

Reconfigurable Binary Image Processor for Brain Tumor Detection

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Abstract: *Nowadays medical field is looking forward for the sophisticated hardware and software VLSI implementations. The next generation medical diagnosis requires fast and robust dedicated hardware for precise applications, MRI images are commonly used for tumor detection and complex hardware are necessary for its better computations. This rises the necessity of dedicated hardware for improved performance. Binary images are optimal for hardware implementation. We propose a novel method in which MRI images are converted to binary images which allows the real time hardware implementation. VLSI implementation using binary images effectively improves performance of the system in terms of reduction in computational complexity, hardware requirements, reduces memory space thus efficiently reduces cost.*

Keywords: binary images, morphological filtering, k-mean filtering

1. Introduction

Images are one of the basic communication strategy through which we can convey messages in a two dimensional platform. Digital image processing helps in extracting set of characters that convey some messages which are helpful in medical diagnosis. Medical images which are the outcomes of MRI or ultra scans especially of internal organs don't give a good quality image which makes visual diagnosis hardly impossible. so further complex processing hardware for medical diagnosis.

1.1 Binary Images

Binary images which possess only two level pixels are simpler and powerful image for digital computations. Binary images only have foreground and background which is represented by 1's and 0's only which reduces memory requirements which allows hardware implementations. The lack of easier conversion methodologies to convert medical images to binary images this problem in binary image process implementations can be easily solved by morphological filtering .morphological operations can be easily applied over binary images. The structuring element of a binary image is usually small so the segmentation operations using k-mean filtering operations for the detection of brain tumor can be easily processed.

The morphological operations improves noise margin and Since the pixels can only have two values, the morphological operations are erosion (any unset pixels within the structuring element cause the pixel to be unset) and dilation (any set pixels within the structuring element cause the pixel to be set). Important operations are morphological opening and morphological closing which consist of erosion followed by dilation and dilation followed by erosion, respectively, using the same structuring element. Opening tends to enlarge small holes, remove small objects, and separate objects. Closing retains small objects, removes holes, and joins objects.

1.2 Challenges

Medical image processing requires high precision images for the accurate decisions but the medical imaging of the human interior is much complex and thus even using high end devices we don't have a high resolution images which limits the medical diagnosis. The quantitative and qualitative biomedical image processing is limited by the computational problem related to low resolution images. Due to the limitation of processing a low resolution images. The lack of standard test cases and standardization further set limitations to the image processing. The imaging techniques in the molecular level as well as sub cellular level complicate the processing capabilities of the system.

The major drawback for the current system is completing in recommending images in the database for the processing. Thus linking or external hard disk memory usage complicates the processing capabilities and requirements. Whatever be the processing idealisms or structures used the limitations in visually identify and processing capabilities of a physician limits the image processing tools also have to consider how well the image can illustrate the current circumstances. In many cases medical images are the proof for a disease or a severe circumstance of a person. But the degraded image can't help the doctors for the decision making.

The brain tumors are created by an abnormal cell growth in brain the Axial MRI view is used to detect the cell growth. Commonly a patient is diagnosed by symptoms. And its conformed by biopsy the imaging techniques MRI/CT scans are used to detect and localize the tumor and also to materialize the tumor growth. MRI-images are commonly recommended since it doesn't involve harmful radiations. The MRI image of patient is the only measure to localize the tumor growth. Since the MRI images are not having a high resolution so visual detection is not much accurate. For that we use image processing tools to detect and localize tumor growth. The medical MRI images s itself is not suitable for image processing so the original image is segmented using

K-mean filtering and morphological operations. These operations preprocessing steps change the original image to a computer suitable form here it's also converted to binary image so that the hardware implementation also of the processor is possible as a simple decided hardware. In the field of brain tumor detection different approaches have been carried out. Sindhusree [14] have detected tumor in 3D view. Mc jobilchrist [6] proposed a method using K-mean clustering. K-means clustering with marker controlled segmentation and with fuzzy c-means clustering for medical image segmentation. The proposed methodology under goes a two stage process, K-means clustering for the primary segmentation secondly marker controlled segmentation to get the finest image. To detect tumor from MRI using fuzzy clustering technique P Vasuda [12] [proposed a technique but it requires a more computation technique. Bin Zhang [1] proposed binary images for morphological operations which reduces computation and complexity and reduces hard ware cost. Supervised segmentation method needs considerable amount of testing data which complicate the hardware requirements and thus increase cost Ananda resmi [13]

2. Proposed Methodology

Binary images replacing the MRI images not only allow a fast reliable and low cost dedicated hardware. It also improves the operational computation features since morphological operations such as dilation, erosion are easily processed in binary images .The complex segmentation operations are also effectively implemented in Binary images .here morphological filletring to K-mean clustering algorithm for segmentation to detect the brain tumors.

