A LabVIEW Approach of Detecting Area of Tumor in a Brain

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Abstract: The Magnetic Resonance Imaging (MRI), and Computed Tomography (CT) scan plays an important role in Brain Tumor detection. The tumor means abnormal cells growth in a human body. In this paper, comparison of abnormal brain with normal brain is done and exact position and area of the tumor using NI LABVIEW software was found out. This technique is carried out in two steps: i) First acquire gray scale image from MRI and CT scan images[1] and then comparing the tumor images using IMAQ tools ii) Applying edge detection, FFT filter techniques and measurement technique to find out exact location and area of the brain tumor. The edge detection technique is based on drastic changes in intensities of brain and tumor region. Fast Fourier Transform is used here to study the tumor region of MRI Brain Image in terms of its pixel intensity as it helps in removing the frequency components of edge detected MRI scan image. Not only for the brain tumor, this techniques can also be used for the analysis of clots in the brain.

Keywords: IMAQ, Sub annulus to ROI, Circular fitting, IMAQ RESAMPLE, MRI scan, CT scan, Edge detection, FFT Filter

1. INTRODUCTION

It is very important to detect and classify tumors in a brain in early stage of its growth. The abnormal cells growth in the tissues of the brain are tumors. There are various techniques available for identifying the tumors in brain based on different sources of information. Some inventions such as X-rays, Ultrasound, Radioactivity, Magnetic resonance imaging (MRI) or computed tomography (CT) are very helpful for mankind in this present era. MRI is very good for showing disorders of the brain such as: stroke, hemorrhage, tumor, multiple sclerosis or lesions. The MRI image shows complex characteristics, thus it is indeed necessary to perform the image enhancement and segmentation process on the images. Medical image segmentation [2] had visualized various problems for the proper diagnosis of brain disorders. The Digital Image Processing has provided the means to overcome these limitations in the analysis.

2. PROPOSED WORK

In this paper, image from MRI scan or CT scan has been considered. We will compare two images, one is normal brain image and other is tumor affected brain image. Tumor affected brain image has more brightness in a particular area than normal one. The area of the tumor in the image can be measured with the help of LabVIEW software by makes use of NI Vision Assistant Tools. For compared image, we will apply edge detection, filters and find out the exact area of the tumor.

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3. IMPLEMENTATION & VISION ASSISTANT TOOLS IN LABVIEW

- Algorithm for identification of tumor: MRI and CT scan images are pre-processed for removal of different noises by non-linear filters.

- The following steps are followed for identifying and detecting the tumor:

i) Read, load and compare both the normal brain MRI scan Image and tumor affected brain images.

ii) Develop a Histogram and from it, calculate mean, standard deviation of the affected part in an image.

iii) For compared image, apply edge detection. Use FFT filters to attenuate frequency components of an image. The result is then converted back to the time domain using the IMAQ Inverse FFT function.

