Extraction of Tumor and Cancer Cells of Brain MRI Images by using different Morphological Operations

K. Sailakshmi Parvathi, Rajiv Tawde and Snehal Shah

ABSTRACT: In the recent time, it has been observed that cancer and tumor problems are alarming. Cancer can be cured if detected early. So, development of a robust method for detection of cancer and tumor cells is the crying need of the day. In this paper, we present a new method for identification of cancer and tumor cells in the MRI scan of brain.

Keywords
Image enhancement , CIELab color space model k-means clustering algorithm, morphological operations.

1. INTRODUCTION

The ever-increasing number and variety of digital images generated everyday are becoming a major information source in daily life. Examples of these include natural images, digital commercial television, magnetic resonance images, as well as geographical information systems and astronomy. Digital image processing generally refers to the processing of a two-dimensional (2-D) picture signal by a digital hardware. In a broader context, it implies processing of any signal using a dedicated hardware, e.g. an application specific integrated circuit (ASIC) or using a general-purpose computer implementing some algorithms developed for the purpose. An image is a 2-D function (signal), X(m,n), where m and n are the spatial (plane) coordinates. The magnitude of X at any pair of coordinates (m,n) is the intensity or gray level of the image at that point. In a digital image; m ,n, and the magnitude of X are all finite and discrete quantities. Each element of this matrix (2-D array) is called a picture element or pixel. image processing may be defined as a process where both input and output are images. At the high level of processing and after some preliminary processing, it is very common to perform some analysis, judgment or decision making or perform some mechanical operation (robot motion). These areas are the domains of artificial intelligence (AI), computer vision, robotics, etc. Digital image processing has a broad spectrum of applications, such as digital television, photo-phone, remote sensing, image transmission, and storage for business applications, medical processing, radar, sonar, and acoustic image processing, robotics, and computer aided manufacturing (CAM) and automated quality control in industries.

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The developments in the application of information technology have completely changed the world. The obvious reason for the introduction of computer systems is: reliability, simplicity and ease of use. Brain tumor is one of the major causes for the increase in mortality among children and adults.[4] A tumor is a mass of tissue that grows out of control of the normal forces that regulates growth. To identify these tumor and cancer cells we use different kinds of methods to scan the brain such as X-ray, magnetic resonance imaging (MRl), and ultrasound, image among these most popular method is magnetic resonance imaging (MRl) strongly depend on computer technology to generate or display digital image. In medical imaging, an image is captured, digitized and processed for doing segmentation and for extracting important information.[3] Manual segmentation is an alternate method for segmenting an image. This method is not only tedious and time consuming, but also produces inaccurate results. To avoid this, we are using the K-means clustering algorithm which is pixel based image segmentation. K-means algorithm computational complexity is relatively low compared with other methods, but the limitations of K-means clustering algorithm require many iterative rounds. In order to reduce the number of iterations, modification is applied to K-means algorithm that makes it faster and more efficient[3]. In order to improve the resolution of image before applying the modified K-means algorithm we are converting the gray scale image from MRI scan to CIELab color space model which will cause the improvement in the image segmentation. This paper proposes automatic method to find characteristics of Tumor and Cancer cells using Morphological technique. after extraction of the desired portion of image we are saving the image in the JPEG standard 2000 which is a lossless compression system.

2. Approach using the combination of CIE Lab Color Space Model and Morphological Operation

Cancer known medically as a malignant neoplasm, is a broad group of various diseases, all involving unregulated cell growth. In cancer, cells divide and grow uncontrollably, forming malignant tumors, and invade nearby parts of the body. The cancer may also spread to more distant parts of the body through the lymphatic system or bloodstream .MRI provides good contrast between the different soft tissues of the body, which makes it especially useful in imaging the brain, muscles, the heart, and cancers compared with other medical imaging techniques such as computed tomography (CT) or X-rays. Unlike CT scans or traditional X-rays, MRI

does not use ionizing radiation. The image from the MRI scan contains the noise to remove the noise from the image here is one technique called image enhancement .

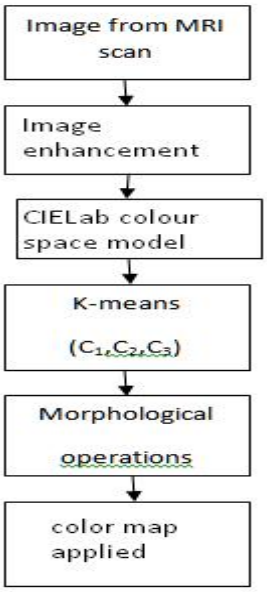

Fig 1: Block diagram of the proposed method.

