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MATHEMATICAL FUNCTION DEVELOPMENT FOR ABNORMALITIES OF KIDNEY USING SPECTRAL IMAGES

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ABSTRACT: This paper discusses the quantitative measure the various types of carcinogenic abnormalities in specific part of body.in this paper we have developed the mathematical function of MRI images normal and abnormal human kidney. The Abnormalities have been discussed in Frequency domain. There is a crystal clear demarcation in abnormal area in stem graph of normal MRI image and its Fourier transform image of stem graph. These Mathematical functions can lead to quantitative method for evaluating and hence providing therapy.

Keywords: Carcinogen, Discrete Fourier Transform, Frequency domain, Human kidney, Magnetic resonance imaging, Stem graph, Histogram graph

I.INTRODUCTION

Magnetic resonance imaging (MRI) 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.[6]

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.[2] 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. [6]

The MRI machine is a large cylindrical tube machine that creates a strong magnetic field around the patient. The magnetic field along with radio frequency after's the hydrogen atoms natural alignment in the body. Computer is then used to form 2D dimensional image of a body structure of organ based on the activity of the hydrogen atoms. MRI does not use the radiation, as X-RAYS or Computer tomography (CT scan). [3] A magnetic field creates and pulse of radio waves is sent to scanner. The radio wave knocks the nuclei of the atoms in your body out of their normal position. As the nuclei realign into the proper position, they send to the radio signals.[1] These signals are received by a computer that analyzes and convert them into an image of the part of the body being examined. The image appears on a viewing monitor. Magnetic resonance imaging (MRI) is done for many reasons.[4] It is used to find problems such as kidney 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. Contrast material may be used during MRI (Magnetic resonance images) to show abnormal tissue more clearly. An MRI scan can be done for the **Abdomen and pelvis.** MRI can find problems in the organs and structures in the belly, such as the Liver, Pancreas, **Kidneys**, and Bladder. It is used to find kidney tumors, carcinogen, bleeding, infection, and blockage. [7]

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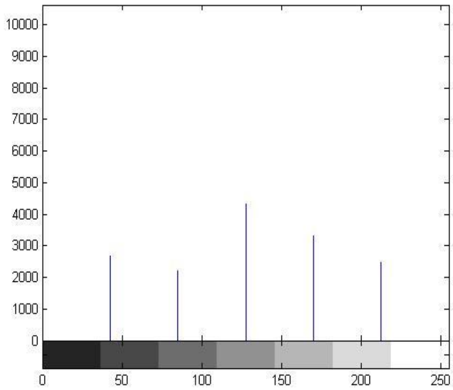
II.EXPERIMENT WORK

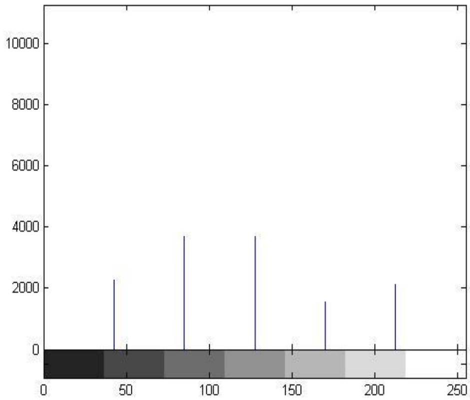
In this experiment we take MRI images of normal kidneys and abnormal kidneys. And take a histogram graph and stem graph of image using Mat lab Programming and analysis the graph for various diseases.To perform the result in Frequency domain first we have taken the MRI Imagesof human kidney in Normal and abnormal condition. This is shown in below fig.1 (a) and fig.1 (b). Then using mat lab (metrics Laboratory) codding has done histogram of Normal and Abnormal MRI Images which is shown in fig.1 (c) and (d) as well as stem graph shown in fig. (e) And (f).which is very useful to analyse the various types of diseases in human kidney.

(a)Normal kidney image

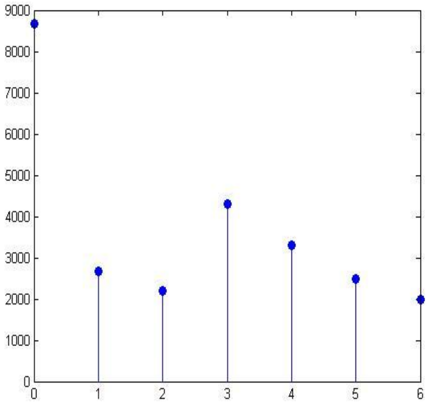
(b) abnormal kidney image



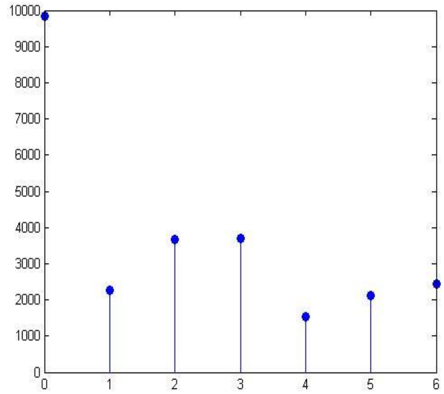
(c)Histogram of normal kidney



(d) Histogram of Abnormal kidney



(e)Stem graph of normal kidney



(f) Stem graph of abnormal kidney

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In above figure shows (a) Normal kidney image (b) Abnormal kidney image (c) Histogram of normal kidney image (d) Histogram of abnormal kidney image (e) Stem graph of normal kidney image (f)Stem graph of abnormal kidney image .