iv) Select ROI using select annulus tool that displays in separate window and Apply circle fitting tool where area is fitted in a circle on the image.
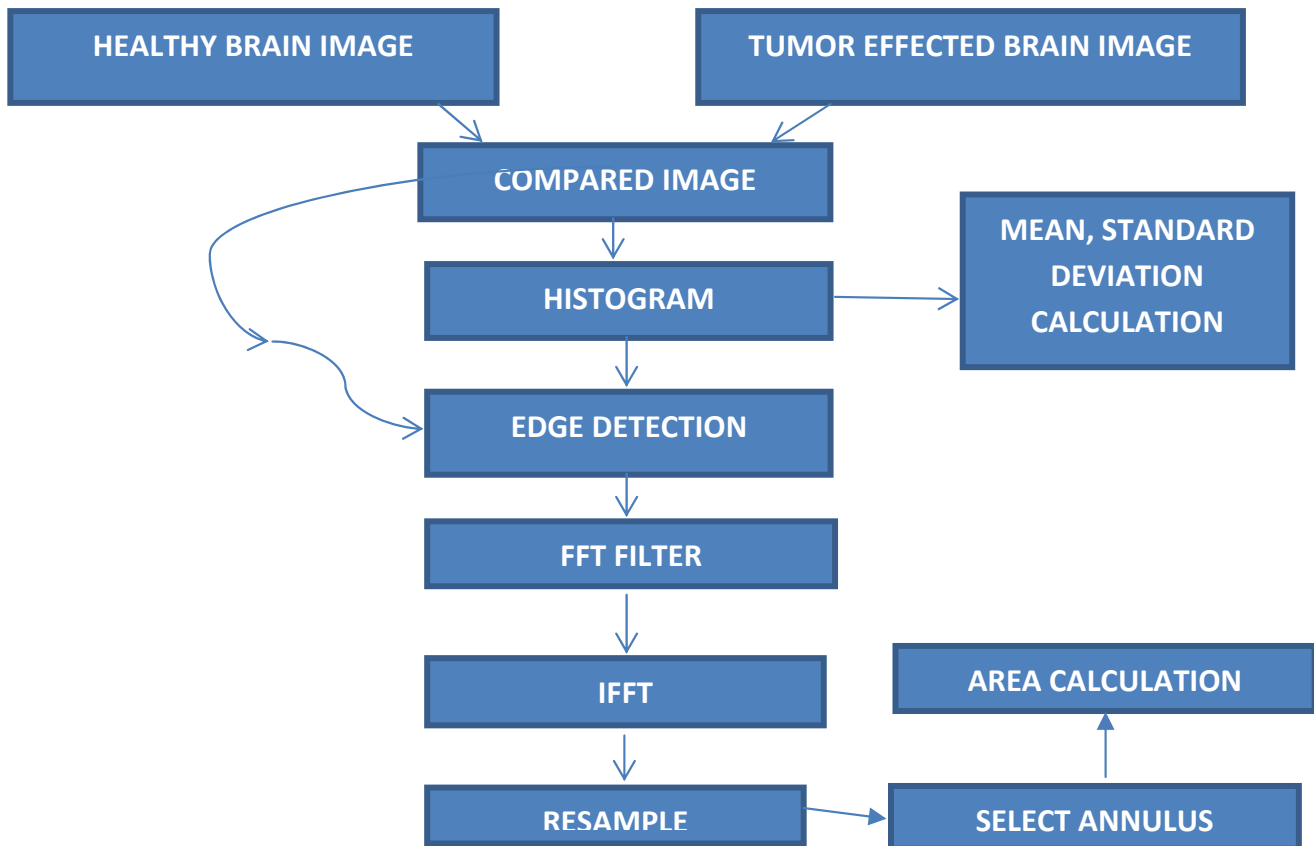
v) Measure the area of the tumor

Figue 1: Flowchart

(a) Histogram

Image consists of different regions of a certain gray level value, those gray level values can be found out with the help of histogram. It is a plot between number of pixel and pixel intensity. In this paper, histogram of the comparison output of two images (with and without tumor images of a brain) is taken. Using histogram graph, we can measure mean, standard deviation. The mean and standard deviation will give the measure of the tumor in a sample image.
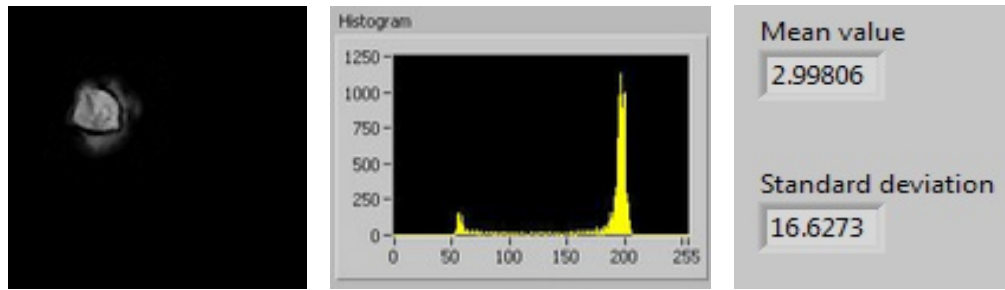
Figure 2: Histogram

(b) Edge Detection

For any image the magnitude of the gradient gives the measure of edge. The brightness of the image changes by identifying points in a digital image with the help of set of mathematical techniques. This points where brightness changes are organized into set of curved line segments known as Edges. The edges extracted from a two-dimensional image of a three-dimensional image. We apply Roberts filter for edge detection, this can be also done using other filters such as laplacian, differential filters but Roberts filter is preferable as it has less noise. The Roberts filter performs a simple, fast to compute, 2-D spatial gradient measurement . Pixel values at each point represent the estimated absolute magnitude of the spatial gradient of the input image at that point.

