ISSN: 2278 – 7798
International Journal of Science, Engineering and Technology Research (IJSETR)
Volume 2, Issue 11, November 2013

Mathematical function development for abnormalities of bones using spectral images

1. SangeetaBhalavi, 2.Professor M.P. Parsai

Abstract- This paper discusses the quantitative measure for the various types of carcinogenic abnormalities in specific part of the body. In this paper we have developed the mathematical function of MRI images Normal and Abnormal human bones. The Abnormalities have been discussed in frequency domain. There is a crystal clear demarcation in abnormal area in histogram of normalMagnetic Resonance Imaging(MRI) image and its Fourier transform image of Stem graph. These Mathematical functions can lead to quantitative method forevaluating and hence providing Therapy.

Key words-Carcinogen, Fourier Transform, Frequency domain, Human bones, Magnetic resonance imaging,

Introduction

MRI is short form of Magnetic resonance imaging is based on the absorption and emission of energy in radio frequency range of the electromagnetic spectrum .Magnetic resonance imaging (MRI) is a test that uses a magnetic field and pulses of radio wave energy to make pictures of organs and structures inside the body. In many cases MRI gives different information about structures in the body than can be seen with an X-ray, ultrasound, or computed tomography (CT) scan. MRI also may show problems that cannot be seen with other imaging methods. MRI is done for many reasons. It is used to find problems such as Bone carcinogen, tumors, bleeding, injury, blood vessel diseases, or infection. MRI also may be done to provide more information about a problem seen on an X-ray, ultrasound scan, or CT scan.

For an MRI test, the area of the body being studied is placed inside a special machine that contains a strong magnet. Pictures from an MRI scan are digital images that can be saved and stored on a computer for more study. The images also can be reviewed remotely, such as in a clinic or an operating room. The role of computed tomography (CT) and magnetic resonance imaging (MRI) in the evaluation of renal abnormalities is ever increasing.

.Most MRI machines look like a long tube, with a large magnet present in the circular area. When beginning the process of taking an MRI, the patient is laid down on a table. Then depending on where the MRI needs to be taken, slides a coil to the specific area being imaged. The coil is the part of the machine that receives the MR signal. A strong magnetic field is created by passing an electric current through the wire loops. While this is happening, other coils in the magnet send and receive radio waves. This triggers protons in the body to align them. Once aligned, radio waves are absorbed by the protons, which stimulate spinning. Energy is released after "exciting" the molecules, which in turn emits energy signals that are picked up by the coil. This information is then sent to a computer which processes all the signals and generates it into an image. The final image is a 3-D image representation of the area being examined.

Imaging plays an integral role in intracranial bone tumour management. Magnetic resonance (MR) imaging in particular has emerged as the imaging modality most frequently used to evaluate intracranial bone tumours, and it continues to have an ever-expanding, multifaceted role. In general, the role of MR imaging in the workup of intra axial tumours can be broadly divided into tumour diagnosis and classification, treatment planning, and post treatment surveillance.

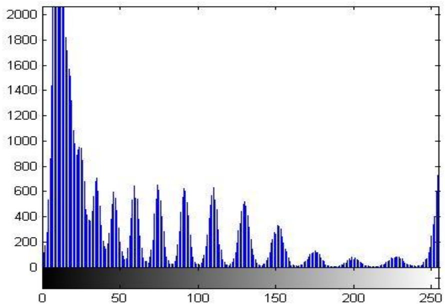
Experimental Work

To perform the result in Frequency domain first we have taken the MRI condition. This is shown in below fig.1 (a) and fig.1(d). Then using mat lab (metrics Laboratory) codding has done histogram of Normal and Abnormal MRI Images which is shown in fig.1 (b) and (e) as well as stem graph shown in fig. (c) And (f).which is very useful to analyse the various types of disease in human bones.

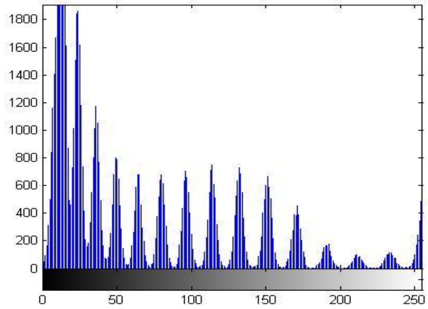
ISSN: 2278 – 7798
International Journal of Science, Engineering and Technology Research (IJSETR)
Volume 2, Issue 11, November 2013

Normal Image (a)