III.DEVELOPMENT of MATHEMATICAL ALGORITHM

In this we convert the stem graph into a mathematical function by using the Fast Fourier Transform (FFT) with the help of mat lab program. First convert the normal kidney and abnormal kidney image of stem graph of FFT or Discrete Fourier Transform (DFT) and its value corresponding FFT obtain by the Mat lab.

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

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

Where K = 0, 1, 2……………N-1

Using above DFT equation we have converted time domain sequence into frequency domain of MRI normal and abnormal images of human kidney. For that we have taken stem graph of normal and abnormal images which is show in fig1. (e) and (f) .

Using above DFT equation we have converted time domain sequence into frequency domain of MRI normal and abnormal images of human kidney. For that we have taken stem graph of normal and abnormal images which is show in fig1. (e) and (f) .

Discrete time sequence of Normal Image stem graph x (n) = [0.865, 0.265, 0.219,0 .430, 0.330, 0.247, 0.199]*10^4

Discrete time sequence of Abnormal Image stem graph x (n) = [0.984, 0.227, 0.367, 0.369, 0.154, 0.211, 0.245]*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 value as-

For K = 0, 1, 2, 3, 4, 5, 6 …N-1,

N = 7,

$X(0) = \sum_{n=0}^{6} x(n)e^{-j2\pi n*0/7}$ = 2.550

$X(1) = \sum_{n=0}^{6} x(n)e^{-j2\pi n*1/7}$ = 0.3659-0.0677i

$X(2) = \sum_{n=0}^{6} x(n)e^{-j2\pi n*2/7}$ = 0.8158+0.0017i

$X(3) = \sum_{n=0}^{6} x(n)e^{-j2\pi n*3/7}$ = 0.5684-0.1480i

$X(4) = \sum_{n=0}^{6} x(n)e^{-j2\pi n*4/7}$ = 0.5684+0.1480i

$X(5) = \sum_{n=0}^{6} x(n)e^{-j2\pi n*5/7}$ = 0.8158-0.0017i

$X(6) = \sum_{n=0}^{6} x(n)e^{-j2\pi n*6/7}$ = o.3659+0.0677i

- The corresponding of normal kidney of amplitude value is given by

|x (k)| = {2.555, 0.372, 0.815, 0.586, 0.586, 0.815, 0.372} *10^4----------------eq.(2)

- The corresponding of normal kidney of phase value is given by

{0, -10.401, 0.070, -14.604, 14.604, -0.070, 10.401} -----------------eq.(3)

Similarly using Eq. No.1 we convert the stem graph discrete time finite sequence values of Abnormal image into corresponding Magnitude and Phase value as -

For K = 0, 1, 2, 3, 4, 5, 6 …N-1,

N = 7,

$X(0) = \sum_{n=0}^{6} x(n)e^{-j2\pi n*0/7}$ = 2.5570

$X(1) = \sum_{n=0}^{6} x(n)e^{-j2\pi n*1/7}$ = 0.6785-0.2313i

$X(2) = \sum_{n=0}^{6} x(n)e^{-j2\pi n*2/7}$ = 0.6843+0.2533i

$X(3) = \sum_{n=0}^{6} x(n)e^{-j2\pi n*3/7}$ = 0.827-0.0798i

$X(4) = \sum_{n=0}^{6} x(n)e^{-j2\pi n*4/7}$ = 0.8027+0.0798i

$X(5) = \sum_{n=0}^{6} x(n)e^{-j2\pi n*5/7}$ = 0.6843-0.2533i

$X(6) = \sum_{n=0}^{6} x(n)e^{-j2\pi n*6/7}$ = 0.6785+0.2313i

- The corresponding of abnormal kidney of amplitude value is given by

|x (k)| = {2.557, 0.716, 0.729, 0.805, 0.805, 0.729, .716}*104 -----------------eq.(4)

- The corresponding of abnormal kidney of phase value is given by

{0, -18.814, 20.298, -5.625, 5.625, -20.29, 18.814} -------------------eq.(5)

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IV.RESULT

In this paper, the normal kidney and abnormal kidney images stem graph is convert to the mathematical function by Fast Fourier Transform (FFT). There are shown in equation (2) and equation(4) are the many difference in the normal and abnormal kidney of the amplitude value and same condition in equation (3) and equation (5) are the major difference in the normal and abnormal kidney of the phase value . This difference in value shows the magnitude of disease. With the help of this numerical value Physician and Surgeon choosing optimal treatment modality until the abnormal value exact equals the normal. Using these mathematical results the Physician can be overcome the abnormality level by regular therapy and proper medicine to the patient. Due to this side effect of medicine can be overcome.

V. DISCUSSION

To comparison of above results which are shown for normal and abnormal images can find out the abnormality level of humankidney.The main advantage of this paper, if we know that the mathematical value of disease so the exact treatment of any diseases. If we know that the mathematical value on normal kidney and abnormal kidney, this mathematical results help of the Physician and Surgeon are used to the exact treatment of any diseases. This method is used to easily treatment of any disease such as carcinogen, tumour, infection and blockage. Using this mathematical value is very useful for Physician and Surgeon to overcome the abnormality level by regular therapy and proper medicine to the patient.

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