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Review of Optimization Methods in Medical Imaging

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ABSTRACT

Digital medical images play a major role in clincal detection of the patient and determine the appropriate treatment for the condition. Because of the exposure of medical digital images to several factors that affect their clarity, accuracy, noise or quality, there was a need for techniques to improve medical images and maintain the information in them, as this information is very important and related to the patient's health and diagnosis of his condition. There are many techniques to optimize the medical images that will be mentioned in this research, explain them, and discuss the challenges and difficulties of optimizing digital images in the medical domain.

Key words: Medical Imaging, Image Segmentation, Image Registration, Image Reconstruction

1. INTRODUCTION

I. Due to the great development in the digital technology field in all areas of life, medical images have taken their share of development. Most medical images are digital images or converted it into digital format. The digital field offers many advantages in dealing with the image, but there are many challenges to digital medical images during the process of optimization, such as image quality control, image clarity, noise and other challenges. There are The doctor asks many medical media to provide accurate and complete information about the patient. For example, CT provides information about bone structure. The MRI scan provides information about tissue structure such as muscles and blood vessels, when ultrasound scans focus on organs, lesions, and lumbar structures. As the digital image grows, the medical image can turn into digital information, making the image process work with the computer [1].

II.

There are many differential factors affect to the imaging principles and methods, sampling time, and physical condition of the patient are variables that need to be taken into account when accessing different medical media at the same time, which are serious issues that need to be resolved in image recording techniques. Improved accuracy, time sensitivity, and image recording power are issues that need resolved issues. moreover, automatic diagnose need to combine more medical information which must be registries. The aim of this research is to present and review ways to optimize the medical images and the factors that affect medical images.

2. RELATED WORK

Pointed out [9] for clinical handling, many medical sources are needed by the physician to provide accurate and complete information about the patient. Medical photo recording techniques can provide more detection and remediation information to doctors.

Discussed [5] the process of recording images in the medical field is defined as the process of combining two or more photos to provide further information. This process helps in medical detection by improving image quality. In diagnosis, the image obtained from a single method such as MRI, CT scan, etc. may not be able to provide all the required information.

Discussed [15] the subject of medical imaging compression. With the increased demand for storage and transmission of medical images. The pressure was inserted. Over the past few years in medical imaging systems without loss under intense attention because there is no loss of information. Discussed [16] to combine medical imaging when several complex medical tests ask the merging of information from MR and CT images for a more accurate diagnosis. Then provide a technique to compare the quality of images CT and MR.

Pointed out [2] to protect the subject of useful detection information and suppress noise you should cherish the medical images. Many methods present a way to reduce images. The important feature of the noise reduction model for a good image is that it must remove the noise as completely as possible and keep the edges.

Pointed out [17] to the process of fusion medical images for obtaining accurate diagnosis of the patient's condition. However, some images suffering from noise during capture, combining or other factors affecting the medical image,

which affects the quality of the image, and the removal of noise may lose the image some of its information or quality, Thus, the researcher provide a way to solve this problem.

Discussed [18] in his paper, a reviewed the technique of automated image recording that was used in the medical field. The purpose of this paper is to be an introduction to the field, provide knowledge about the work that has been developed and be a suitable reference for those who are searching registration techniques for a particular application.

Discussed [19] in his research he presents a review of new innovations on the process and application of 3D printed objects from medical imaging data. Data on three-dimensional medical imaging models of CT, MRI, and ultrasound can be obtained using DICOM. Others optimization methods can be used to solve the image problems as [20-26].

3. IMAGE RECONSTRUCTION

Image reconstruction has fundamental effects on image quality and thus on radiation dose. For a certain radiation dose, it is convenient to rebuild images with minimal noise without losing image resolution and spatial accuracy [2]. Recoding that the image quality is best can be translated to reduce radiation dose because images can be a rebuild of the same quality at a lower dose. There are two main categories of reconstruction techniques [1]:

A. Analytical remodel

B. Iterative remodel (IR).

There are several types of analytical remodel techniques. The most commonly used analytical remodel methods on commercially computerized CT scanners are in the form of FBP, which uses a 1D filter on projection data before 2D or 3D data re-projection on the image area. The cause of using FBP-type of the method is mainly due to its arithmetic efficiency and numerical stability. Various types of FBP remodel methods for different generations of CT scan architecture, ranging from the parallel 2D beam and the CT fan in the 1970s and 1980s, were developed for helical and multi-slice tomography with narrow coverage of the detector in the late 1990s and early 2000s and for multiple CT segments with coverage Wide detector (up to 320 row detector and 16 cm width). The 3D weighted FBP techniques generally rely on scanners with more than 16 description lines [3]. Typically, users of computerized tomography scanners have very finite control over the inside workings of the remodeling technique and are mainly limited to adjusting many parameters that may affect image quality.

