

Application of Image Processing Technology based on Matlab

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Abstract: In the actual computer image processing technology, most digital images are acquired by electronic devices and stored in a digital format in a database. In the process of acquiring images by electronic devices, there may be image blurring, image size is not standard, and image occupying space is too large. The problem is that image processing technology is to remove noise, image enhancement, image size, image compression, image recognition, etc. for such images. Matlab is literally translated into a matrix laboratory. It is an interactive environment and advanced computing language for high-end computing environments such as scientific computing, interactive programming and visualization. It can realize various functions such as data visualization, data analysis and algorithm development. Therefore, the application is very extensive. The article mainly introduces several image processing techniques based on Matlab.

1. Introduction

Matlab is a high-tech computing environment with image processing functions that is developed by Math Works in the United States. Compared with other image processing software, Matlab's advantages are mainly reflected in the following aspects: First, The programming environment is simple and easy to learn. It has a relatively complete debugging system. The grammar rules are not much different from other programming languages. You can run directly in the programming environment without compiling the program, and it has more functions and functions. In many cases, you don't need to write code to implement the functionality you need. Second, the application operation is simple. Matlab will have a lot of functions and write them into functions. The code is short and efficient. The user only needs to control the following callback function to complete the operation. It can also directly synchronize the statement input with the command execution in the command window. Again, good scalability, the latest Matlab language based on C++ language, not only easy to operate, but also has good scalability and portability, users can write their own files, form their own toolbox, so it can be widely Applied to various fields. Finally, powerful, Matlab comes with more than 600 commonly used mathematical functions, which can meet the basic requirements of users for computing functions. Users can use the general symbols and functions to add, subtract, multiply, divide, and transpose the matrix. And the inverse operation and so on; and the related algorithm of the function has been optimized and fault-tolerant, can directly replace the C language and C++ language without special requirements, greatly reducing the workload of programming; in addition, Matlab also has a powerful Graphic drawing and processing functions, using graphics to display the characteristics of the data field, improve data processing results.

2. Matlab image processing technology

Matlab is powerful and easy to operate. It is widely used in various fields. Here are some commonly used Matlab-based image processing technologies:

Data compression exposes as much information as possible in a limited information space by changing the way information is presented. Data compression can provide more data to people. There is a certain redundancy between the image data, so the image compression processing can be realized by Matlab. There is a great correlation between the pixels of an image, and the image data can be compressed by using code to remove some redundancy. Redundancy of images includes spatial redundancy of correlation between pixels, temporal redundancy between two consecutive

frames of moving images, information entropy redundancy with unit information larger than its entropy, and structure with extremely strong texture on regions Redundancy has a fixed structure of knowledge redundancy and some visual redundancy of image distortion that is not easily noticeable to the human eye.

The basic principle of image compression mainly utilizes the correlation of digital images. There is usually a strong correlation between adjacent pixels in the same row of the image and corresponding pixels of adjacent frames of the moving image, and these correlations are removed or reduced. The redundancy in the image information can be reduced, thereby realizing the compression processing of the image. Image compression can analyze lossy compression and lossless compression according to whether the reduction effect is distortion. Usually, lossless compression is mostly applied to computer application software programs or other important data, that is, each data must not be changed. For some color images, some of the human eyes can be compressed short to increase the compression ratio, which is lossy compression or distortion compression. Common coding methods for image compression processing in Matlab include

Huffman coding, LZ77 compression algorithm, discrete cosine transform (DCT), RLE coding, etc.

The main function of image enhancement is to improve the visual effect of the image to improve the convenience of subsequent work. In the actual image processing work, different image enhancement processing methods can be selected according to the purpose, purpose, and requirements of the image. Specifically, image enhancement processing techniques commonly used in Matlab include spatial domain filtering enhancement and frequency domain image denoising.

In general, the area of pixels in an image is large, including not only its own pixels, but also other pixels. In the actual image processing, the actual value of $g(x, y)$ at $f(x, y)$ is analyzed, and the gray value of the field is calculated. The spatial filtering enhancement technology mainly uses some filters to achieve sharpening filtering or smoothing filtering. The sharpening filter can reduce the high-frequency components of the image. Generally, a high-pass filter can be used when processing the image with a sharpening filter, and the Laplace operator is utilized. Principle, the coefficient of each element on the template is 0. If the gray value in the image does not change much, the high frequency components in the original image will be eliminated. The smoothing filter can reduce the high-frequency components without affecting the low-frequency components, and avoid the change of the gray value of the image, which has the distinction between linear and nonlinear. The linear low-pass filter is used in the image processing process, and each coefficient has a value of 1, which not only ensures that the image gray value is not affected, but also enhances the processing effect. The nonlinear smoothing filter mainly refers to the median filter, which needs to analyze the actual gray value of the pixels in the field, and then sort according to the level condition, change the intermediate value and apply it to the pixel.

