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Identification of Bone Cancer in Edge Detection Using Discrete Wavelet Transform

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***Abstract*—Medical image is a process of collecting information about a specific physiological structure (an organ or tissue) using a predefined characteristic property that is displayed in the form of an image. CT provides Anatomical structure images & then the edge of CT images is detected by using a new method to enhance the disease affected part. This paper employs an easy, fast and reliable technique to detect cancerous tissue in bone by using different image processing techniques such as contrast enhancement, edge detection. The experimental results show, the proposed method could obtain the smooth image with edge showing the disease affected part without the spatial and spectral noises**.

Key words: **Contrast enhancement, Image registration, Normalization, Resembling and edge detection**

I. INTRODUCTION

A bone tumor, (also spelled bone tumour), is a neoplastic growth of tissue in bone. Abnormal growths found in the bone can be either benign (noncancerous) or malignant (cancerous). Bone tumors may be classified as "primary tumors", which originate in bone or from bone-derived cells and tissues, and "secondary tumors" which originate in other sites and spread (metastasize) to the skeleton.

Primary tumors of bone can be divided into benign tumors and cancers. Primary bone cancer caused by the heredity growth of cancer cells, called primary bone cancer. A *primary* bone tumor starts in the bone itself. True (or primary) bone cancers are called *sarcomas*. Sarcomas are cancers that start in bone, muscle, fibrous tissue, blood vessels, fat tissue, as well as some other tissues. Primary bone cancer (tumor) these can be divided into benign tumors which can have a neo plastic (abnormal tissue growth) developmental traumatic infectious or inflammatory cause and cancer.

The secondary bone cancer is a metastasis. Metastasis occurs when cancer from one part of the body spreads to other areas, which can include the bones. Breast cancer, lung cancer and prostate cancer all have a tendency to spread to the bones. Metastatic bone cancer causes the same bone pain and weakness of other forms of bone cancer, as well as fatigue and weight loss.

Common benign bone tumors may be neoplastic, developmental, traumatic, infectious, or inflammatory in etiology. Some benign tumors are not true neoplasms, but rather, represent hamartomas, namely the osteochondroma. The most common locations for many primary tumors, both benign and malignant include the distal femur and proximal tibia. Since, by definition, benign bone tumors do not metastasize, all secondary bone tumors are metastatic lesions which have spread from other organs, most commonly carcinomas of the breast, lung, and prostate.

Reliable and valid statistics on the incidence, prevalence, and mortality of malignant bone tumors are difficult to come by, particularly in the oldest (those over 75 years of age), because carcinomas that are widely metastatic to bone are rarely ever curable, biopsies to determine the origin of the tumor in cases like this are rarely done.

The survival of bone cancer patients is related to the extent of their disease at the time of diagnosis. In the absence of distant metastases, the spread of tumors to the meditational lymph nodes is a major determinant of both the prognosis and the therapeutic approach. Proper staging is important for selecting patients who may benefit from surgical resection and for defining the treatment modalities of patients who will undergo radiotherapy.

Tomographic imaging in nuclear medicine is based on the metabolic activity of tissues and may be useful for identifying pathological changes before they are detected by radiological examinations such as CTs. CT provides the anatomical structure an the edges of the CT images is detected by using a new method to enhance the disease affected part.The bone image feature analysis technique developed consists of steps such as pre -processing,

contrast enhancement, Image registration, Normalization, Resampling and Edge detection.

Preprocessing of an image is performed for the improvement of the image data and also for identifying image features which are important for further processing. Pre-requisite for preprocessing of an image is knowledge about the image acquisition device, conditions under which the image was obtained and objects that are searched in the image.

II. METHODOLOGY

2.1. COMPUTED TOMOGRAPHY (CT)

Computed tomography (CT) scan (also known as a computed axial tomography scan, or CAT scan) is one of the most commonly used tools for the screening, diagnosis and treatment of cancer.

A CT scan is an X-ray procedure that uses a computer to produce three-dimensional, cross-sectional images of inside the body. Unlike conventional X-rays, CT scans provide exceptionally detailed images of the bones, organs and tissues. X-rays are taken from many angles and combined to create a cross-sectional image.

