Detail Completion of Low Resolution Images

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Abstract: In this paper, the multi-frame image is generated by analyzing the visual field motion to restore the detail information of the low-resolution object image. We divide the field of view motion into close, distant linear motions and plane motions that are independent of the horizontal distance from the object. Then the model is improved on the local binarization process, and the practicability of the local adaptive threshold binarization is found, and the ability to integrate the pictures with large difference in gray value is found.

1. Introduction

The Chinese name of the pixel is called the image element, which refers to the basic encoding of the basic original pigment and its gray level [1]. The image resolution is usually expressed in pixels per inch PPI (pixels per inch). Digital images have a continuous tone and tone, that is, after the image is magnified several times, the continuous tone is composed of many small squares with similar colors. Numerous small square points are the smallest unit that constitutes an image—pixel [2]. This minimal graphical unit displays on the screen usually a single stain point. The higher the pixel, the richer the swatch it has, and the more realistic the color. Under the condition of monochrome imaging, the color of each pixel is pure white, pure black and a series of transition colors from black to white. Grayscale uses black tones to represent objects, that is, black as the reference color and black with different saturations to display the image. Each gray object has a brightness value from 0% (white) to 100% (black). Generally, the pixel value is quantized and represented by one byte (8b). For example, the gray value of black-gray-white continuous variation is quantized to 256 gray levels, and the range of gray values is 0~255[3], indicating that the brightness is from deep to light, and the color in the corresponding image is from black. To white. The grayscale image is different from the black and white image. In the computer image field, the black and white image has only two colors of black and white. Each pixel value of the grayscale image is between 256 shades of gray with different depths between black and white.

2. Research methods

This paper mainly studies the motion of the field of view in the direction of the line close to the object. Use the enlargement conversion method [4]. According to the principle of convex lens imaging, the closer the camera lens is to the object, the more the physical information is included in the object image. The image object near the enlarged image is introduced into a larger matrix, and the matrix is converted into a clearer image than the image of the first frame. The higher the magnification, the clearer the image becomes after transformation. After the establishment of the model, we obtained the final simulation results, the resolution reached 576 × 1152, the detail similarity reached more than 85%.

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3. Model establishment and solution

According to the principle of convex lens imaging (Fig. 1), the smaller the distance from the object to the convex lens, the larger the real image of the object through the convex lens, the smaller the distance from the object to the convex lens is greater than the focal length of the convex lens. We used Solidworks to draw a simulation of the camera's convex lens imaging (Figure 2, Figure 3):

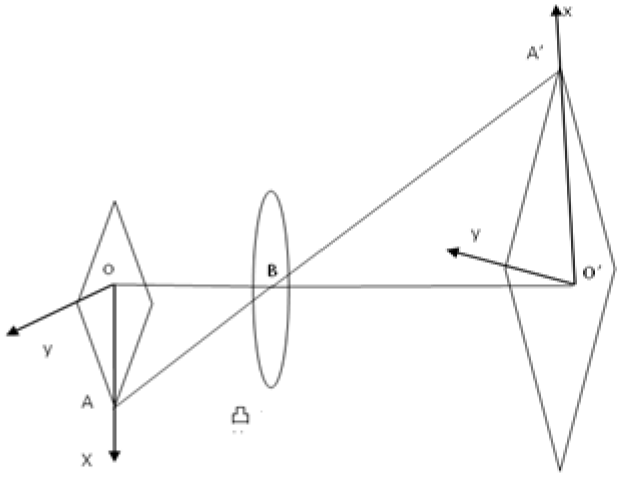

Figure 1 Schematic diagram of convex lens imaging [5]

