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Computer Aided Detection of Ischemic Stroke Using Verilog HDL

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Abstract

Computed tomography (CT) images are widely used in the diagnosis of ischemic stroke because of its faster acquisition and compatibility with most life support devices. In present work we proposal advance techniques to automated detection of ischemic stroke using verilog code and image feature characteristics, which separate the ischemic stroke region from healthy tissues in computed tomography images.

Keywords: Verilog HDL , Behavioural model , Computed Tomography image (CT).

Introduction

Annually, 15 million people worldwide suffer a stroke, and 5 million are left permanently disabled. A stroke is usually caused when a blood clot blocks a vessel in the brain and acts like a dam, stopping the blood reaching the regions downstream.

Alternatively, it may be caused by a hemorrhage, in which a vessel ruptures and leaks blood into surrounding areas. As a result, some of the connecting nerve cells die, and the person commonly suffers partial paralysis on one side of the body, termed hemiplegic. Cells killed in this way cannot regrow, but the brain has some spare capacity and, hence, new connections can be made. The brain is continually and rapidly changing as new skills are learned, new connections are formed, and redundant ones disappear.

- Over 20 million people across the world are hit by stroke every year and 25 per cent of them die.
- Over 1.5 million Indians suffer stroke every year and about 30 per cent of them die.
- More than 86 per cent of strokes take place in middle and low-income countries.

Stroke survivors often have a complex pattern of upper limb motor impairments, resulting in a loss of functional abilities such as reaching. The current prognosis for upper-limb recovery following a stroke is poor, with a review reporting that complete recovery occurs in less than 15% of patients with initial paralysis. Stroke is also an age-related disease, placing an increasing burden on long-term health and related resources unless improvements are made in achieving independence.

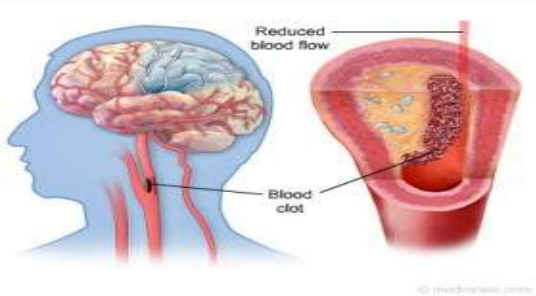

Fig: 1 Ischemic Stroke

Stroke is a form of cardiovascular disease affecting the blood supply to the brain. Also referred to as cerebrovascular disease or apoplexy, strokes actually represent a group of diseases that affect about one out of five people in the United States. In the ischemic stroke are shown in fig(1) .When physicians speak of stroke, they generally mean there has been a disturbance in brain function, often permanent, caused by either a blockage or a rupture in a vessel supplying blood to the brain. In order to function properly, nerve cells within the brain must have a continuous supply of blood, oxygen, and glucose (blood sugar).

Many surgical and endovascular techniques have been studied in the treatment of acute ischemic stroke. Carotid endarterectomy has been used with some success in the acute management of internal carotid artery occlusions, but no evidence supports its use acutely in ischemic stroke. In addition to limiting the duration of ischemia, an alternative strategy is to limit the severity of ischemic injury (i.e., neuronal protection).

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The presence of the speckle noise will cause the low contrast images where low contrast lesions and tumors can't be detected in the diagnostic phase.

Related Works

Jalal M. Fadili, and Jean-Luc 2009 (1) says that the image to restore is assumed to be sparsely represented in a dictionary of waveforms msuch as the wavelet or curvelet transforms. Our key contributions are as follows. First, we handle the Poisson noise properly by using the variance stabilizing transform leading to a nonlinear degradation equation with additive Gaussian noise. Second, the de convolution problem is formulated as the minimization of a convex functional with a data-fidelity term reflecting the noise properties, and a non smooth sparsity promoting penalty over the image representation coefficients An additional term is also included in the functional to ensure positivity of the restored image.

Fedra Hajizadeh, and Mohammadreza Ommani 2013 (3) describes about a multimodal approach for vessel segmentation of macular optical coherence tomography (OCT) slices along with the fundus image. The method is comprised of two separate stages; the first step is 2-D segmentation of blood vessels in curvelet domain, enhanced by taking advantage of vessel information in crossing OCT slices (named feedback procedure), and improved by suppressing the false positives around the optic nerve head.