Figure 3: Kernels

As shown in the Fig 3, the filter consists of a two 2×2 convolution kernels. Gx and Gy are identical if they are rotated by 90^0 same as sobel operator.

Gx and Gy are made such that they respond maximally to edges running at 45° to the pixel grid, one kernel for each of the two perpendicular orientations. These kernels are applied separately to the input image, to produce gradient component in each orientation .These can then be combined together to find the absolute magnitude. The gradient magnitude is given by:

$$|G| = |Gx| + Gy|$$

(c) FFT Filter

After edge detection, the compared image is given as input to FFT filters to attenuate frequency components of an image. The result is then converted back to the time domain using the IMAQ Inverse FFT function. FFT filter gives efficient output by smoothing the edges of the images.
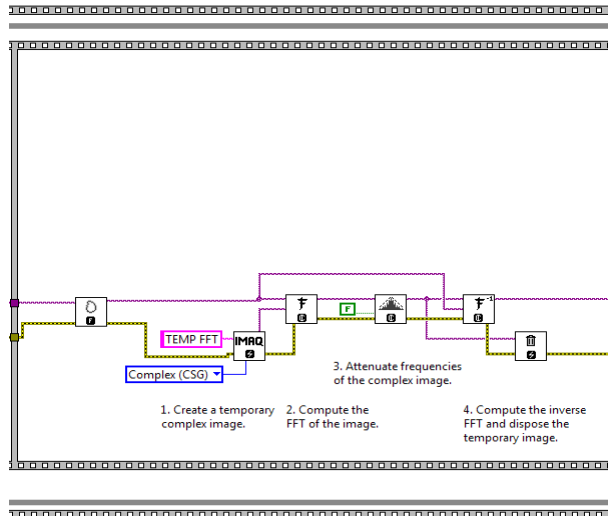
Figure 4: LabVIEW implementation of FFT filter

(d) IMAQ Select Annulus

This is VI tool which allows the user to specify an annulus area in an image.
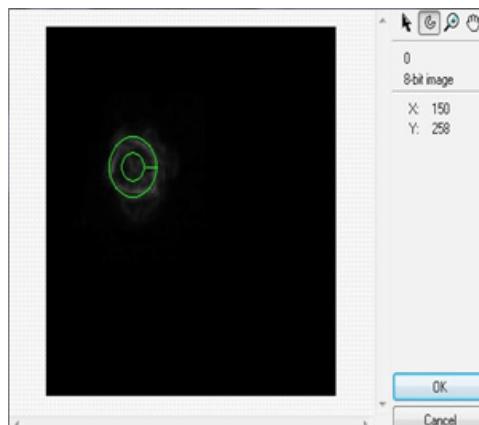

Figure 5: Selection of inner and outer radius

(e) Circle Fitting

The use of fitting circles or circular arcs are to observe points arised in many areas. In medical field, one estimates the diameter of a human brain on a photograph or designs a dental arch from an X-ray. On Appling circle fitting tool with external ROI in a circle region, It locates a circular edge in a search area based on the average intensity pixel value in given ROI and fitted a circle on the image.

Figure 6: Circle fitting

(f) Measurement-Pixel to MM Conversion

By using this measurement technique we can find out length and area of the tumor.

Millimeter (mm) = (Pixel×25.4)/dpi

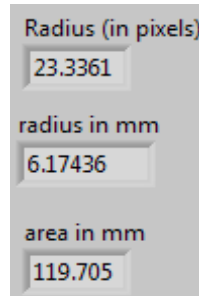1 millimeter (mm) = 3.77952755 pixel(Y)

