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Research Paper

Morphological Approach for the Detection of Brain Tumour and Cancer Cells

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ABSTRACT:- *The boundary of the tumour in an image is usually traced by hand which is time consuming and difficult to detect and localize, detection becomes infeasible with large set of data sets. While typically dealing with medical images where pre-surgery and post surgery decisions are required for the purpose of initiating and speeding up the recovery process. Computer aided detection of abnormal growth of tissues is primarily motivated by the necessity of achieving maximum possible accuracy. Manual segmentation of these abnormal tissues cannot be compared with modern day's high speed computing machines which enable us to visually observe the volume and location of unwanted tissues. Hence there is a need for the automatic system for the detection of tumour.*

Image Processing is used to analyze different medical and MRI images to get the abnormality in the image. The Medical Image segmentation deals with segmentation of tumor in MR images for improved quality in medical diagnosis. It is very important and a challenging problem due to noise present in input images while doing image analysis. Here the segmentation is carried out using k-means and fuzzy c-means clustering algorithm for better performance. This enhances the tumor boundaries more clearly. Tumour can be found with more precision and also fast detection is achieved with only few seconds for execution. The input image of the brain is taken either from the available data base or the real time image by using the scanner. So that the presence of tumour in input image can be detected and the area of the tumour can also be analyzed.

I. INTRODUCTION

A brain tumour is an abnormal growth of the cells inside the brain, which can be cancerous or non cancerous. It is generally caused by abnormal and uncontrolled cell division, which is normally either in the brain itself, or in the cranial nerves, or in the brain envelopes, skull, pituitary and pineal gland, or spread from cancers primarily located on other organs. Brain tumours are of two types: primary and secondary. Primary brain tumour includes any tumour that starts in the brain, which can start from brain cells, the membranes around the brain, nerves, or glands [3].

Primary brain tumours are classified as benign and malignant. Benign tumours can be removed and the seldom grow back. Benign tumours usually have a border or an edge. They do not spread to other parts of the body. Malignant brain tumours are generally more serious and often are a threat to life. They grow rapidly in crowd and invade the nearby healthy tissue. Cancer cells may break away from malignant brain tumour and spread to the other parts of the brain or to the spinal cord but it rarely spread to other parts of the body [3]. The most common primary brain tumours are Gliomos, Meningiomas, Pituitary adenomas, Nerve sheath tumours [1].

Any brain tumor is inherently serious and life-threatening because of its invasive and infiltrative character in the limited space of the intracranial cavity. However, its threat level depends on the combination of factors like the type of tumor, its location, its size and its state of development. Because the brain is well protected by the skull, the early detection of a brain tumor occurs only when diagnostic tools are directed at the intracranial cavity. Usually detection occurs in advanced stages when the presence of the tumor has caused unexplained symptoms.

According to National Brain Tumour Society, an estimated 688,000+ people are living with primary tumours of the brain and central nervous system (CNS) in the United States, 138,000 with malignant tumours and 550,000 with non-malignant tumours. That is from an estimated 612,000+ people living with a primary

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brain and central nervous system tumour in the United States in 2004, 124,000 with malignant tumour and 488,000 with non-malignant tumours.

An estimation of 13,700 deaths are expected to occur in a year due to brain tumours, 7720 males, and 5,980 females. About 43% of brain and CNS tumours occur in men and about 57% occur in women. So efficient and accurate techniques are required for brain tumour detection. In India totally 80,271 people are affected by various types of tumour (2007 estimates) [3].

The current advancements in computer technologies have envisaged a developed vision based world, amended by the artificial intelligence. This trend motivated the development in machine intelligence especially in the field of medical imaging. Medical imaging focuses to improve the real time medical image diagnosis. Since the development of medical imaging in clinical applications a new era of unhurt diagnosis has evolved. Many techniques are being explored and practiced to improve clinical diagnosis. The main application is driven toward more generalized and significant application of medical imaging related to a broader field of brain tumour detection in CT scan and MRI images [4].

II. METHODOLOGY

Clustering is one of the widely used image segmentation techniques which classify patterns in such a way that samples of the same group are more similar to one another than samples belonging to different groups. The process of organizing objects into groups whose members are similar in some way, thus a collection is therefore a collection of objects which are similar between them and are dissimilar to the objects belonging to other clusters.