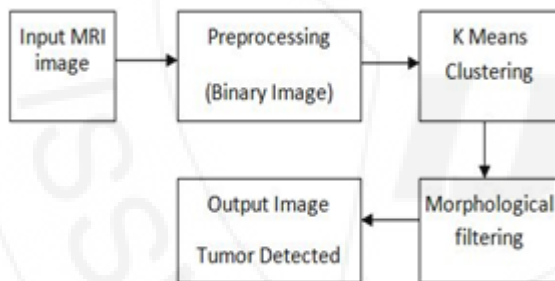


Figure 1:- proposed block diagram

The grey scale MRI image is converted to binary image, then its pasted to morphological filtering operations as a pre processing of image then the image is clustered by using K-mean clustering algorithm are recommended to perform a morphological filtering to avoid clustered regions.

2.1 Morphological Filtering

A set of image processing operations that a basically done to emphasis an image for digital image processing application are known as morphological filtering operations. The basic operation of morphological filtering dilation and erosion is a comparison technique which optimizes the image for other digital image operation such as clustering and segmentation. In this paper the pre processing operations are carried out to convert a MRI image to binary image thus morphological operations can be implemented effectively. Since the dilation and erosion operations are carried out in binary Images the

operation is assumed to setting a pixel value to one. By comparing with the nearby pixels

2.2 K-Means Clustering

Clustering is a method of grouping of related things together to perform similar groups. K-means is an algorithm commonly used to cluster by defining cluster center and finds the position of other cluster points as a relative positioning from the cluster data. To minimize the distance from data points to cluster center.

Algorithm

K-means [Llyods algorithm]

1. Decides the number of clusters 'k'.
2. Initialize the center of the clusters.
3. Attribute the closest cluster to each data point.
4. Set the position of each clusters to the mean of all data points belonging to that clusters.
5. Repeat the steps 3&4 until it converges.

3. Simulation Result

Tumor detection from an MRI image using our proposed method. The brain tumor is located from equivalent binary image using K-mean cluster algorithm and morphological filtering.

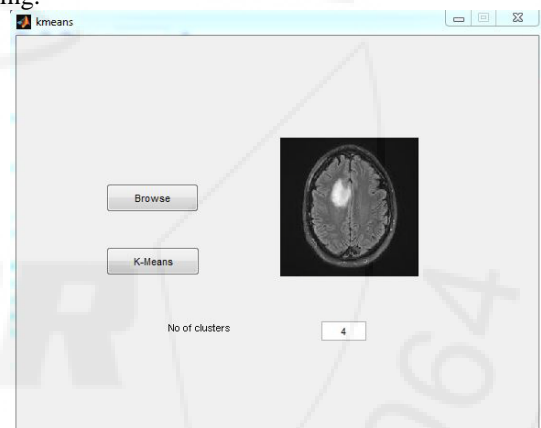


Figure 2: Original MRI image with tumor

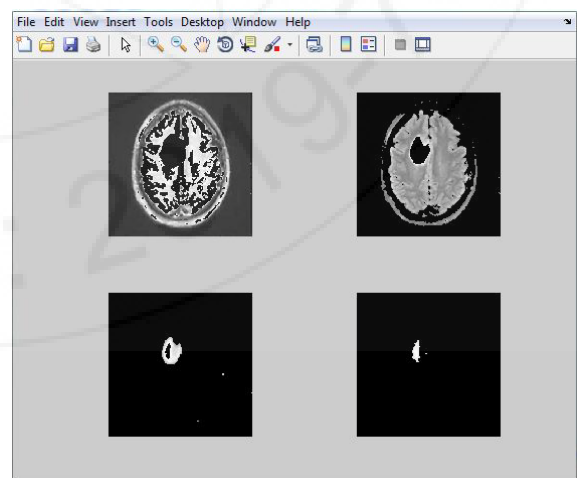


Figure 3: dilation and erosion outputs of binary image

Using mat lab we success fully located the tumor growth in an input MRI image using K-men clustering and morphological filtering

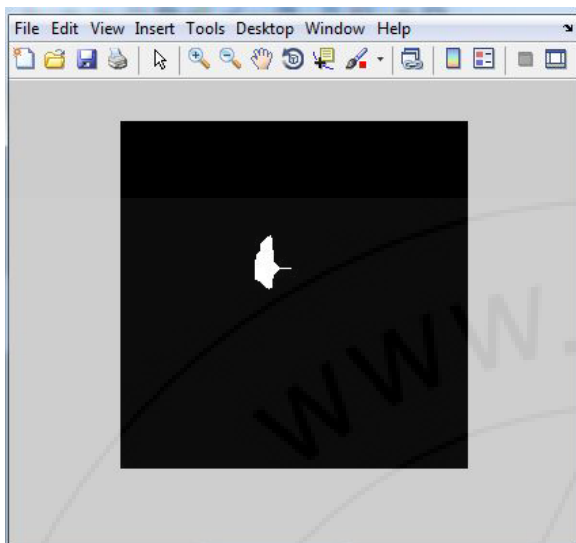


Figure 4: Tumor detected binary image

4. Conclusion

Simplified computation method on a MRI image for tumor detection is detailed above using K-means and morphological filtering on a binary image which is extracted from the input image. Since binary images are used for image processing it paves the hardware implementation. This technique leads to the reduction in existing hardware complexity end thus reduces cost .future scope of this work should be focused on on-chip implementation of the hardware.

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