Gang Tang and Jianwei Ma 2011 (4) says that Transform-based denoising methods are popular lyused in image and signal processing, including seismic data processing. However, they often suffer from unwanted artifacts, e.g., nonsmooth edges and pesudo-Gibbs phenomena. A total variation (TV) minimization techniquehas the ability to suppress these artifacts, particularly in the vicinity of discontinuities. In this letter, we employ the almost optimal sparse transform for seismic data, i.e., curvelet transform, to represent and denoise seismic cubes, combining a projected TV technique as a postprocessing method, in order to reduce unwanted nonsmooth artifacts caused by the curvelet transform.

Gary Gelfand, and John H. MacGregor 2009(14) describes Modernmultislice computed tomography (CT) scanners produce isotropicCTimageswith a thickness of 0.6 mm. These CT images offer detailed information of lung cavities, which could be used for better surgical planning of treating lung cancer. The major challenge for developing a surgical planning system is the automatic segmentation of lung lobes by identifying the lobar fissures. This paper presents a lobe segmentation algorithm that uses a two stage approach: 1) adaptive fissure sweeping to find fissure regions and 2) wavelet transform to identify the fissure locations and curvatures within these regions.

Mohammad Saleh Miri 2011(6) says that Retinal images can be used in several applications, such as ocular fundus operations as well as human recognition. Also, they play important roles in detection of some diseases in early stages, such as diabetes, which can be performed by comparison of the states of retinal blood vessels.

Thomas Flohr, and Joachim Hornegger,2008(8)describes about the projection data measured in computed tomography (CT) and, consequently, the slices reconstructed from these data are noisy. We present a new wavelet based structure-preserving method for noise reduction in CT-images that can be used in combination with different reconstruction methods. The approach is based on the assumption that data can be decomposed into information and temporally uncorrelated noise. In CT two spatially identical images can be generated by reconstructions from disjoint subsets of projections: using the latest generation dual source CT-scanners one image can be reconstructed from the projections acquired at the first, the other image from the projections acquired at the second detector.

Aleksandra Pizurica, Stefaan Vandenberghe, and Steven Staelens 2013(11)Total variation (TV) methods have been proposed to improve the image quality in count-reduced images, by reducing the variation between neighboring pixels. Although very easy to implement and fast to compute, TV-based methods may lead to a loss of texture information when applied to images with complex textures, such as high-resolution abdominal CT images. Here, we investigate the use of another regularization approach in the context of medical images based on multiresolution transformations.

V. Sanchez, 2013 (12)presents a 3-D medical image coding method featuring two major improvements to previous work on 3-D region of interest (RoI) coding for telemedicine applications. Namely, 1) a data prioritization scheme that allows coding of multiple 3-D-RoIs; and 2) a joint/source channel coding scheme that allows prioritized transmission of multiple 3-D-RoIs over wireless channels. The method, which is based on the 3-D integer wavelet transform and embedded block coding with optimized truncation with 3-D context modeling, generates scalable and error-resilient bit streams with 3-D-RoI decoding capabilities.

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Steven Enkemann, and Steven EschrichMicroarray 2009(13) technology for measuring gene expression values has created significant opportunities for advances in disease diagnosis and individualized treatment planning. However, the random noise introduced by the sample preparation, hybridization, and scanning stages of microarray processing creates significant inaccuracies in the gene expression levels, and hence presents a major barrier in realizing the anticipated advances. Literature presents several methodologies for noise reduction, which can be broadly categorized as: 1) model based approaches for estimation and removal of hybridization noise; 2) approaches using commonly available image denoising tools; and 3) approaches involving the need for control sample(s). The present work aims to provide a further contribution in this direction, by assessing clinical effects of a new robotic therapy approach targeting the distal part of the arm. The proposed robotic therapy trains the three distal degrees of freedom (DoF) separately by means of three
different protocols, each one designed in order to match specific needs.

Materials and Method

A.Subjects Summary

Field Programmable Gate Arrays are reconfigurable devices. Hardware design techniques such as parallelism and pipelining techniques can be developed on a FPGA, which is not possible in dedicated DSP designs. Implementing image processing algorithms on reconfigurable hardware minimizes the time-to-market cost. Therefore, FPGAs are an ideal choice for implementation of real time image processing algorithms.

FPGAs have traditionally been configured by hardware engineers using a Hardware Design Language (HDL). The two principal languages used are Verilog HDL (Verilog) and Very High Speed Integrated Circuits (VHSIC) HDL (VHDL) which allows designers to design at various levels of abstraction.