4. IMAGE REGISTRATION

Image recording is the process of merging two or more images to equipping more information. In the medical picture, integration helps in medical detection by improving image quality. sometimes in detection image obtained from a single modality like MRI, CT etc, may not be able to provide all the information about the patient's condition. There is also a need to integrate information obtained from other methods to improve the information obtained [4]. In combining medical images obtained from different techniques, the images may be in different coordinate systems and must be properly aligned for effective integration. So the information should be preserved in the picture.

5. QUALITY MEASURES FOR EVALUATING IMAGE INTEGRATION TECHNIQUES

The image combined process should preserve all valid and useful information from the input images also it should not introduce undesired facts. There are various metrics are used to evaluate the performance of Image Fusion techniques. Such as: mean square error (MSE) and peak signal to noise ratio (PSNR), mean absolute error (MAE).

5.1 Mean Square Error (MSE)

Is one of the well-known metrics that used to find the average squared difference between the rated values and what is estimated? The Mean Squared Error (MSE) between the images $I(m,n)$ and $I(m,n)$ is calculated according to Equation 1 [5].

$$MSE = \frac{\sum_{M,N}[I1(m,n) - I2(m,n)]}{M \times N} \qquad (1)$$

5.2 Peak Signal to Noise Ratio (PSNR)

Is the most metrics to be used in many experiments. It avoids the issue of an image intensity by having the MSE scaled based on the range of an image where it is provided by Equation 2 [6].

$$PSNR = \frac{10\, log_{10}\, R^2}{MSE} \qquad (2)$$

5.3 Mean Absolute Error (MAE).

Is the one of the most metrics to be used in many experiments. It is a measure the average size of the errors in a group of forecasts, without considering their direction. It measures precision, for continuous variables and the bigger value of mean absolute error (MAE) means that image is of bad quality. Calculated according to Equation 3.

$$MAE = \frac{1}{n}\sum_{i=1}^{n} | Yi - Xi | \qquad (3)$$

6. MEDICAL IMAGING

New 3-D medical imaging offers the potential and promise for great advances in science and medicine as higher reliability images are created. It has developed into one of the most important domains within scientific imaging due to rapid and continuing progress in computerized medical image [7]. Medical images are many and varied: photographic image, text image, graphic image (including synthetic image), biomedical image (X-ray, ultrasound, MRI, CT-scan etc.) [8][9].

In the first phase, input is an image scene and output are a corresponding digital image. In the second phase of processing, both the input and output are digital images where the output is an improved version of the input. In the last phase,

input is still a digital image, but the output is description of the contents. Image processing field has a wide spectrum of applications and can be used into different domains where images are used such as [10]:

- Brain Tumor disclosure.
- Cranial shatter.
- Breast Cancer Detection.
- Congenital Heart Defects.
- Diagnosis Heart Valve Diseases.
- Tuberculosis (TB).
- Pathological Brain Detection (PBD).
- Birth Defects.

The growth of digital medical imaging methods to reform newfangled medicine [11]. The quality of digital medical pictures has become a serious problem because noise and other factors affect the medical photo. Medical images must be sharp, pure, free of noise and antiques [12].

The removal of noise in digital medical pictures remains one of the main confrontations in the study of medical imaging because noise removal offers artifacts and reason image confusion.

7. CHALLENGES IN MEDICAL IMAGE PROCESSING

Several of specific confrontations in medical picture processing, such as [13]:

A. Optimize and restore your image.
B. Mechanical fragmentation must be accurate to the advantages of benefit.
C. The automatic recording must be precise and combine multimedia images.
D. Classification of image properties, characterization and writing structures.
E. Quantitative image features and explanation of the measurements.
F. Development of integrated systems for the clinical field.

8. IMAGE SEGMENTATION

Image Segmentation is defined as dividing an image into meaningful areas for a specific function; it's one of the first steps that lead to picture test and explanation. The goal is easy to define, but difficult to obtain. Many techniques of image segmentation have been utilized in medical applications of organ tissues and organs. Segmentation of images becomes important in many applications such as border disclosure in coronary angiography, surgical planning, surgical simulation, tumor disclosure and division, brain development, functional mapping, automated classification of blood cells, comprehensive disclosure of mammograms, image recording, cardiac division, and cardiac image analysis, etc [14].

9. CONCLUSION

This paper presents the basics of medical image processing and explains the confrontation in the treatment of medical imaging. There are a number of algorithms and their applications in medical image testing need to be studied and developed, because of great technological advances in all fields.

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