A. Image Enhancement

Image enhancement is a process principally focuses on processing an image in such a way that the processed image is more suitable than the original one for the specific application. The word "specific" has significance. It gives a clue that the results of such an operation are highly application dependent. The technique falls in two categories on the basis of the domain they are applied on. These are the *frequency* and *spatial* domains. The frequency domain methods works with the Fourier Transforms of the image. The term spatial domain refers to the whole of pixels of which an image is composed of. Spatial domain methods are procedures that operate directly on the pixels. A number of enhancement techniques exist in the spatial domain. Among these are histogram processing, enhancement using arithmetic, and logical operations and filters.

Image enhancement operation improves the qualities of an image. They can be used to improve an image‟s contrast and brightness characteristics, reduce its noise content or sharpen its details. In view of the wide usage of loosely defined terms covering the general topic of image-enhancement, it is appropriate to give a precise definition of what this term denotes within the present context. Other terms such as image-processing are often used as synonyms, along with those such as image-restoration and image-manipulation, and catch-all phrases such as photo-editing are now widely used in the an ever-growing modern circle of consumer digital-imaging. But all these and other common terms are frequently used interchangeably, and mean quite different things in different contexts.

B.Morphological Operations

Morphological processing is constructed with operations on sets of pixels. Binary morphology uses only set membership and is indifferent to the value, such as gray level or color, of a pixel. It relies on the ordering of pixels in an image and many times is applied to binary and gray scale images. Through processes such as erosion, dilation, opening and closing, Binary images can be modified to the user's specifications. Binary images are images whose pixels have only two possible intensity values. They are normally displayed as black and white. Numerically, the two values are often 0 for black, and either 1 or 255 for white.

Binary images are often produced by thresholding a gray scale or color image in order to separate an object in the image from the background. The color of the object (usually white) is referred to as the foreground color. The rest (usually black) is referred to as the background color.

Morphological Operators

After converting the image in the binary format some morphological operations are applied on the converted binary image. The purpose of the morphological operators is to separate the tumour part of the image. The portion of the tumour in the image is visible as white color which has the highest intensity then other regions of the image. Some of the commands used in the morphing are strel which is used for creating morphological structuring element, imerode which is used to erode or shrink an image and imdilate which is used to for dilating i.e. expanding an image[7].After segmentation and thresholding some percent of noise will be there, in order to remove this noise two important morphological operations have been used: opening and closing. The proposed algorithm is shown in figure1.

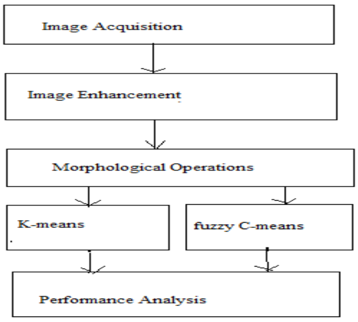

Figure.1 Proposed Method

In the detailed-Level Design, the details and flow chart of each module has been described in depth. This mainly involves module specification such as

- Image Acquisition
- Image Enhancement
- Morphological Operations
- K-means Clustering
- Fuzzy C-Means Clustering
- Performance Analysis

III. PROPOSED ALGORITHM

Segmentation

Segmentation refers to the process of partitioning a digital image into multiple segments. Image segmentation is typically used to locate objects and boundaries in image. Image segmentation can also be considered as a process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. It can also be defined as a technique which partitions a given image into a finite number of non overlapping regions with respect to some characteristics, such as gray value distribution, texture. Segmentation subdivides an image into its constituent region or objects. The level of detail to which the subdivision is carried depends on the problem being solved. Most of the segmentation algorithms depend on one of two basic properties of intensity values: discontinuity and similarity. In the first category the approach is to partition an image based on abrupt changes in intensity, such as edges. The second category approaches is based on partitioning an image into regions that are similar according to a set of predefined criteria. In this project second approach is used.

