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Brain Tumor Detection using VLSI

Monika G.B,
Muthyammal Engineering College,
M.E (VLSI DESIGN),
monisid63@gmail.com

Prof.T.Kowsalya, M.E (Ph.D),HOD,
Muthayammal Engineering College,
Department of ECE,
kowsalyadoss@yahoo.com

Abstract-- Magnetic Resonance Imaging is a technique used in hospitals to scan patients and determine the severity of certain injuries. It produces high quality images of the human body part. Tumors in various parts of the body are also scanned using MRI. Tumors are nothing but the abnormal growth of tissues or cells. Since, brain tumor is an abnormal cell formation within the brain which leads to brain cancer. Thus, it is very important to detect and extract brain tumor in early stage. The most important process in brain tumor detection and extraction from an MRI image is the image segmentation. Segmenting of an image means dividing the image into different region and extracting the interested target. For this implementation the algorithm is FIR algorithm and the software used is Modelsim.

Keywords-- MRI, Modelsim, FIR filter,Carry save adder,Wallace multiplier.

1 INTRODUCTION

MEDICAL IMAGE PROCESSING

Imaging technology in medicine made the doctors to see the interior parts of the body for easy diagnosis. It also helped the doctors to make keyhole surgeries for reaching the interior parts of the body. CTscanner, Ultrasound and Magnetic Resonance Imaging took over x-ray imaging by making the doctors to look at the body's elusive third dimension view. With the CT scanner, body's
interior partsand the diseased areas can be identified without causing discomfort or pain to the patient. MRI picks up signals from the body's magnetic particles spinning to its magnetic tune and with the help of its powerful computer, converts scanned data into revealing pictures of internal organs. Image processing techniques developed to analyze remote sensing data may be modified to analyze the outputs of medical imaging systems to get more advantage to analyze symptoms of the patients.

Advantages of Image Processing in medical applications

- Data will not change when it is reproduced any number of times and retains the originality of the data.
- Displaying images immediately after acquiring.
- Enhancement of images to make them easier for the Physician to interpret.
- Providing a set of images for teaching and to demonstrate the diseases.
- Quick comparison of images.

IMAGE PROCESSING SYSTEMS FOR MEDICAL APPLICATIONS

(a) Endoscopy

In each endoscope, there are two fiber bundles. One is used to illuminate the inner structure of object. Other is used to collect the reflected light from that area. The endoscope is a tubular optical instrument to inspect or view the body cavities, which are not visible to the naked eye normally.

For a wider view and better image quality, a telescope system is added in the internal part of the endoscope. Gastrointestinal fiberoscopes and laparoscopes are important endoscopes used in hospitals for examination, treatment of diseases and surgery.

(b) Computed Tomography

Computed tomography is a method of forming images from X-rays. Measurements are taken from X-rays transmitted through the body. These contain information on the constituents of the body in the path of the X-ray beam. By using multidirectional scanning of the object, multiple data is collected. The cross-sectional image of the body is produced by measuring the total attenuation along the rows and columns of a matrix. The number of mathematical operations necessary to yield clinically applicable and accurate images is so large that a computer is essential to do them. The information obtained from these computations can be represented in a conventional raster form resulting in a two dimensional picture. The output unit then produces a transverse plane cross-section of the patient on the cathode ray tube.

These images are stored in computer for image processing.

(c) Ultrasonic Imaging System

Ultrasonography is a technique by which ultrasonic energy is used to detect the state of the internal body organs. Bursts of ultrasonic energy are transmitted from a piezo-electric or magnetostrictive transducer through the skin and into the internal anatomy. When this energy strikes an interface between two tissues of different acoustical impedance, the reflections are returned to the transducer. The transducer converts these reflections to an electric signal proportional to the depth of the interface, which is amplified and displayed on an oscilloscope. The stored digital image signals are processed and given to digital-to-analog converter. Then they are fed to the TV monitor. These signals are converted to digital form using frame grabber and can be stored in the PC/AT disk.Wherever the images lackin contrast and brightness, the image processing techniques is used to get the entire details from the ultrasound images.

(d) Magnetic Resonance Imaging (MRI)

Superconducting magnets are used in MRI systems to provide strong uniform, steady magnetic fields. The superconducting magnetic coils are cooled to liquid helium temperature and can produce very high magnetic fields. Hence the signal to noise ratio of the received signals and image quality are better than the conventional magnets used in the MRI systems. The patient is kept in the gradient field space. The transmitter and receiving RF coils surrounding the site on which the image are to be constructed. There is a superposition of a linear magnetic field gradient on to the uniform magnetic field applied to the patient.