A CT scan may be used to pinpoint the location of a tumor, evaluate the extent of cancer in the body, and assess whether the disease is responding to treatment. In some cases, CT technology is used to accurately guide cancer treatment during a procedure.

Fig 1: Input image

2.2 PREPROCESSING

The preprocessing operation is carried out to extract details that are obscured in an image or to highlight features of interest in an image

Wiener Filter

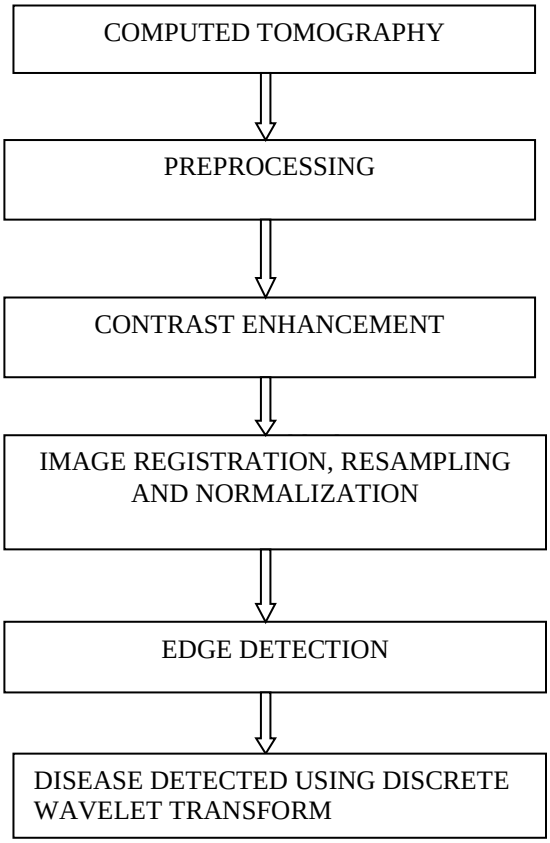
The main objective of least mean square filter or wiener filter is to approximate the original image in such a way that the mean square error between the original and approximated image is minimized.

Advantages

- Wiener filter has no 'small or zero value problem'.
- The results obtained in Wiener filtering are more closer to the original image than the inverse filtering

Fig 2: wiener filter

System Block Diagram



2.3 Contrast Enhancement

Improving the contrast of medical images would lead to better visual representation of the images, improved syndromes diagnosis, more accurate detection of diseases and as a consequence enhancing the contrast of the CT images will show smaller components and features of the medical image allowing the therapist to perform a healthier treatment for the patient. Enhancing the contrast of CT images is considered as a pre-processing step in many medical image processing applications. When enhancing the contrast of computed tomography (CT) medical images, two factors to complete the task must be considered, those are speed and efficiency. The proposed technique considers these two factors by supplying a fast processing with effective results.. Then the enhancement variable (K) is computed using the subsequent equation.

$$\mathbf{K} = \frac{\sum_{i=1}^{i}\sum_{j=1}^{j} x(i,j)}{m \times n}$$

Where (x) is the degraded image, the above equation sums all pixels values and divides them by the size of the image represented by (m) and (n). Finally, the image is enhanced using the following equation.

$$EI = \frac{[x - \min(x)]e^{k}}{\max(x) - \min(x)}$$

Where (x) is the degraded image, (min, max) are the minimum and maximum pixel values of the processed image, (K) is the enhancement variable, and (EI) is the contrast improved image following flow chart represents the enhancement methodology.

