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An Approach to Detect and Classify Bone tumour using fast andRobust Fuzzy C Means Clustering technique

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***Abstract*—** A tumor is an abnormal growth of new tissue that can occur in any of the body's organs. There are many kind of tumors detected in the human body like breast cancer, bone tumor, brain tumor, etc . Bone tumors develop when cells within a bone divide uncontrollably, forming a lump or mass of abnormal tissue. Bone marrow biopsy is mostly done to detect any abnormal growth inside the bone. But this procedure carries many risks. Medical image processing is an important field of research as its outcomes are used for the betterment of health issues. This project proposes an approach to detect bone tumor in MRI images. The proposed approach uses fast and robust fuzzy C means clustering (FRFCM) to detect bone tumor from the acquired MRI images. This approach also further identifies whether the tumor is non- cancerous (benign) or cancerous (malignant) based on the comparative analysis of segmentation techniques.

Keywords **- Segmentation; K-Mean;, Fuzzy C- Means; Bone tumour detection; Medical Imaging; MRI images**

I INTRODUCTION

Medical image processing is a significant approachin tumour detection proving to be much reliable and less time consuming. A tumour is an abnormal growth of tissues . As the tumour grows, the abnormal tissue displaces healthy tissue. Bone tumours develop when cells within a bone divide uncontrollably, forming a lump or mass of abnormal tissue .

There is a large class of bone tumour types which have different characteristics. There are two types of bone tumours, Non-cancerous (Benign) and Cancerous (Malignant) . The benign tumour are the ones which when removed by surgery don't usually reoccur. Malignant tumour has a larger nucleus that looks different from a normal cell's nucleus and can also reoccur after they are removed [9] [11].

Various types of image modalities are available like X-ray, MRI and CT scans. The MR imaging technique is considered to be the best for applications that require a higher resolution scans. Magnetic resonance imaging (MRI) is a non- invasive medical system used to show 2D images of the body [3]. This technique is based on a process that uses highly charged magnetic fields and radio waves to make images of the inside the body [1]. It is one of the most unharmed methods of obtaining images of the human body. Its data are most relevant and it helps in early detection of tumours and precise estimation of tumour boundaries. Magnetic resonance (MR) sequences such as T1-weighted, T2-weighted, contrast-enhanced T1W and T2W, STIR (Short T1 inversion recovery), PD-Weighted scans provide different information about tumours.

II. METHODOLOGY

Image segmentation means the partitioning of image into multiple regions. Segmentation aims to extract useful information from images in medical imaging applications as well. Image

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segmentation algorithms are based on one of the two fundamental properties of image intensity values: discontinuity and similarity. In the formal category, the segmentation approach is based on partitioning the processed image based on changes in intensity [18].It includes methods such as edge detection which segments an image which have varied in intensity between the dissimilar regions. The second one is based on partitioning an image into regions that are similar due to a set of predefined criteria [18]. Itincludes region based segmentation and clusteringtechniques as it has some predefined criteria. Bone tumour segmentation means segregating tumour fromnontumour tissues.

Image segmentation is very challenging as it is difficult to select appropriate technique for a particular kind of image. Thus, there is no universallyaccepted method for image segmentation. Each technique has its own advantages as well its drawbacks, so it depends on the user which techniquehe uses to solve his problem to the best extent.Clustering is an approach in which pixels are grouped to form a cluster, which is closest among all clusters. A cluster is a collection of objects which are "similar" between them and are "dissimilar" to the objects belonging to other clusters. Pixels having homogenous characteristics belong to the samecluster and pixels must follow the homogeneity criteria in the same cluster [1]. Clustering provides us an exact and subtle analysis tool from the mathematic view. Clustering techniques provide better results for exact shapes, range and area of tumours or any sort of abnormal growth [2].

III. PROPOSED WORK

In this paper, the system detects and classifies Bone tumour from MRI. Proposed work divided into four stages. The first stage is a pre-processing stage for denoising the image, second stage is segmentation using fuzzy c-means, third stage consists of identification and classification of tumour and the last stage is tumour detection. The overall workflow is shown in fig. 1.