K-means based Segmentation

The k-means algorithm is an iterative technique that is used to partition an image into *K* clusters. The basic algorithm is:

1. Pick *K* cluster centers, either randomly or based on some heuristic
2. Assign each pixel in the image to the cluster that minimizes the distance between the pixel and the cluster centre
3. Re-compute the cluster centers by averaging all of the pixels in the cluster
4. Repeat steps 2 and 3 until convergence is attained (e.g. no pixels change clusters)

The k-means method is the simplest methods in unsupervised classification. The clustering algorithms do not require training dada. k-means clustering is an iterative procedure. The k-means clustering algorithm clusters data by iteratively computing a mean intensity for each class and segmenting the image by classifying each pixel in the class with the closest mean [10]. In this case, distance is the squared or absolute difference between a pixel and a cluster centre. The difference is typically based on pixel color, intensity, texture, and location, or a weighted combination of these factors. *k* can be selected manually, randomly, or by a heuristic.

This algorithm is guaranteed to converge, but it may not return the optimal solution. The quality of the solution depends on the initial set of clusters and the value of *k*.

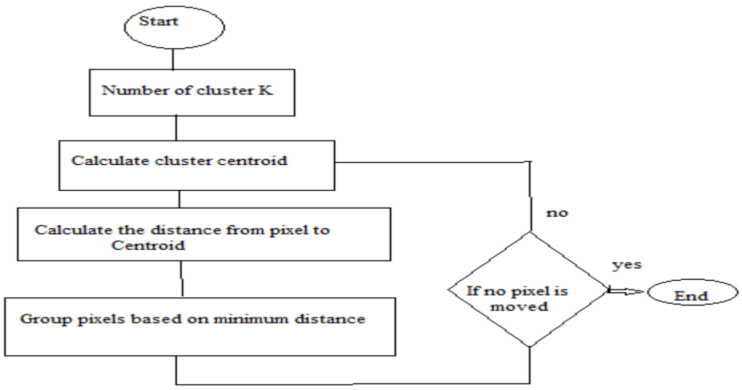

Figure.2 proposed algorithm

IV. RESULT AND DISCUSSION

Input to the system would be the both CT and MRI Images of brain. Output is image where tumours are segmented and can be clearly distinguished from the other parts of the brain and area of the tumour is calculated after the detection of the tumour. After the execution of the fuzzy c-means clustering algorithm the output of the GUI with the area of the tumour is given below in **figure 3**

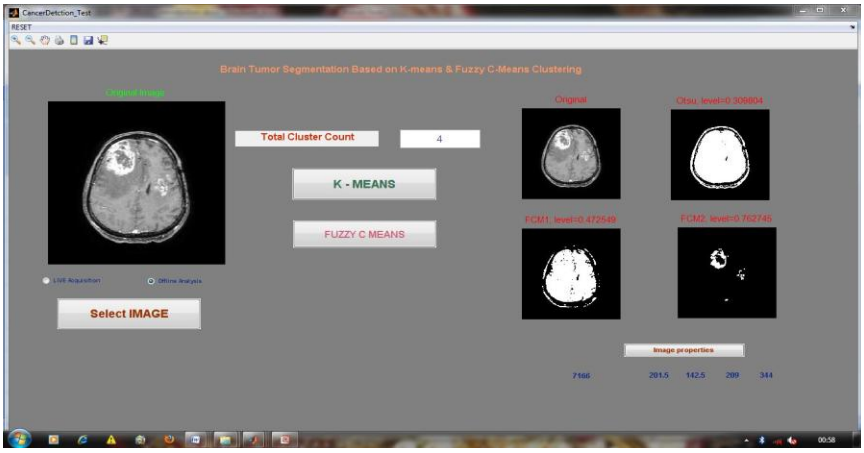

Figure.3 Result window after execution of fuzzy c-means clustering

The comparison between both k-means and fuzzy c-means clustering algorithm can be seen below in figure 4.

