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Medical Image Analysis Based on Image Processing Techniques and Embedded System

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Abstract:
Medical image processing and analysis techniques are important in disease diagnosis. Thus, several notable advances in medical diagnostics have been made over the last decade using medical image processing techniques. The variety of techniques available in Embodiment can improve the accuracy of the composition's results. In this context, efforts to improve diagnosis accuracy resulted in lists of previous studies and researchers in various fields. The purpose of this research is to propose a model for FPGA and embedded systems to evaluate the impact of grayscale images. Deep Learning Approach (DLA) in medical image analysis is a rapidly expanding research field. DLA has been widely used in medical imaging to detect disease presence or absence. This paper describes the development of artificial neural networks, as well as a thorough analysis of DLA, which results in promising medical imaging applications. Medical imaging is rapidly evolving as a result of advances in image processing techniques such as image recognition, analysis, and enhancement. Image processing increases the number and percentage of detected tissues.

Keywords:
Medical Image Analysis, Image Processing Technique, Deep Learning Approach, FPGA, disease diagnosis system.

I. Introduction:

Classification methods have grown in importance, and they now play an important role in image processing. Their significance stems from their applications in a variety of fields, most notably medicine. Given the significance of classification in medicine, new and sophisticated classification tools and methods are required to efficiently diagnose and classify medical images [1]. Several classification algorithms cover hundreds of different classification issues, and no single classification method can address all classification problems successfully and efficiently. As a result, determining which classification approach is best for a particular study is difficult. The rapid growth of medical data and imagery in recent years has necessitated the use of new methodologies in health care that rely on big data technology, artificial intelligence, and machine learning, making it an important research area [2]. Given the importance of classification in medicine, new methods for quickly identifying and evaluating medical images are required. As a result, the purpose of this study is to compare existing and conventional methods for medical image classification and, based on the results, propose a novel algorithm for medical image classification [3].

II. Medical Image Processing:

Image processing is a technique for improving image quality by removing irrelevant image data. Many irrelevant and unwanted segments are included in medical images. Some preprocessing methods are required to remove these segments from an image. The goal of image preprocessing is to improve the quality of the images in the dataset, which improves the results of segmentation and feature extraction methods. This section describes the preprocessing methods used in the studies examined. Filtering is an important technique for improving medical images and removing noise. [4]

Image processing is the use of a computer to manipulate a digital image. This technique has numerous advantages, including elasticity, adaptability, data storage, and communication. Images can be kept efficiently with the development of various image resizing techniques. This technique employs a large number of rules that must be applied synchronously to the images. Images in 2D and 3D can be processed in multiple dimensions. The techniques for image processing were developed in the 1960s. These techniques have been used in a variety of fields, including space exploration, clinical research, the arts, and television image enhancement. With the advancement of computer systems in the 1970s, the cost and speed of image processing decreased. Image processing became faster, cheaper, and simpler in the 2000s [5].

The authors of [6] used the synthetic minority over-sampling technique to generate synthetic samples from minor classes rather than simply replicating them, and they expanded the dataset using the changing

perspective of images technique. Computer vision techniques such as grey scaling, blurring, enhancing contrast, changing the colour channel, sharpening, minimising noise, and smoothing were used to create new images.
Image processing has been widely used in various illness diagnosis procedures (human, animal, and plant), assisting professionals in selecting the best treatment. Image processing techniques are critical in the diagnosis of human diseases. They can be used to identify disease signs (on the skin, for example) or in molecular research to show the anatomy of tissues using microscope images. Disease diagnosis systems include stages and diagnostic methods. It begins with the first stage, which is the collection of images from various sources, either through an online database or by collecting images from various sources, such as images of patients available on the internet or from a specific hospital. The image is then preprocessed as various filtering methods are used to improve it, and the segmentation stage follows by isolating the regions of interest and extracting the important features in the feature extraction stage. The input image is classified at the end of the process, and metrics for evaluating the effectiveness of disease diagnosis techniques are applied. Figure 1 depicts the general system stages for the diagnosis of any disease in image processing. This diagram depicts a conceptual map that explains concepts related to disease diagnosis steps, as well as a descriptive summary of the major evaluation metrics. [7]