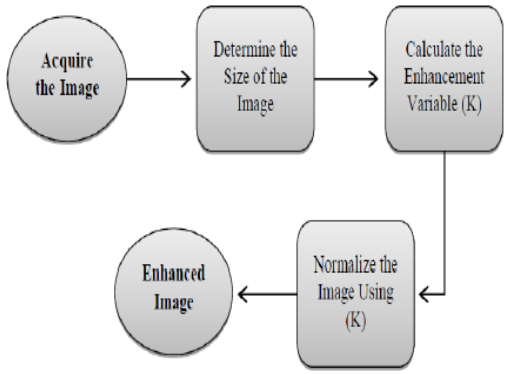


Fig. 4 Contrast Enhancement method

1.4 IMAGE REGISTRATION

Image registration is the process of transforming different sets of data into one coordinate system. Data may be multiple photographs, data from different sensors, from different times, or from different viewpoints. It is used in computer vision, medical imaging, military automatic target recognition, and compiling and analyzing images and data from satellites.

Registration is necessary in order to be able to compare or integrate the data obtained from these different measurements. Image registration essentially consists of following steps Feature detection: Salient and distinctive objects (closed-boundary regions, edges, contours, line intersections, corners, etc) in both reference and sensed images are detected. Feature matching: The correspondence between the features in the reference and sensed image established. Transform model estimation: The type and parameters of the so-called mapping functions, aligning the sensed image with the reference image, are estimated. Image resampling and transformation: The sensed image is transformed by means of the mapping functions.

2.4.1 Image Resampling (RS)

RS is the procedure that creates a new version of the original image with a different width and height in pixels. Simply speaking, RS can change the size of the image. Increasing the size is called up sampling, for example. On the contrast, decreasing the size is called down sampling. Note that the spatial resolution would not change after the RS procedure, either up sampling or down sampling.

2.4.2 Image Normalization

A common problem associated with the use of multisource image data is the grey value differences caused by non-surface factors such as different illumination, or sensor conditions. Such differences make it difficult to compare images using same color metric system. Image normalization is required to reduce the radiometric influences caused by non-surface factors and to ensure that the grey value differences between temporal images reflect actual changes.

2.5 EDGE DETECTION

An edge is a set of connected pixels that lie on the boundary between two regions. Edge detection is the most common approach used for detecting meaningful transitions i.e. discontinuities in the gray level of an image.

2.5.1 Edge Models

There are two important edge models, namely

1. Ideal digital edge model
2. Ramp edge model

2.5.2 Gradient Operators

The gradient method detects the edges by looking for the maximum and minimum in the first derivative of the

image. A point is said to be an edge-point if its two dimensional first-order derivative is greater than a specified threshold. The first order derivatives in an image are computed using the gradient operators.

Now, three types of gradient operator can be used to calculate the first order derivative .They are

1. Roberts cross-gradient operator
2. Prewitt operator
3. Sobel operator

Fig 5:Prewitt

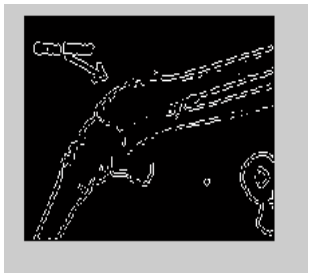


Fig 6:Sobel

Fig7: Robert

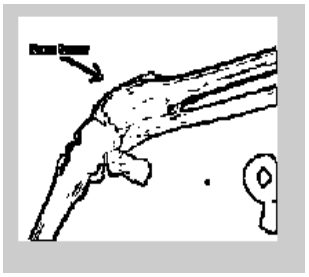


Fig 8: Threshold (100)

Canny Edge Detection

The Canny Edge Detector is one of the most commonly used image processing tools, detecting edges in a very robust manner. It is a multi-step process, which can be implemented on the GPU as a sequence of filters.

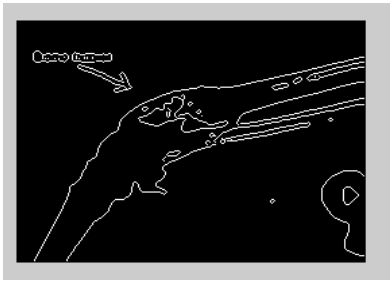


Fig 9: Canny edge detection

Advantage

The Smoothing concept has been applied in this Gaussian operation, so the finding of errors is effective by using the probability. The next advantage is improving the signal with respect to the noise ratio and this is established by Non maxima suppression method as it results in one pixel wide ridges as the output. The third advantage is Better detection of edges especially in noise state with the help of thresholding method.