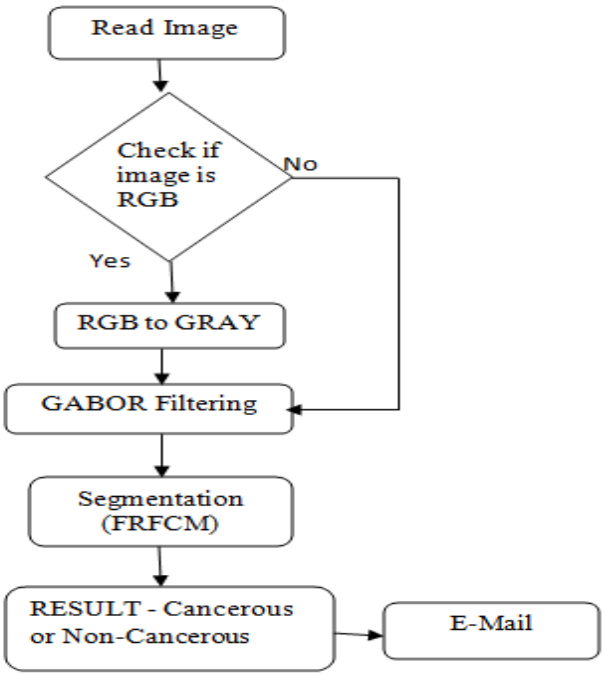

Figure.1 Work flow of proposed work

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A. PREPROCESSING

Image acquisition -

The first step in any image processing system is the image acquisition. After the image has been obtained, various methods of processing can be applied to the image to perform the many different vision tasks required today. However, if the image has not been acquired satisfactorily then the intended tasks may not be achievable, even with the aid of some form of image enhancement. Digital imaging ordigital image acquisition is the creation of a digitally encoded representation of the visual characteristics ofan object, such as a physical scene or the interior structure of an object.

The term is often assumed to imply or include the processing, compression, storage, printing, and display of such images. A key advantage of a digital image, versus an analog image such as a film photograph, is the ability make copies and copies of copies digitally indefinitely withoutany loss of image quality.

Filtering -

Filtering is used to remove noise from the image andenhancing the images. Gabor filter based anisotropic diffusion is a technique aiming at reducing image noise without removing significant parts of the imagecontent , typically edges , lines or other details that are important for the interpretation of the image. `Gabor filter' based anisotropic diffusion is a technique aiming at reducing image noise without removing significant parts of the image content , typically edges , lines or other details that are important for the interpretation of the image.

B. SEGMENTATION

By de-noising the MRI image, the images are fed to FCM technique. Fuzzy C-Means is a method of clustering which allows one pixel to belong to two ormore clusters. It is a soft clustering technique and unsupervised clustering algorithm

.Fuzzy logic is a form of probabilistic logic which contains only approximate values. The fuzzy logic is a way to process the data by giving a partial membership value to each pixel in the image.

C. FAST AND ROBUST FUZZY C MEANS CLUSTERING

FCM algorithm based on morphological reconstruction and membership filtering (FRFCM) that is significantly faster and more robust than FCM. First, the local spatial information of images is incorporated into FRFCM by introducing morphological reconstruction operation. Second, the modification of membership partition, based on the distance between pixels within local spatial neighbors and clustering centers, is replaced by local membership filtering that depends only on the spatial neighbors of membership partition.The segmented image is thresholded to get a black & white image which highlights tumor cell in the images.

D. TRANSMISSION OF RESULTS VIA E-MAIL

After classification the results are forwarded to the patients through the Simple Mail Transfer Protocol. It is an Internet standard for email transmission. Email is submitted by a mail client(Mail User Agent, MUA) to a mail server(Mail Submission Agent, MSA) using SMTP . The MSA delivers the mail to its Mail Transfer Agent (MTA). The boundary MTA uses the domain name system DNS to look up the Mail Exchanger record(Mx) for the recipient domain.Message transfer can occur in a single connection between two MTA’s or in a series of Hops through intermediary system. Once the

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final hop accepts the incoming message it hands it to a MDA for delivery

IV. RESULTS

CLASSIFICATION AS CANCEROUS OR NON CANCEROUS

After the segmentation process based on the **orientation value** the classification of tumor for the input image is done.It is classified as begin if the value is below 20 and malignant otherwise.

Figure.2 Input image

Figure.3 Filtered image

Figure.4 Segmented image

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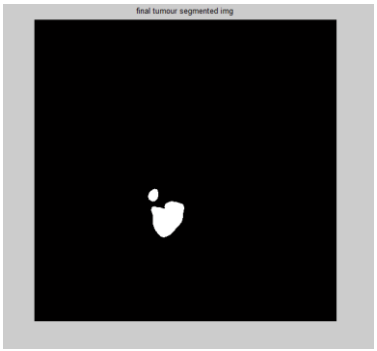

