

Medical Application of Digital Image Processing Based on MATLAB

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ABSTRACT

Image is the main source of human access and exchange of information. The application of digital image processing in medical engineering is very extensive, and the result is very effective. Medical digital image processing can reduce the effect of noise, enhance the image and improve its quality. Processed images can accurately reflect the focus of disease and visually communicate medical and pathological information of the image. This paper introduces the technology of digital image processing based on Matlab. Using Matlab can acquire and recognize and process the images. As a powerful simulation software, Matlab is widely used in scientific research and solved specific problems. Matlab toolbox for medical image processing

can be effectively process the medical images ,also provides a powerful way for medical image analysis.

Introduction

Since the CT appearance, with the rapid development, it brings a revolutionary contribution to brain diseases and heart and lung disease because of its non-invasive inspection without breaking the surface^[1]. Diagnostic value beyond doubt, it has special value to the discovery of the neck, lungs, chest wall, liver, kidney, ovarian lesion and other disease, also to lesion location and severity. CT scan for images will be influenced by external light and creep of human organs and its spatial resolution, causing the medical image noise so that leading to hide some information. What's more, vision

is the main measure that the doctor can get the pathological information. Digital image processing can process medical images, improve its quality, enhance the visual effects, hence, the true situation can be showed clearly.

Digital image processing with the development of computer technology has been widely used in various fields, and the medical field is no exception. Transform in digital image processing through various operations, highlights, enhanced image characteristics can improve the accuracy of diagnosis.

1 Development of digital image processing technology

Multi-disciplinary comprehensive development not only can avoid some local defects, but also will be applied in practice to the fullest. In the field of modern medicine, image processing technology has become an important branch. Noise pollution, information hiding, organizing fuzzy edges and other issues have potential impact on the accuracy of pathological diagnosis

and treatment^[2].

With the progress of science and technology, the existing digital image processing can meet the demand of the medical examination, doctor can intuitively to inform the patient of illness. Early 60s in the 20th century, image processing was the initial stage, image processing cannot be used widely spread due to the backward technology and incomplete algorithm, also high price of image processing equipment and higher storage cost. In the late 80s, image processing technology has also gradually took on the stage and popularized further, lower cost was the main reason. The emergence of a large number of mathematical algorithm and theory made image processing theory quicker and better and integrated with other disciplines, then get the application in more and deeper field^[2].

At present, the digital image processing is mainly focused on the improvement of the image quality., the radiation needs to collect information of hard and soft tissue at the same time,

influenced by the artifact , and all kinds of noise during the procedure of image processing. If the diseased tissue and normal tissue attenuation coefficient vary a little, it cannot be distinguished lesions. However, digital image processing can be gained through a combination of a variety of mathematical algorithms and high-tech equipment to obtain more clear anatomic structure of information, at the same time reduce the intensity of radiation, and thus obtain a better diagnostic information.

2 The Principle and Method of Digital Image Processing

2.1 Principle

Digital image processing is that getting the results through a series of algorithms of image representative numerical computations^[3]. For the image, "processing" is to change its form, and make it more conform to the requirements or to achieve some predetermined goals. The process is as follows:

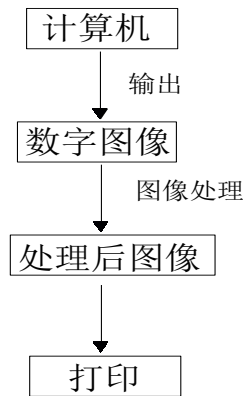


Fig.1 The principle of digital image processing

Digital image processing has the following advantages: (1) good reproducibility; (2) high precision; (3) flexibility, not only can accomplish linear operation, but also complete nonlinear and mathematical algorithm expression of image processing operations. (4) widely application. these advantages of digital processing technology make it widely used in the medical field.

2.2 Medical Basic Method of Digital Image Processing

The basic methods of digital image processing are image restoration and image enhancement^[4]. Image restoration is to restore the original image information improve fidelity as

far as possible. A basic feature of digital is its inherent noise. Noise, considered as a value around the random fluctuations of the real value, is the main factor to reduce image quality. The fundamental problem in image restoration is to eliminate the noise.

Image enhancement is to use the related digital image processing technology. Select or extract the important part of the image or a particular area effectively through processing the preprocessed image.

And at the same time, filter or attenuate the unnecessary image information. Image enhancement contribute to the image detail or calibration area identification, and improve the interpretation accuracy of the image. At present, the most commonly used method is histogram correction as different space of the image enhancement processing. based on calibration of image gray points (histogram) information on the gray level distribution form, adjusting the image gray scale, so that eventually

achieving the goal of image enhancement by using the physiological characteristics of human visual system to distinguish image detail^[4].

