), and define the threshold as a=9, b=4, and define the relationship between the absolute value of the grayscale difference between each edge pixel and the center pixel and the threshold to define the primitive mode, recorded as P{p_1, p_2, p_3, p_4}. It stipulates three modes of 0, 1, and 2 to represent p_i = (i = 1, 2, 3, 4), which represents the relationship between the absolute value of qi and the two thresholds. If the absolute value of qi is greater than a, then p_i =0. If the absolute value of q_i is less than b, then p_i=1 is recorded. If the absolute value of qi is between a and b, p_i=2 is recorded. When there is a large change in grayscale between the edge pixels and the center pixels, the image at this time is mostly in the boundary area, and p_i=0 is often present at this time. Therefore, P {0,0,0,0} can be defined as Boundary mode; Similarly, when the edge pixels have almost no change compared with the center pixels, the image at this time is mostly in the non-border area, that is, p_i=1, and the non-edge mode can be defined as P {1,1,1,1}. It would be too simple to consider just using the above two modes as the judgment conditions for boundary areas and non-boundary areas. In order to find out the boundary area of the crimping wheel as completely as possible, this article adds several more types that often appear in boundary areas and non-boundary areas. The mode of the non-boundary area is used to determine whether the image is at the boundary, that is, let P {2,0,0,0}, P {0,2,0,0}, P{0,0,2,0}, P{ 0,0,0,2} to jointly serve as the boundary determination mode, let P{2,1,1,1}, P{1,2,1,1}, P{1,1,2,1}, P{1,1,1,2} to jointly define the non-boundary mode. [3]

Crimping wheel extraction implementation. Select a 15*15 window and slide it along the direction of Figure 5 on the normalized image. In the same window, if the boundary mode appears more often, the non-border mode will appear less often, and vice versa. In order to achieve an accurate description, the boundary point on a certain column is determined by using the quotient of the number of occurrences of the boundary pattern within the window and the number of occurrences of the non-border pattern within the window, and the quotient is recorded as B. [4]

The extraction steps of the crimping wheel are as follows, and the extraction flow chart is shown in Figure 4.

(1) Use a 15×15 window to slide on the normalized image in the direction as shown in Figure 3, count all B, record the maximum value, and save the center point of the window where the maximum value of the quotient is located, which is the boundary point of the column.

(2) Move the window one pixel to the right and repeat the above steps until the image is traversed and all boundary points are found.

(3) Connect all the boundary points and map them to the original image, which is the calibrated shrinking wheel.

Figure 3 – Window sliding direction

Experimental results and analysis. The results of the curling wheel extraction are shown in Figure 5. It can be seen from the figure that the curling wheel outline extracted by this algorithm covers the entire curling wheel area, basically outlines the outline shape of the curling wheel, and is not affected by the eyelashes above the iris. interference.

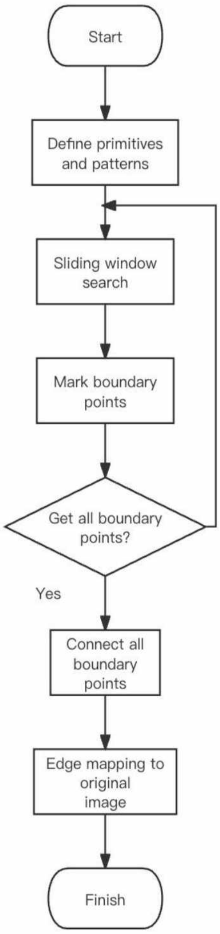

Figure 4 – Curled round extraction flow chart

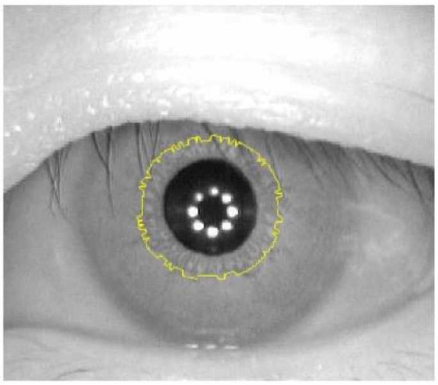

Figure 5 – Curled round extraction

Conclusion. As a combination of traditional Chinese medicine visual examination and western medicine iridology, iris diagnostics plays a huge role in the field of human sub-health evaluation and disease prevention. It has gradually been valued by various countries in the world. As a subject that has attracted widespread attention from the world, iris diagnostics has developed a An iris-assisted diagnosis system based on this discipline has become an inevitable trend. Crimping wheel extraction is a key step in the iris diagnosis process. Deep learning algorithms can quickly and automatically identify and extract key features such as crimping wheels from a large number of iris images, significantly improving the speed of analysis and batch processing. The use of deep learning to extract crimped wheels in iris diagnosis is not only a technological advancement, but its practical significance and application value involve many aspects such as medical health, safety certification, and technological innovation. It is an important step in the current and future field of artificial intelligence. one of the research directions.

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