The noise on the image directly reduces the quality of the image and affects people's acquisition of relevant information in the image. Therefore, it is necessary to apply frequency domain image denoising technology to reduce or eliminate noise on the image. The frequency domain image denoising technology includes low-pass filtering technology and high-pass filtering technology. When using low-pass filtering technology, the noise of the image should be analyzed. Since the noise belongs to the high-frequency part, the image belongs to the low frequency. The high-frequency part can be eliminated in the image processing to achieve the purpose of noise reduction. In actual operation, the Butterworth can be written in Matlab. Through the code, you can get obvious image noise reduction effect. When using the high-pass filtering technique, it is necessary to analyze the change of the function value in the frequency range of 0 to 1. If the frequency range is gradually increased, the function value will also increase, and the transfer function will decrease until a certain value is reached. For this situation, Butterworth Qualcomm code can be written in Matlab.

Image restoration is an important application of Matlab. The specific applications include image decoding, image network transmission, special effects processing, image restoration and so on. Commonly used restoration algorithms include image decomposition, image retouching, and texture

synthesis.

Image decomposition refers to extracting valuable information from an image to decompose the image and decompose it into two parts, making it suitable for repairing with retouching and texture synthesis. The structural frame suitable for the image repaired by the retouching is to be regarded as the outline of the image composed of homogeneous regions of the same kind, which has obvious boundaries; the part suitable for texture synthesis repair has the repeated detailed texture pattern and random noise. , can be regarded as the texture of the image. The above two parts can be expressed by applying the ROF model of image noise reduction and the oscillation function of Yves Meyer.

Image retouching is a technique for restoring the structure of a static image. The algorithm automatically fills in the surrounding structure information after the user selects the area to be restored. Image retouching not only restores damaged images, but also removes unwanted objects and handwriting from the image, and automatically fills in different background structure information without being affected by the image topology. In the image retouching technique, the structural information around the repaired area is filled inwardly, and the outline extends naturally inward. The outline separates different parts of the repaired area to ensure that the color matches the periphery of the boundary; when the diffusion reaches a steady state Indicates that the spread is very smooth and the repair area is getting smaller and smaller until it disappears.

Texture synthesis technology is based on samples and implements image restoration through texture filling. At present, most of the algorithms are based on the Markov Random Field model. The basic principle of the model is to set some seeds in the image to be processed, and then find matching points in the sample through a given neighborhood, and randomly select an eligible one. Selecting a point to fill the target area to achieve image restoration, the method mainly utilizes the feature of strong correlation between adjacent points in the texture image.

Key techniques for edge detection include conventional operator detection and edge extraction. The main purpose of edge detection in images is to detect the feature difference between objects in the image to determine the edge of the object in the image, that is, to detect the position where the image characteristics change. The main detection indicators include the gray value of the image, the texture feature, and the color transformation. Wait. In the actual detection process, the image can be subjected to first-order and second-order differential processing, the function derivative is calculated, and the degree of gradation change of the image is reflected, and then it is determined according to other conditions such as extreme points to determine whether it is a boundary point to realize the extraction of the region boundary. . The first-order derivative edge detection operator in the specific application process can detect the edge of an image by Sobel operator, Log operator and Canny operator. Select “General Operator Detection” in the “Edge Detection” menu. After a new interface pops up, select the specific operator type in the pop-up menu on the interface. The specific operator type corresponds to an edge detection implementation method. Need to choose. Edge extraction refers to the edge extraction implemented by the morphological method, which can be implemented by the bwperim function in Matlab. It can extract the edge of the binary image. The function format is as follows:

`BW=bwperim(BW1,CONN)`

Where, CONN is the number of neighborhoods.

3. Conclusion

In short, the application of image processing technology in various fields is more and more extensive, which directly affects people's work and life. The image processing technology based on Matlab has the advantages of perfect function, simple operation and strong applicability, which greatly simplifies the algorithm of traditional digital processing technology and promotes the development of digital image processing technology. Of course, in the actual image processing process, the program developer should select different processing methods according to the actual processing requirements to improve the image processing effect; and strengthen the research strength of Matlab, and constantly expand its functions and performance to make it practical. Play more value in your work.

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