B.Verilog HDL

In order to implement the upcoming digital image processing algorithms and to process the amount of data captured from sources such as medical instruments, intelligent high speed real-time systems have become imperative. In this paper an efficient FPGA-based design and implementation of image processing algorithm are presented using hardware description language. The FPGA provides the necessary hardware for image processing algorithms with flexibility to support medical image processing by using point operations.

The Hardware Description Languages (HDLs) larger availability allows the designers to not only logically describe circuit functionality but to simulate and evaluate the processing performances using appropriate development and test environments. While the simulation is generating the logical results a natural step consist in extending the use of the hardware simulators into the field of signal processing.

The main advantage of using HDLs to simulate digital processing of any logical inputs is related with the possibility of an immediate FPGA based hardware implementation. Since the HDL syntax is always related to a hardware structure, the timing information of the potential hardware implementation is also available allowing specific speed optimizations. Out of that, the use of HDLs means hardware portability and on-the-fly re-programmability. The main challenge is to transpose the validated algorithms into a non-programming language as hardware description languages are. Also, the input and output data files need to be reshaped to match the binary content permitted into the hardware simulators. Interesting results are obtained in video processing as is presented in the paper.

C.Behavioural model:

In the field of neuro technology, we have made tremendous progress gathering foundational knowledge of the brain and the nervous system, and in recent years, we have begun translating this knowledge to build technology to diagnose and treat some neurological and mental diseases. The size is less than the wavelength of the ultrasound. The presence of the speckle noise will cause the low contrast images where low contrast lesions and tumors can't be detected in the diagnostic phase. So there is a strong need in developing the despeckling techniques to improve the quality of ultrasound images.

Feature Extraction Parameter

Texture is a repeating pattern of local variation s in image intensity. The co-occurrence matrix is a statistical method used for texture analysis .As the name suggests, the co-occurrence matrix is constructed from the image by estimating the pair wise statistics of pixel intensity.

The use of the co-occurrence matrix is based on the hypotheses that the same grey-level

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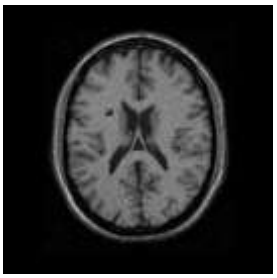
configuration is repeated in a texture. This pattern will vary more by fine textures than by coarse textures. The co-occurrence matrix P(i, j | d, h) counts the co-occurrence of pixels with grey values i and j at a given distance d and in a given direction h. According to the number of intensity points (pixels) in each combination, statistics are classified into first order , second order and higher-order statistics .The gray level concurrence matrix (GLCM) method is a way of extracting second order statistical texture features. However, the performance of a given GLCM based feature, as well as the ranking of the texture features , depend on the number of gray levels used. G is the size of the co-occurrence matrix. Here the number of rows and columns of co-occurrence matrix is equal. The following GLCM features are extracted in our research work: angular second Moment, contrast, entropy, correlation, sum of squares , difference entropy ,inverse Difference moment, inertia cluster prominence , cluster shade ,energy, homogeneity, dissimilarity and difference invariance.

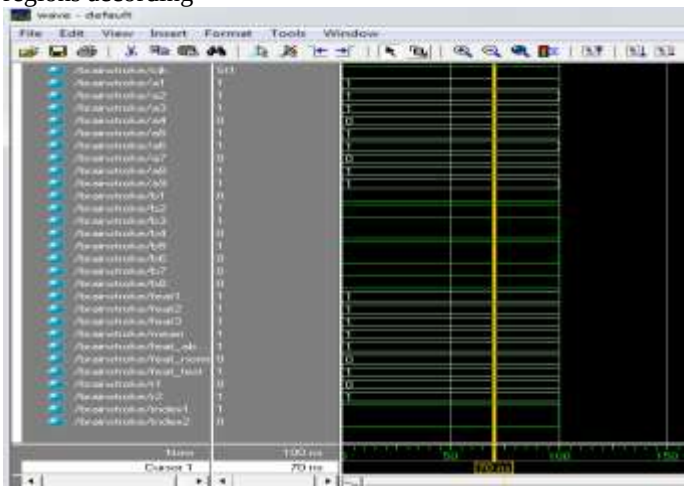


Fig(2) Image 1 (Ischemic stroke Image)

In the various type of image got from international medical library. Stroke is a serious and frequent cerebrovascular disease with an enormous socioeconomic burden worldwide. Stroke prevention includes treatment of carotid atherosclerosis, the most common underlying cause of stroke, according to a specific diagnostic algorithm. However, this diagnostic algorithm has proved insufficient for a large number of mostly asymptomatic subjects, which poses a significant research challenge of identifying novel personalized risk markers for the disease.