Figure.5 Output tumor image

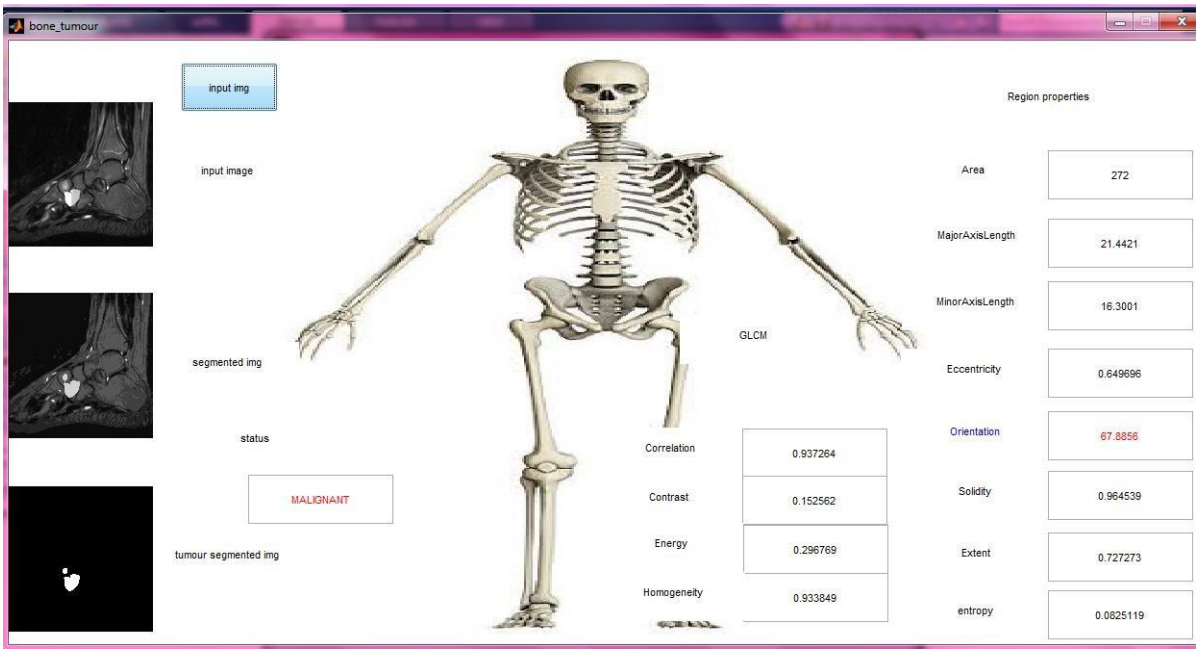

Figure.6 Final ouput image shown for Malignant condition

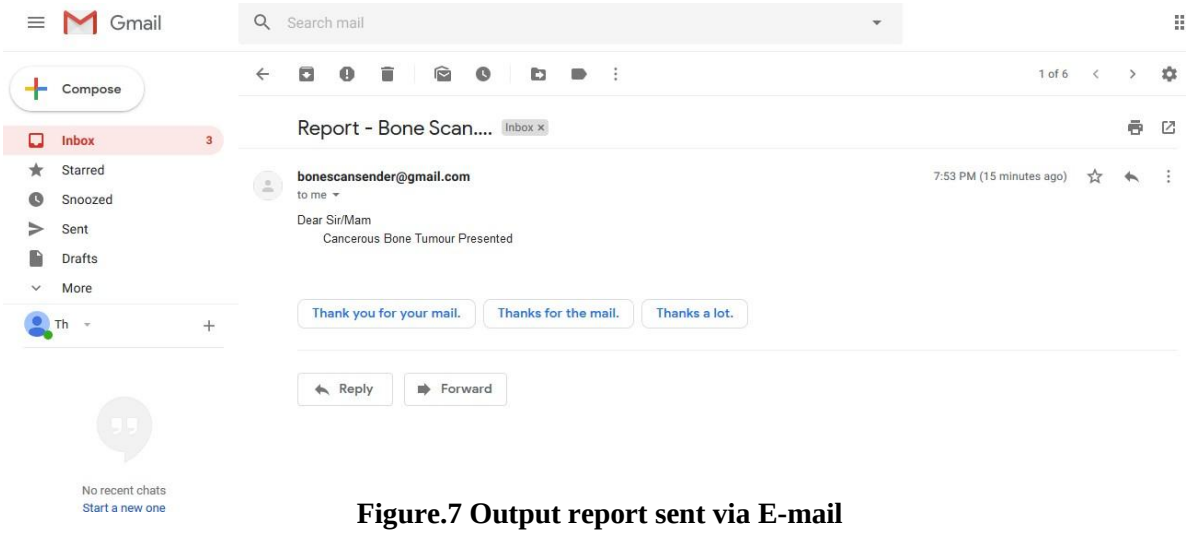

Figure.7 Output report sent via E-mail

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V. CONCLUSION

This work proposes a method to detect and classify the bone tumor using comparative analysis of segmentation technique. Fuzzy C means clustering technique is used for segmentation purpose. Fast and robust fuzzy C-means (FRFCM) algorithm is found to be efficient than other algorithms of clustering. The Fast and Robust Fuzzy C means clustering based Bone tumor detection and classification system is found to be having much more noise immunity and less computational complexity compared to the other clustering based techniques. The results are highly reliable and processing time is observed to be 0.5 seconds or less.

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