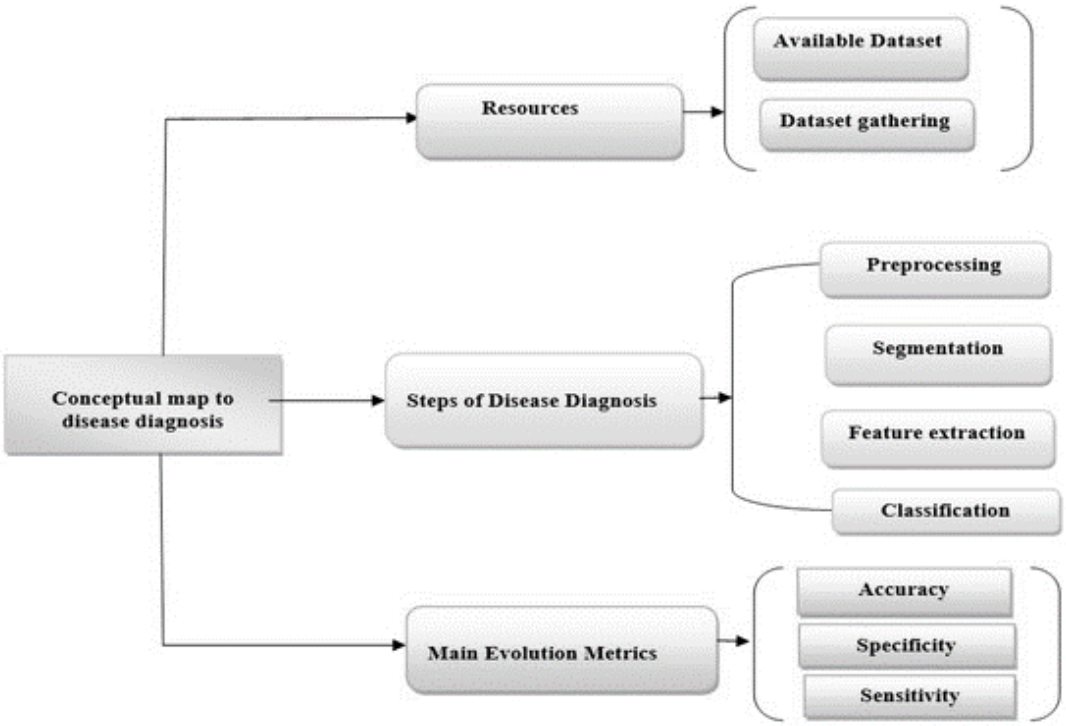

Figure 1: Conceptual map of disease diagnosis system.

Several disease diagnosis methods that used distinctive image treatment and classification strategies, which included diagnosing human diseases, were investigated in this study to examine the new and important methods that addressed in the studies.

Objectives:
1. Define Medical Image Analysis
2. Conceptual map of disease diagnosis system
3. Medical Image Analysis Based on Image Processing Techniques and Embedded System

III. Result and Discussion:

Medical imaging systems generate images based on the signals received from the patient. Ionising and nonionizing sources are used in medical imaging systems.

1. X-ray imaging systems

Since the German scientist Roentgen discovered X-rays, they have been used to image body parts for diagnostic purposes. Electrons are produced in the cathode by a thermal emission process and accelerated by a potential difference of 50-150 KV in an X-ray tube. The X-rays are produced when electrons strike the anode. Only 1% of this energy is converted to X-rays, with the rest converted to heat (Figure 2). [8]

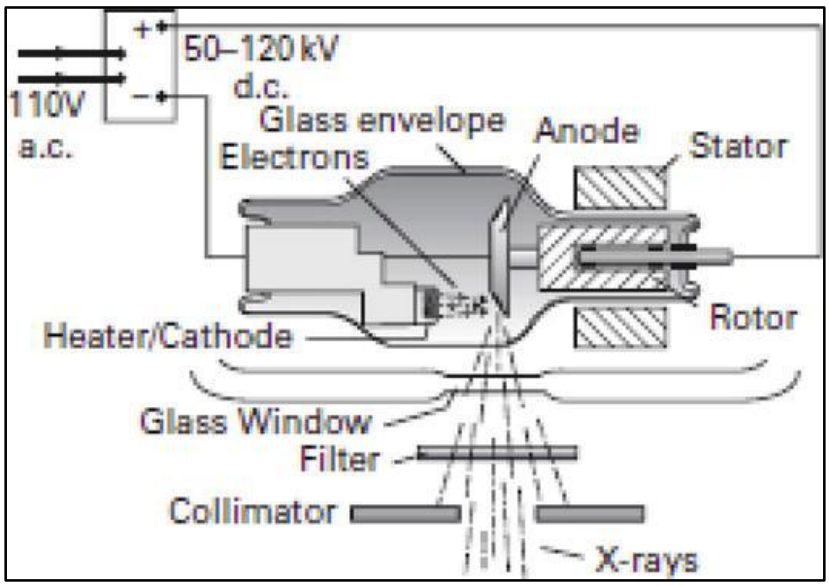

Figure 2: X-rays tube

The images produced by X-ray machines are 2D plans of the body being examined. The moving organs are scanned using a fluoroscopy system. The acquired images can be displayed, saved, and communicated via various machines.