Simulation Results

In our ischemic stroke images get from international medical library. In image segmentation, one challenge is how to deal with the nonlinearity of real data distribution, which often makes segmentation methods need more human interactions and make unsatisfied segmentation results. Medical image segmentation plays an instrumental role in clinical diagnosis. An ideal medical image segmentation scheme should possess some preferred properties such as minimum user interaction, fast computation, and accurate and robust segmentation results. Image segmentation is an image analysis process that aims at partitioning an image into several regions according



Fig(3) Detection of normal image using VLSI

Image segmentation is a very complex task, which benefits from computer assistance, and yet no general algorithm exists. It has been a research field in computer science for more than 40 years now, and the early hope to find general algorithms that would achieve perfect segmentations independently of input data has been replaced by the active development of a wide range of very specialized techniques. Most of the existing segmentation algorithms are highly specific to a certain type of data, and some research is pursued to develop generic frameworks integrating these techniques.

These discrepancies can be partially ascribed to the many methodological differences in the studies such as duration and intensity of treatments, contribution of physiotherapy, and severity of the pathology.fig(4) Moreover, literature agrees on the need to better understand the influence of the intervention time on the effectiveness of intensive practice in stroke patients.A set of displacement vectors is computed that parameterizes the observed deformation. An iterative relaxation algorithm is employed to adapt the information extracted from the mages to a finite-element model of the stent, and the radial components of the interaction forces between the stent and the tissue

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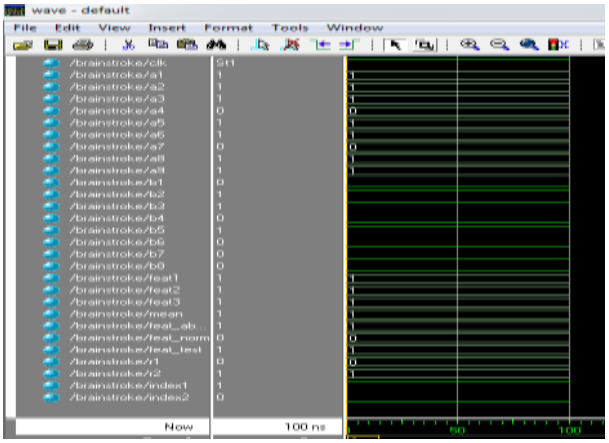

Fig(4) Detection of abnormal(stroke)image using VLSI

These discrepancies can be partially ascribed to the many methodological differences in the studies such as duration and intensity of treatments, contribution of physiotherapy, and severity of the pathology.fig(4) Moreover, literature agrees on the need to better understand the influence of the intervention time on the effectiveness of intensive practice in stroke patients. An ideal medical image segmentation scheme should possess some preferred properties such as minimum user interaction, fast computation, and accurate and robust segmentation results.

Many recent studies have especially highlighted that early and intensive rehabilitative treatments can significantly favor the functional recovery of post-stroke patients.

Discussion

We have various type of ischemic stroke CT image analysis by various type of filter and find out feature extraction parameter. The main focus was on testing a previously published algorithm on clinical data. In earlier studies, this method has been reported to work well on synthetic cases.

In ischemic stroke patients with known atrial fibrillation or other conditions that require anticoagulation, few data are available to provide guidance as to when and how to reinitiate anticoagulation. In our method to provide accurate Quantitative values.

Conclusion

Using HDLs for Medical Image processing is a quite new approach extending the field of digital design to image processing simulation. This research was to convert the input information in HDL readable data, pass those data through the virtually circuit described with Verilog , extract the binary results of the hardware simulation and convert them back into signal. All these actions are using the HDL development environment and its hardware simulation facilities. There are some important advantages of this technique. The most important one is due to the fact that processing is always related with a hardware structure with immediate implementation availability and is not generated based on a mathematical only model.

More, the use of digital design tools in image processing simulations is offering a shorter way to the final implementation of processing circuit since a configuration file is immediately available for use.

- It can help the physicians to better diagnose human brain stroke, for further treatment.
- This system is able to generate accurate quantitative results ready for clinical use.
- In the method for early detection of ischemic stroke is demonstrated to improve efficiency and accuracy of clinical practice.

Our approach improves the use of medical image library images and produces comparable results to various filter. At the level of individual voxels, correlation tests successfully enhance and indicate the difference between healthy and abnormal region.

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