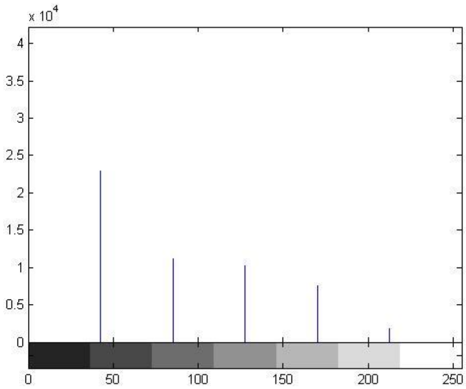
Abnormal Image(e)



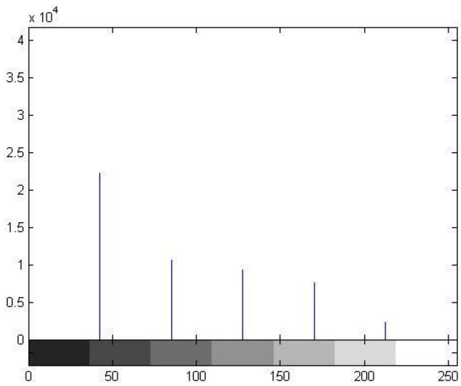
histogram graph of normal image(b)



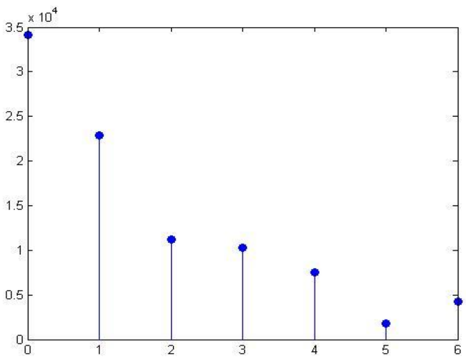
Abnormal image histogram(f)



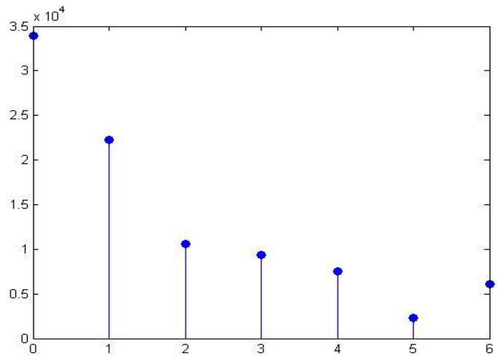
Normal Image Histogram(c)



Abnormal Image Histogram(g)



Normal Image Stemgraph(d)



Abnormal Image Stemgraph(h)

ISSN: 2278 – 7798
International Journal of Science, Engineering and Technology Research (IJSETR)
Volume 2, Issue 11, November 2013

Fig.1-MRI Images of human bones in Normal and Abnormal Condition and their Histogram and Stem graph.

Development of Mathematical Algorithm

To development of the mathematical algorithm for Normal and Abnormal Stem graph As shown in above fig.1(d) and (h). We used Discrete Time Fourier Transform or simply, Fourier Transform of a discrete time sequence x (n) which is represented by the complex exponential sequence [$e^{-j\omega n}$] where ω is the real frequency variable.

This transform is useful to map the time domain sequence into a continuous function of a frequency variable. If the sequence to be represented is of finite duration, i.e. has only a finite number of non- zero values the transform used is discrete Fourier transform (DFT). [3]

Definition- Let x (n) be a finite duration sequence the N point DFT of the sequence x (n) is expressed by-

X (K) = $\sum_{n=0}^{N-1}$ x(n)$e^{-j2\pi nK/N}$…. Eq.No. (1)

Where K = 0, 1, 2……………N-1

Using above DFT Eq.No.1 we have converted time domain sequence into frequency domain variables. For that we have taken stem graph of normal and abnormal images which is shown in above fig1.(c) and fig1.(f)

Discrete time sequence of Normal Image stem graphx(n)=[3.4 2.28 1.12 1.028 0.7533 0.17750.4288]*10^4

Discrete time sequence of Abnormal Image stem graph x(n) =[3.392 2.22 1.061 .9317 .7563 .2324 .6067]*10^4

By using Eq. No. (1) We convert the stem graph discrete time finite sequence values of normal image into corresponding Magnitude and Phase.