III. Discrete Wavelet Transform

The Wavelet Series is just a sampled version of CWT and its computation may consume significant amount of time and resources, depending on the resolution required. The Discrete Wavelet Transform (DWT), which is based on sub-band coding, is found to yield a fast computation of Wavelet Transform. It is easy to implement and reduces the computation time and resources required.

The foundations of DWT go back to 1976 when techniques to decompose discrete time signals were devised. Similar work was done in speech signal coding which was named as sub-band coding. In 1983, a technique similar to sub-band coding was developed which was named pyramidal coding. Later many improvements were made to these coding schemes, which resulted in efficient multi-resolution analysis schemes.

In CWT, the signals are analyzed using a set of basic functions, which relate to each other by simple scaling and translation. In the case of DWT, a time-scale representation of the digital signal is obtained using digital filtering techniques. The signal to be analyzed is passed through filters with different cutoff frequencies at different scales.

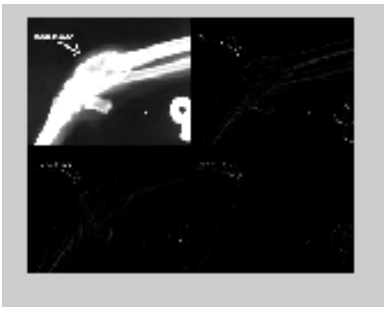


Fig10 :1D DWT

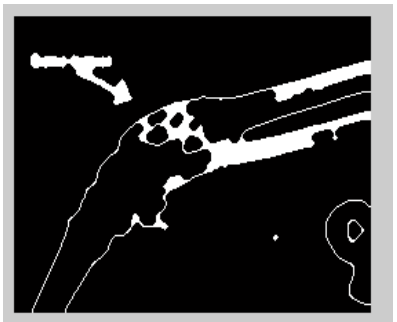


Fig11:2D DWT

IV. Conclusions

This paper proposed a simple and easy method to detect the bone cancer by edge detection .Edge detection is a set of connected pixels that lies on the boundary between the two regions. By using the discrete wavelet transform the noise is compressed and the image have enhanced.

References

[1] *Changtao He, Guiqun Cao, Fangnian Lang, "An Efficient Fusion Approach for Multispectral and Panchromatic MedicaI maging",Biomedical Engineering Research, March. 2013, Vol. 2 Iss. 1,.*

[2] *MA,Jing, BI,Qiang, "Processing practise of remote sensing image based on spatial modeler"" The National Natural Science Foundation of China (No. 41071237) IEEE 2012*

[3] *V. N. Prudhvi Raj and T. Venkateswarlu, Editors, "Denoising of Medical Images Using Total Variational Method", Signal & Image Processing: An International Journal (SIPIJ), vol. 3, no. 2,* ***(2012).*** *[4] Zohair Al-Ameen, Ghazali Sulong and Md. Gapar Md. Johar " Enhancing the Contrast of CT Medical Images by Employing a Novel Image Size Dependent Normalization Technique" International Journal of Bio-Science and Bio-Technology Vol. 4, No. 3, September, 2012*

[5] *T. Tan, K. Sim and A. Chong, Editors, "Contrast Enhancement of CT Brain Images for Detection of Ischemic Stroke", International Conference on Biomedical Engineering (ICoBE),* ***(2012)*** *February 27 – 28; Penang, Malaysia, pp. 385 – 388.*

[6] *Disha Sharma, Gagandeep Jindal "Identifying Lung Cancer Using Image Processing Techniques" International Conference on Computational Techniques and Artificial Intelligence (ICCTAI'2011)*

[7] *H. S. Bhadauria, M. L. Dewal and R. S. Anand, Editors, "Comparative Analysis of Curvelet based techniques for denoising of Computed Tomography Images", IEEE International Conference on Devices and Communications (ICDeCom),* ***(2011)*** *February 24 – 25; Mesra, Malaysia, pp. 1 – 5.*

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