3 Matlab-based Digital Image Processing Technology

3.1 Medical Digital Image Processing Technology Research Content

Digital image-processing is a strong commonality, information storage, transmission and reliable image processing technology, because it implements the nonlinear processing of digital image processing easily, and the processing procedures and processing parameters are variable. In the image processing, the input is the low quality image, and the output is the improved quality images, hence, the commonly used image processing methods are such as image enhancement, restoration, coding and compression.

3.2 Matlab-based in Medical Image Processing

Now, computer networking and remote diagnosis of medical image has become an irreversible trend, and confronted with massive data processing and image post-processing, Matlab software will undoubtedly has a broad application prospect.

At present, Matlab is highly accepted in medical field ,due to its powerful functions and easy operation. What's more, it can be utilized among ultrasound, CT and X-ray perspective of image enhancement, segmentation, morphological analysis etc processing, which its characteristic image information is consistent with the expected standards and clinical diagnosis requirements, having a better reference value^[5-8].

3.2.1 Matlab-based Image Acquisition and Image Reconstruction

image processing software toolkit of Matlab provides general image file format (e.g., PCX, BMP, GIF, HDF, Tiff, XWD, etc.) to read and write functions, such as `bmread`, `bmpwrite`, `tiffread`,

`tiffwrite` etc. These function can be used to read the medical image in Matlab, or convert the image file format. Also it can be read directly from the coordinate system using `get_lager` function image data, that is generated by Matlab graphics. that can be turned into image data. Matlab software has the characteristics of that it can generate the image only with the data, and it take the convenience for image reconstruction. Matlab is the matrix lab, that can directly obtain the CT or MRI image data matrix. with the correct selection of specific tissue reconstruction algorithm so that it can easily build two-dimensional or three-dimensional image. In addition, Matlab also provides a large number of FIR (finite impulse response) filter function, nonlinear filtering function and the two-dimensional convolution, two-dimensional fast Fourier transform, Radon transform, such as transformation function, there is no doubt that it provide a great convenience for image reconstruction

algorithm and filtering algorithm.

3.2.2 Image Post-processing Based on Matlab

General medical imaging post-processing includes edge enhancement^[9], smooth the interested region, filtration, calibration, and wide window adjustment. Matlab provides the corresponding processing function, which can generate the corresponding software system. Using Matlab `imresize()` function will enlarge (narrow) and keep its length unchanged. Also it provides lots of clip image rotation and block processing functions and process individual areas separately, and convert the image format (true color images RGB model will convert to gray scale image by `rgb2gray`) and image statistics processing, etc.

3.2.3 Feature Recognition

Matlab software provides the some simple characteristics image recognition methods can solve the medical image recognition problems. Especially the new Matlab using wavelet analysis software will improve the characteristics of medical image

recognition work. Providing a powerful support to some symptoms of computer automatic recognition and remote diagnosis technology .

3.2.4 programming processing

Everyone has right to get the interested image and processing image, different methods of image processing and character recognition algorithm will be needed. Matlab software provides a convenient and easy programmatic interface, especially for medical experts who can according to their own interest and specialty selected special algorithm. They can achieve their goals through using the matlab programming function. The development of the remote diagnosis technology also need simple and powerful image programming software, including sending image, image acquisition and image reconstruction, image post-processing, characteristic recognition aspects of programming, matlab software programming platform also can do this. Through Matlab for medical image processing, so as to generate the image processing system, can improve the

image quality of the image, due to its simple operation, it is accepted in medical field.

4 Medical Application of Digital Image Processing Based on MATLAB

Digital image occupies an important position in the field of medical engineering. Through the analysis of medical microscopic image processing and ultrasonic image processing, and the enhancement of X-ray lung image and etc, it has been widely used in medical diagnosis^[10,11]. Grayscale enhancement, wavelet noise reduction and point feature matching can improve the CT, ultrasonic image and radioactive isotope (RI) image quality, so that people have a clearly understanding of the lesions environment surrounding. Combined with advanced networking technology can achieve remote consultation and treatment.

5 Prospect

Digital image processing not only improves diagnostic value but also has a prominent advantage in terms of visibility. From a medical image gray-scale enhancement, wavelet denoising, edge segmentation, image fusion, we also need to introduce some more precise mathematical algorithms. Combined with advanced computer equipment to handle this, of course, this is an important direction for future development, constantly improving the quality of images, can not only expand the scope of its use, but also provide possibilities for clinical diagnosis to a new heights^[12].

Digital image processing cannot be isolated from other methods of image diagnosis, using reasonably in order to make up for the shortcomings of other methods. So as to create a huge social value, have made great contributions for the country and people. In the future, it will provide more in-depth and comprehensive development.

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