For K = 0, 1, 2, 3, 4, 5, 6 …N-1,

N = 7,

X (0) = $\sum_{n=0}^{6}$ x(n)$e^{-j2\pi n*0/7}$= 9.18+0.00i

X (1) = $\sum_{n=0}^{6}$ x(n)$e^{-j2\pi n*1/7}$ = 3.19 - 2.48i

X (2) = $\sum_{n=0}^{6}$ x(n)$e^{-j2\pi n*2/7}$ = 2.73- 1.18i

X (3) = $\sum_{n=0}^{6}$ x(n)$e^{-j2\pi n*3/7}$ = 1.37 - 0.33i

X (4) = $\sum_{n=0}^{6}$ x(n)$e^{-j2\pi n*4/7}$ = 1.37 + 0.33i

X (5) = $\sum_{n=0}^{6}$ x(n)$e^{-j2\pi n*5/7}$ = 2.73+ 1.18i

X (6) = $\sum_{n=0}^{6}$ x(n)$e^{-j2\pi n*6/7}$ = 3.19 + 2.48i

Corresponding Amplitude of above complex numbers are = { 9.188 4.04 2.98 1.412 1.412 2.98 4.04 }*10^4

Corresponding Phase of above complex numbers are = {0 -37.88 -23.32 -13.65 13.65 23.32 37.88}

Similarly, Using Eq. No. (1) We convert the stem graph discrete time finite sequence values of Abnormal image into corresponding Magnitude and Phase.

For K = 0, 1, 2, 3, 4, 5, 6 …N-1,

N = 7,

X (0) = $\sum_{n=0}^{6}$ x(n)$e^{-j2\pi n*0/7}$ = 9.2001 +0.00i

X (1) = $\sum_{n=0}^{6}$ x(n)$e^{-j2\pi n*1/7}$ = 3.3458 - 2.1453i

X (2) = $\sum_{n=0}^{6}$ x(n)$e^{-j2\pi n*2/7}$ = 2.6501 - 1.0762

X (3) = $\sum_{n=0}^{6}$ x(n)$e^{-j2\pi n*3/7}$ = 1.2760 - 0.2232i

X (4) = $\sum_{n=0}^{6}$ x(n)$e^{-j2\pi n*4/7}$ = 1.2760 + 0.2232i

X (5) = $\sum_{n=0}^{6}$ x(n)$e^{-j2\pi n*5/7}$ = 2.6501 + 1.0762i

X (6) = $\sum_{n=0}^{6}$ x(n)$e^{-j2\pi n*6/7}$ = 3.3458 + 2.1453

Corresponding Amplitude of above complex numbers are = {9.20 3.97 2.86 1.29 1.29 2.86 3.96 }*10^4

Corresponding Phase of above complex numbers are = {0 -32.96 -22.09 -9.95 9.95 22.09 32.96 }

Results

In this paper we have convert the stem graph of normal bones and abnormal bones into a mathematical value by Fast Fourier transform. There is difference in Amplitude and phase of normal bones and abnormal bones. This difference in Amplitude and phase shows the magnitude of disease. With the help of this numerical value Physician can choose optimal treatment modality until the abnormal value exactly equals the normal value. Due to this the side effect of medicine can be overcome.

Discussion

The important thing is to be able to interpret accurately test for a patient. The main advantages of this paper we know the mathematical formulation of disease so that the side effect due to the overdose of medicine can be avoided because of We know the exact treatment of any disease.

Reference

1. Rafeal C Gonzalez, Richard E. Woods, SteevenL.Eddins "Digital Image Processing Using Matlab" Second Edition 2009.

2. A. P. Guimaraes, I. S. Oliveira," Magnetism and Magnetic Resonance in Solids" John Willey & sons, INC. NewYork.

3. S. Salivahanan, A. vallavaraj, C. Gnanapriya "Digital Signal Processing" Tata McGraw-Hill Publishing Company Limited.

4. M. A. Bernstein, F. K. King, and p. X J Zhou, Handbook of "MRI pulse sequences" Burlington, MA: Elsevier Academic Press, 2004

5. E. M. Haacke, R. W. Brown, M. R. Thompson, and R. Venkatesan, "Magnetic Resonance Imaging: Physical Principles and Sequence Design", 1st ed. New York: Wiley-Liss, 1999.

6. Bergin C, Glover G, Pauly J. Lung parenchyma: magnetic susceptibility in MR imaging. Radiology 1991; 180: 845-8.

7.Model-based Auto-Segmentation of Knee Bones and Cartilage in MRI DataHeikoSeim, Dagmar Kainmueller, Hans Lamecker, Matthias Bindernagel, Jana Malinowski, and Stefan Zachow

FirstAuthorSangeetaBhalavi, M.E. Communication Engineering Student of Department of Electronics & Telecommunication Engineering Jabalpur, M.P. , India,

Second Author Professor M.P. Parsai, Department of Electronics & Telecommunication Engineering Jabalpur Engineering College Jabalpur, M.P. ,India