2. Computed tomography (CT)

Unlike traditional radiography, images in this modality are produced in multiple dimensions. A CT scanner generates multiple slices of body tissues in various directions. Figure 3 shows a CT scanner with a patient inside its aperture being scanned in all directions by a rotating X-ray tube. [9]

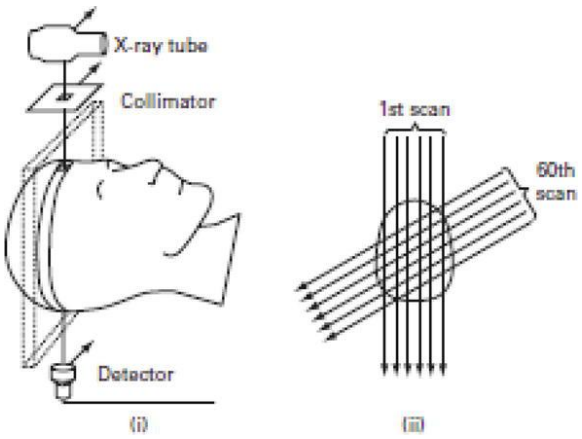

Figure 3: CT scanner.

3. Nuclear medicine

This imaging modality employs radioisotopes to generate images of the functions of various structures such as the heart, kidney, and liver. Pharmaceutical materials label radioisotopes so that they can be guided to specific organs. The photons emitted by the patient are detected and converted into signals by the detectors. These signals are converted into digital images that can be interpreted. [10-11]

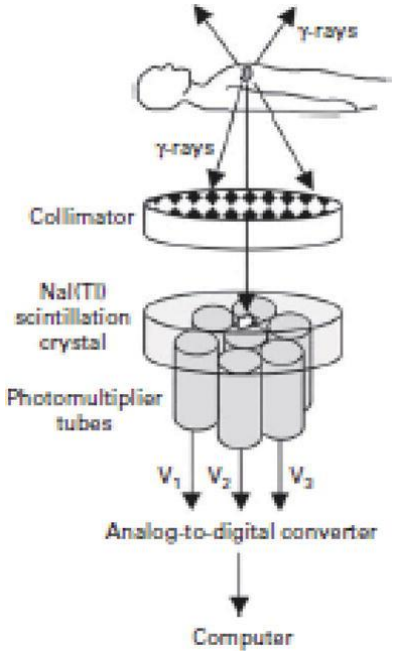

Figure 4: Nuclear medicine imaging.

4. Ultrasound

Ultrasound is a technique that uses high-frequency sound waves to generate images of the body's internal structure from the returned echoes. Ultrasound is similar to the location determination technique used by some animals in nature, such as bats and whales. Ultrasound waves are transmitted into the body in high-frequency pulses via a transducer as they travel through the body tissues. Some of the waves are absorbed, while others reflect back. [12-14]

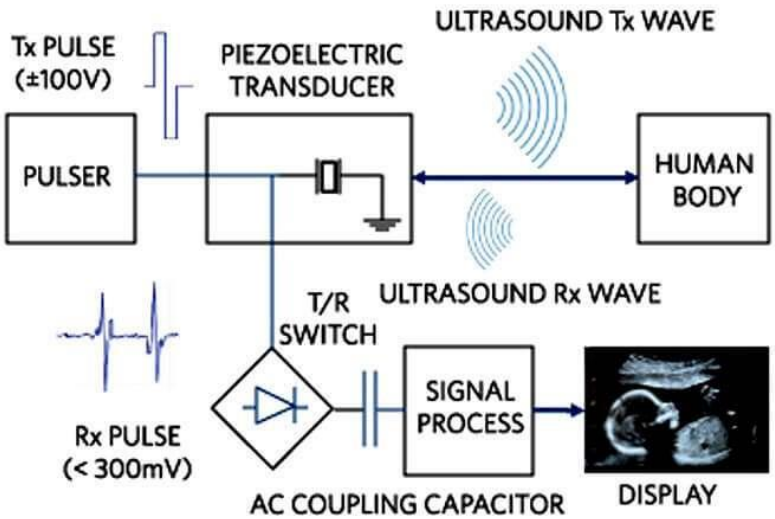

Figure 5: Ultrasound imaging diagram.

IV. Conclusion:

Imaging processing techniques are a collection of approaches used by computers to manipulate images. The goal of segmentation is to divide images into important portions. Local segmentation is concerned with the division of images into small parts within the images. The assembly of those partitions is dealt with by global segmentation. Image segmentation can be done in three ways: region, border, and edge. The region method is used to examine images and the region class of adjacent pixels.

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