When this superposition takes place, the resonance frequencies of the processing nuclei will depend on the positions along the direction of the magnetic field gradient. This produces a one - dimensional projection of the structure of the three dimensional object. By taking these projections at different gradient orientations using X, Y and Z gradients thetwo or three-dimensional images can be obtained. The slice of the image depends upon the gradient magnetic field. The gradient magnetic field is controlled by computer and that field can be positioned in three time invariant planes (X, Y and Z). The transmitter provides the RF signal pulses. The received nuclear magnetic resonance signal is picked up by the receiver coil and is fed into the receiver for signal processing. By two dimensional Fourier Transformation, the images are constructed by the computer and analyzed using image processing techniques.

2 LITERATURE SURVEY

[1] W. Gonzalez proposed a paper on **"Digital Image Processing"** (2008). Brain tumors are mainly result of abnormal or uncontrolled growth of cells. Primary tumors are those tumors which originate in the brain. Secondary tumors originate in some other part of the body. Finally these tumors reach to the brain through the process of metastasis. The symptoms for Brain tumors are headache, vomiting, nausea, sudden change in personality and loss of memory.

[2] S. Murugavalli, V. Rajamani, proposed a paper on **"A high speed parallel fuzzy c-mean algorithm for brain tumour segmentation"** (2006) .The tumour is defined as the abnormal growth of the tissues and multiply uncontrollably.

[3] Dr.G.Padmavathi, Mr.M.Muthukumar and Mr. Suresh Kumar Thakur, proposed a paper on **"Non linear Image segmentation using fuzzy c means clustering method with thresholding for underwater images** (2010). The image segmentation is a major step for automated object recognition systems. In many cases, image processing is affected by illumination conditions, random noise and environmental disturbances due to atmospheric pressure or temperature fluctuation.

[4] Matei Mancas, Bernard Gosselin, Benoît macq, proposed a paper on **"Segmentation Using a Region Growing Thresholding"**. The image segmentation plays a crucial role in medical imaging by facilitating the delineation of regions of interest.

[5] T .Logeswari and M.Karnan, proposed a paper on **"An improved implementation of brain tumor detection using segmentation based on soft computing"** (2010) .The Brain tumor is one of the major causes for the increase in mortality among children and adults.

[6] Wankai Deng, Wei Xiao, Chao Pan, Jianguo Liu Key **"MRI brain tumor segmentation based on improved fuzzy c-means"** method (2009). A new medical image segmentation method is proposed based on fuzzy c-means algorithm and spatial information.

3. EXISTING SYSTEM

ALGORITHM

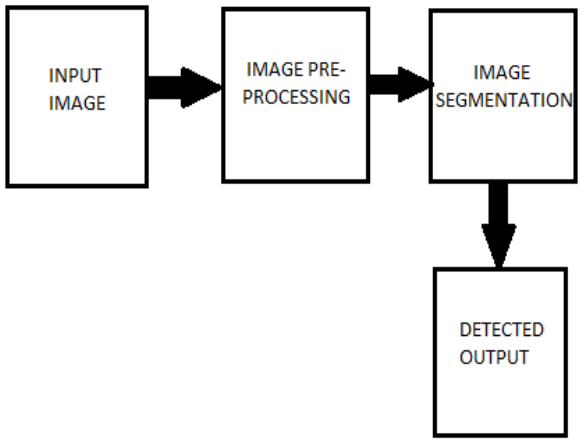
The algorithm has two stage. The first stage is pre-processing of the given MRI image. After thesegmentation process they perform morphological operations.

Steps of algorithm are as follows:-

1) MRI image of brain is given as input.
2) Convert it to a gray scale image.

3) High pass filter is used for noise removal.
4) Median filter is used to enhance thequality of image.
5) Compute threshold segmentation.
6) Compute watershed segmentation.
7) Compute morphological operation.
8) Finally output will be a tumor region.

BLOCK DIAGRAM



4. PROPOSED SYSTEM

ALGORITHM

The algorithm used here is FIR filteralgorithm.In signal processing afinite impulse response filter is a filter whose impulse response is of finite duration. It settles to zero in a finite time. This is in contrast to infinite impulse response filter, which may have internal feedback and may continue to respondindefinitely. The impulse response of an Nth-order discrete-time FIR filter lasts exactly $N + 1$ samples before it then settles to zero.