Figure 7: Display of area of tumor
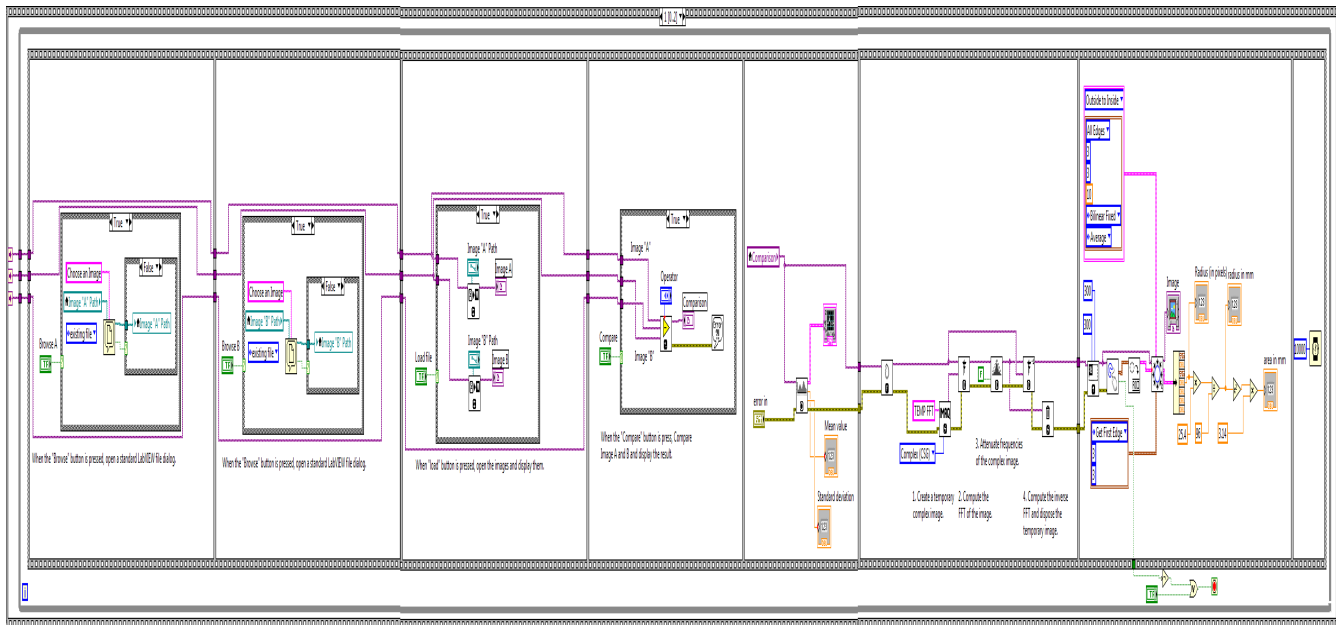
4. SIMULATION RESULTS

Figure 8: LabVIEW Block diagram of compared images

Steps for obtaining an output:

- After the program is run, we need to give paths for the two images for that press the browse.
- After the browsing is done press load the images are loaded.
- After loading press compare. The compared image is given, for the compared image output we apply annulus i.e. for the selection of area, here we used circle fit for area selection. The annulus selection is shown in Fig 9
- After the selection of annulus the preferred area is given, it is first give in number of pixels which is converted in to millimeters, using mathematical parameters. The final output is shown in Fig 10.
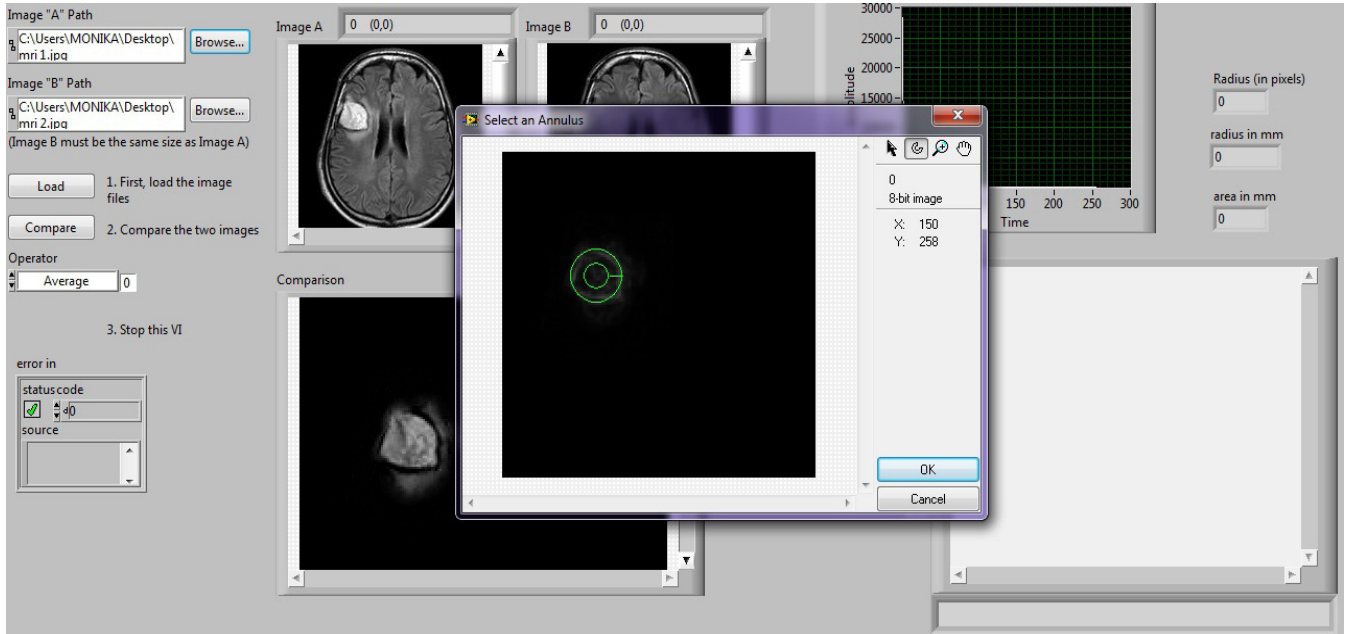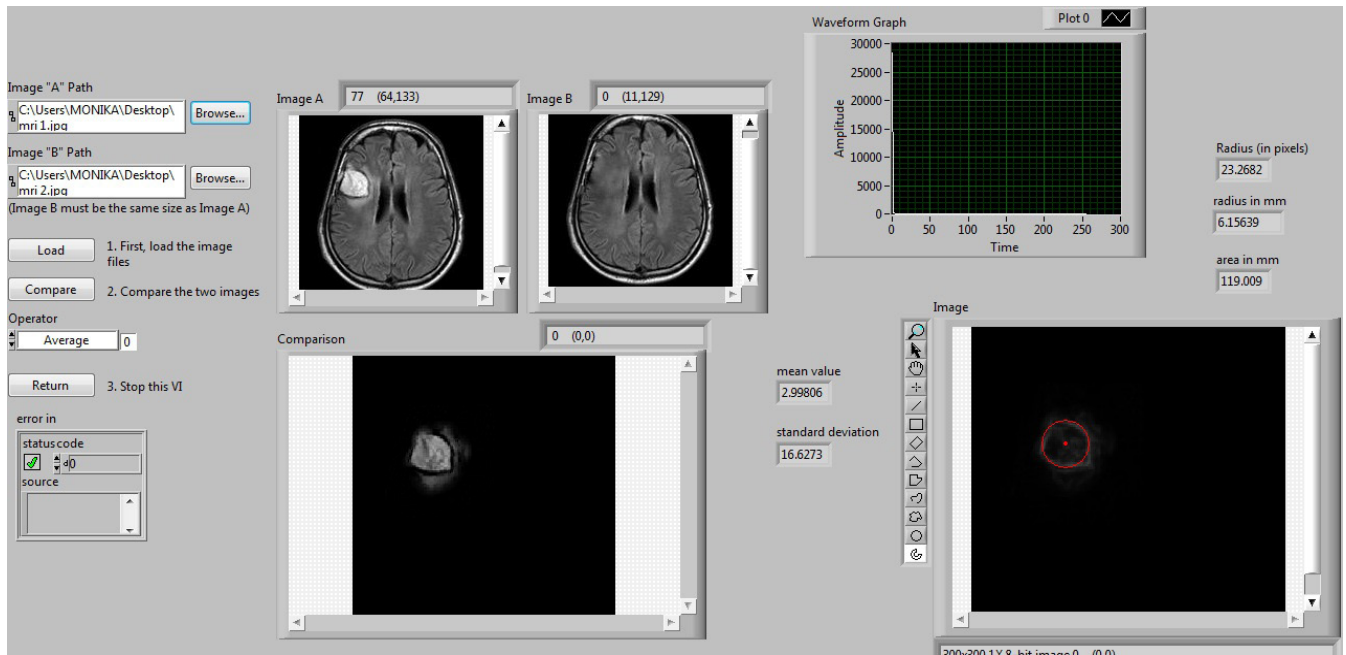
Figure 9 : selection of annulus

Figure 10 : LabVIEW Front panel of result of comparison of two images, its area, mean, standard deviation.

5.   CONCLUSION

Image processing tools in LabVIEW are used to extract tumor region of MRI image and CT scan brain images. FFT is used to study the nature of tumor region and its identification. Boundary layers between the tumor cells and ordinary cells are differentiated using pixel intensity values. In this paper we proposed a parameter Area, of the tumor on MRI scan images and CT scan images. This is a better technique for measuring exact position of tumor.

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