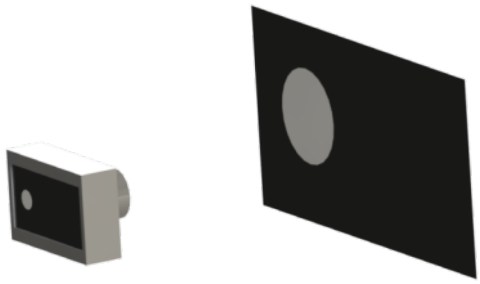

Figure 2 Distant imaging

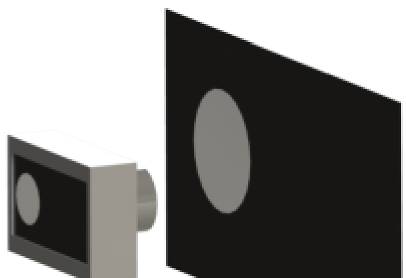

Figure 3 Nearby imaging

The camera lens is a convex lens. Because the camera takes a photo pixel is certain, according to the above principle, the closer the camera lens is to the object, the larger the image is, and the more the physical information is included in the object image. We have thus designed a set of magnification conversion methods. After taking the first frame of photos on a black background, keep the camera moving closer to the subject and continue shooting. We can improve the image clarity by the following steps (the magnification ratio n should be a positive integer greater than 1):

Due to the large shooting error in reality, we simulated the object image in Photoshop software and used a 3200×6400 pixel HD image (Fig. 4) as the real object.

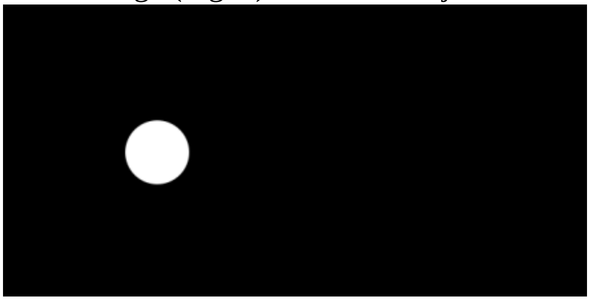

Figure 4 HD image of the object

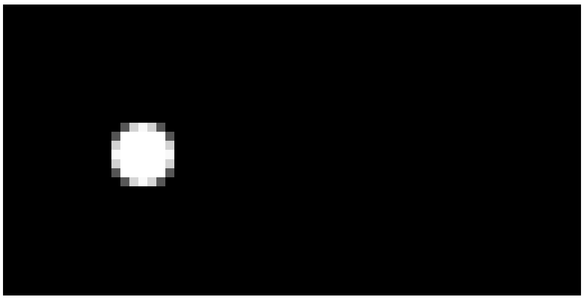

Figure 5 First frame object image

We assume that there is only one object in the field of view and that the object is always completely present in the field of view when zoomed in. When the object is a white circle as shown in Figure 5, the first time is n=2, so a 64×128 is created by the MATLAB program. An all-zero matrix (i.e., a full black image of pixels 64 x 128, the value of which is determined by the background gray value). Then, in the multi-frame image that is continuously shot afterwards, find a picture with the object image similar to the object image in the first frame by 2:1. In this picture, the object image can reflect more information than the first frame image. . It is then converted to a 32x64 matrix and then imported into a 64x128 all-zero matrix. Finally, 64×128 is matrixed into an image (ie, the pixel is 64×128), and its size is scaled to be as large as the image of 32×64 pixels, so that we can clearly observe a clearer image. Figure 7 shows the conversion process of image pixels in Matlab.

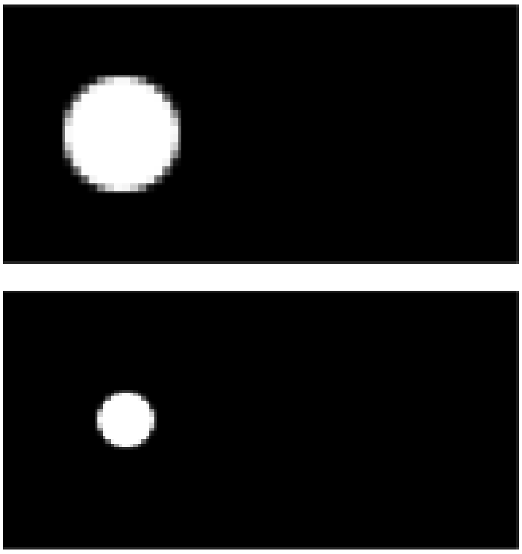

Figure 6 Image after zooming in 2 times (Before the conversion, the next is the conversion)

Similarly, when the amplification ratio n=4, we need to build an all-zero matrix size of 128×256 in MATLAB, and correspondingly find a similar ratio of 4:1 to the image of the first frame in the captured multi-frame image. Object image, import all zero matrix transformation, the final effect is shown in Figure 7:

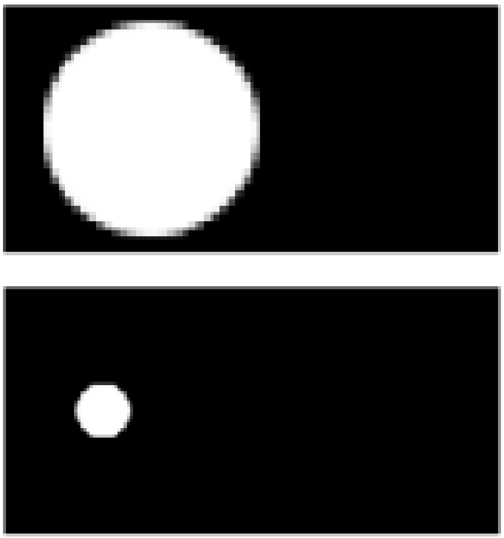

Figure 7 Image after zooming in 4 times (Before the conversion, the next is the conversion)

The image after two enlargement conversions is partially enlarged and compared with the image of the first frame, as seen in FIG. 8:

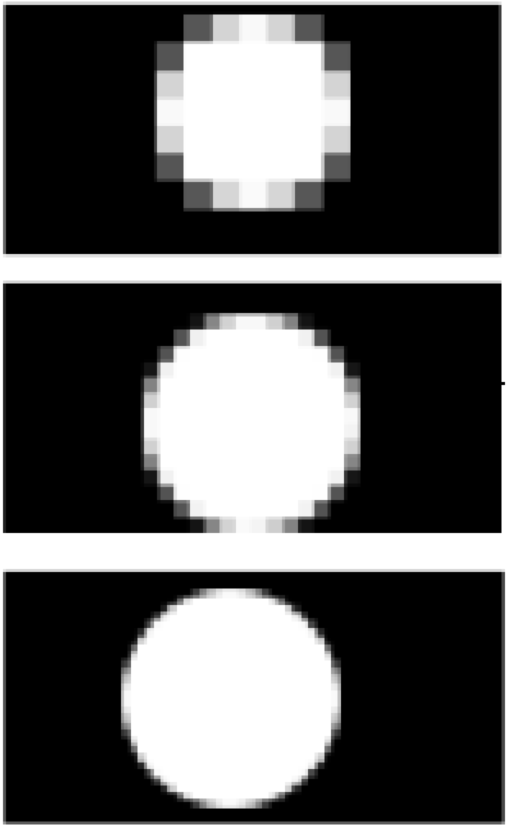

Figure 8: Partial magnification of the image after zooming in and out (up, middle, down are the first frame, zoomed in 2 times and 4 times)

It can be seen that as the magnification ratio n increases, the image pixels are also continuously improved, and the real information of the entity that the object image can reflect will be more and more, that is, the object image can be continuously approached to the real object.

4. Model Improvements - Improvements on Local Binarization Processing

In the first simulation of the model, in order to make the transition between pixel gray values "smooth", we used local binarization processing, that is, manual gray value adjustment [6]. Figure 14 is changed to Figure 15 by the MATLAB program. Disadvantages: Each time the number of simulations is increased, it is necessary to manually fine-tune the minimum gray value and the maximum gray value of the binarization to achieve the purpose of displaying image details.

Improvement: Image binarization based on local adaptive threshold using OpenCV [7] The more common image binarization methods are: 1) global fixed threshold; 2) local adaptive threshold; 3) OTSU. The global fixed threshold is to binarize the entire image with a uniform threshold; the local adaptive threshold determines the binarization threshold at the pixel location based on the pixel value distribution of the neighborhood block of the pixel. The advantage of this is that the binarization threshold at each pixel location is not fixed, but is determined by the distribution of neighboring pixels around it. Local image regions of different brightness, contrast, and texture will have corresponding local binarization thresholds [8]. Commonly used local adaptive thresholds are: 1) the mean of local neighborhood blocks; 2) the Gaussian weighted sum of local neighborhood blocks [9], [10]. The following OpenCV code implements the above binarization method and compares the binarization results of the global fixed threshold and the local adaptive threshold.

5. Conclusion

By comparison, it can be seen that the practicality of the local adaptive threshold binarization, the ability to integrate pictures with large differences in gray values.

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