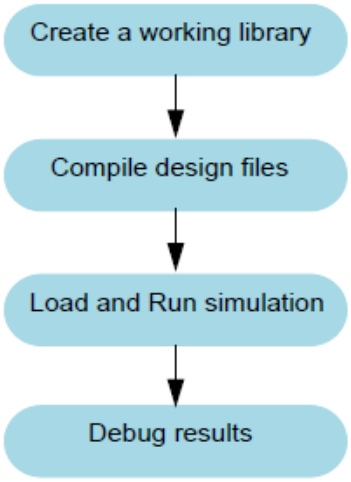
Carry save adder is very useful for adding more than two numbers at a time. Normally if there are three numbers, the method would be to add the first two numbers together and then add the result to the third one.

Wallace multiplier is an efficient hardware architecture for multiplying two integers. While comparing a normal multiplier to a Wallace multiplier, wallacemultiplier is much faster.

SOFTWARE DESCRIPTION

MODELSIM

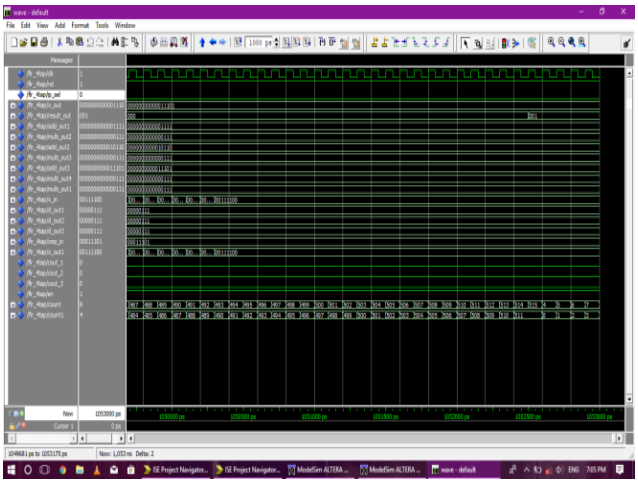
Modelsim is a hardware simulation and debug environment primarily targeted at smaller ASIC and FPGA design. Modelsim combines simulation performance and capacity with the code coverage and debugging capabilities required to simulate multiple blocks and systems and attain ASIC gate-level sign-off.Comprehensive support of Verilog, system Verilog for Design, VHDL, and systemC provide a solid foundation for single and multi-language design verification environments. Modelsim is easy to use. The unified debug and simulation environment provide today's FPGA designers the advanced capabilities make their work productive.Modelsim is a verification and simulation tool for VHDL, Verilog, System Verilog, and mixed language designs.In Modelsim, all designs are compiled into a library.Modelsim offers numerous tools for debugging and to analyze the design.



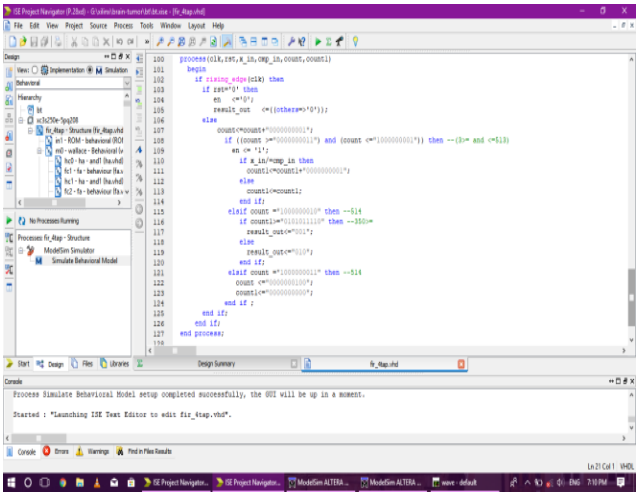
Basic simulation flow

5 RESULT AND DISCUSSION

Output obtained by comparing default brain image and brain image with tumor**.**



This is the program used for comparision process.



As tumor in MRI image have intensity more than that of its background so it become very easy to locate and extract it from a MRI image.

Future research in the medical image will strive towards improving the accuracy, precision and computational speed , as well as reducing the amount of manual interaction using Xilinx technique.

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AUTHOR PROFILE:

- *G.B Monikais currently pursuing master degree program in VLSI Design in Muthayammal Engineering College, Tamilnadu, India, PH-+91-94438-28292. E-mail:monisid63@gmail.com*
- *Prof.T.Kowsalya is the project guide working as H.O.D, Dept. of ECE, Muthayammal Engineering College, Tamilnadu, India, PH-+91-98420-60370. E-mail:kowsalyadoss@yahoo.com*