Basically the image enhancement is useful in feature extraction, image analysis, visual information display. The image enhancement process does not increase information content in the data. It simply emphasizes certain specified image characteristics. The image enhancement is basically classified into two ways. Those are spatial domain method and frequency domain method. The spatial domain method enhances the image pixel by pixel and in the frequency domain method the image is enhanced by applying different transformation methods like Fourier transform. The MRI scan provides the image in the gray scale. Basically, the gray scale image is having the number of gray levels from 0 to 255. To identify the cancer and tumor cells with good resolution, gray scale image needs to be converted into CIELab color space model so that the resolution is better with CIELab color space model image. Color is a powerful descriptor in image segmentation that simplifies object identification and extraction of the required part in the image. CIELab color space model is one of the color model technique. The color model facilitates the specification of a color in a standard way. CIELab color space model is perceptual uniform color model where L component of color model represents human perception of lightness and a,b components represents the amount of a color represent.[5] Now the image is converted into color space. Later to perform the segmentation of the image, we are using the algorithm called k-means clustering algorithm. Image segmentation is useful in many applications. It can identify the regions of interest in a scene. We categorize the existing segmentation algorithm into region-based segmentation, data clustering, and edge-base segmentation. Region-based segmentation includes the seeded and unseeded region growing algorithms.[7]

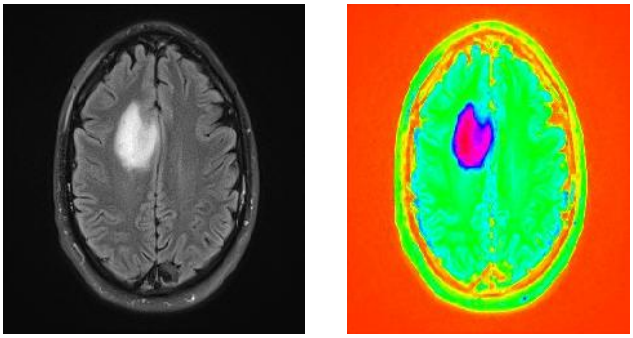

Fig 2(a): MRI Image under consideration.

2(b) MRI Image after applying CIE Lab Color Space Model

The most famous partitional clustering algorithm is k-means clustering. The steps
of k-means clustering are as below.

Step1. Determine the number of clusters we want in the final classified result and set the number as N. Randomly select N patterns in the whole data bases as the N centroids of N clusters.

Step2. Classify each pattern to the closest cluster centroid. The closest usually represent the pixel value is similarity, but it still can consider other features.

Step3. Recompute the cluster centroids and then there have N centroids of N clusters as we do after Step1.

Step4. Repeat the iteration of Step 2 to 3 until a convergence criterion is met. The typical convergence criteria are: no reassignment of any pattern from one cluster to another, or the minimal decrease in squared error[6]

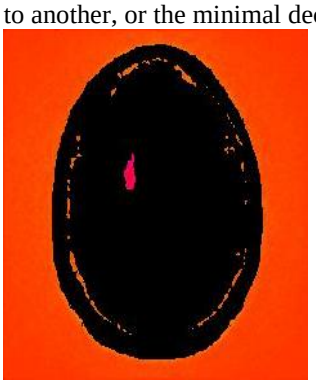

Fig 3(a): Objects in cluster1

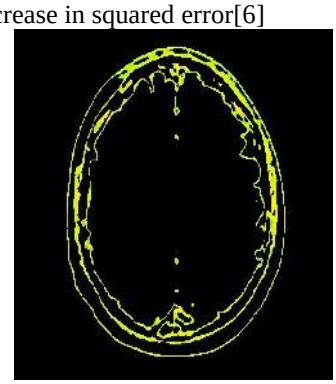

Fig3(b): Objects in cluster2

Fig 3(c) : Objects in cluster3

After applying the k-means algorithm, we have to apply the morphological operations like erosion and dilation to

remove the outer most cover of the ellipse in the image. Later, we have to apply the color map to convert the color space to ROI B/W image then we can identify the cancer and tumor cells in MRI scan image.

Fig4 (a): Identifiying blocks in the image

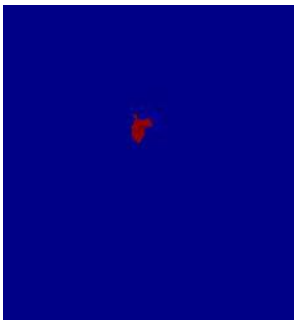

Fig 4(b): Image after applying color map

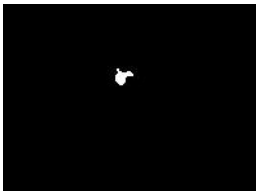

Fig 5: Image after applying the morphological operations

CONCLUSION:

CIELab color space model has been introduced to enhance the overall performance of the tumour detection mechanism. Thus, with the help of the k-means algorithm, CIELab color space model and morphological operations, we can identify the cancer and tumor cells from the MRI scan of the image.

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