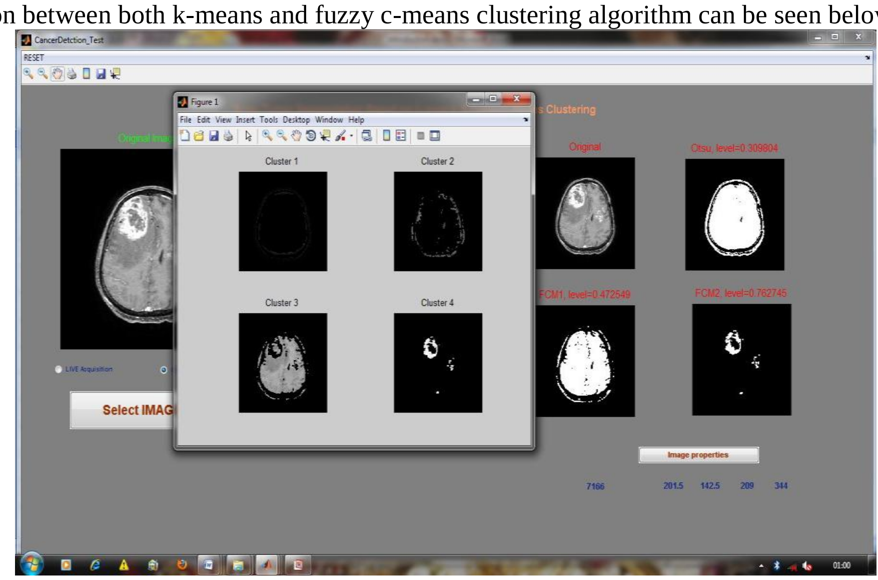

Figure 4 Comparison of k-means and fuzzy c-means clustering

The detection of the tumour can be done by using the brain images which are present in database or by taking the real time image by connecting the scanner. After the execution of k-means clustering algorithm for the real time image, the output is as given below in **figure 5**

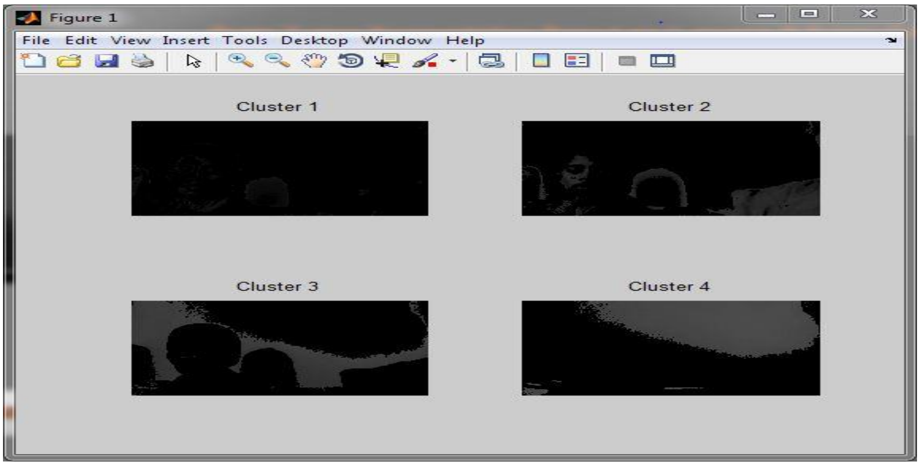

Figure.5 Output of k-means algorithm

After the execution of the fuzzy c-means clustering algorithm for the real time image, the output of the GUI with the area of the tumour is given below in **figure 6.**

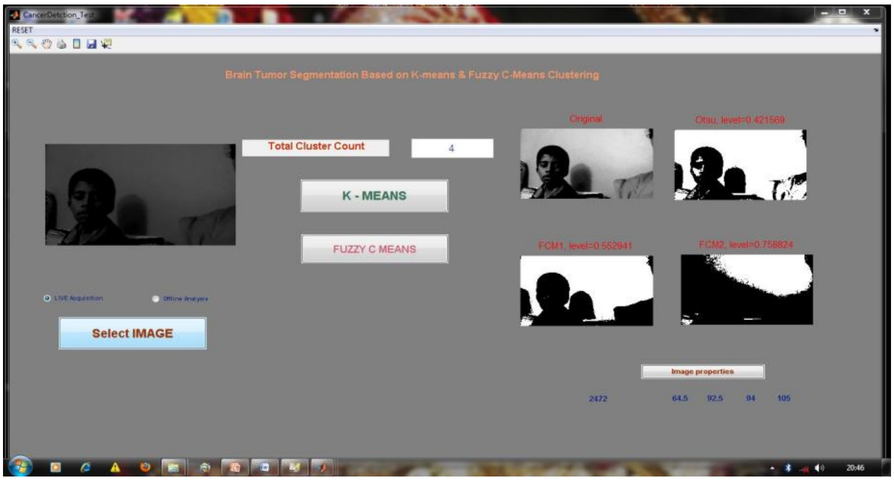

Figure 6 Output of fuzzy c-means algorithm

The comparison between both k-means and fuzzy c-means clustering algorithm for the real time image can be seen below in 7.

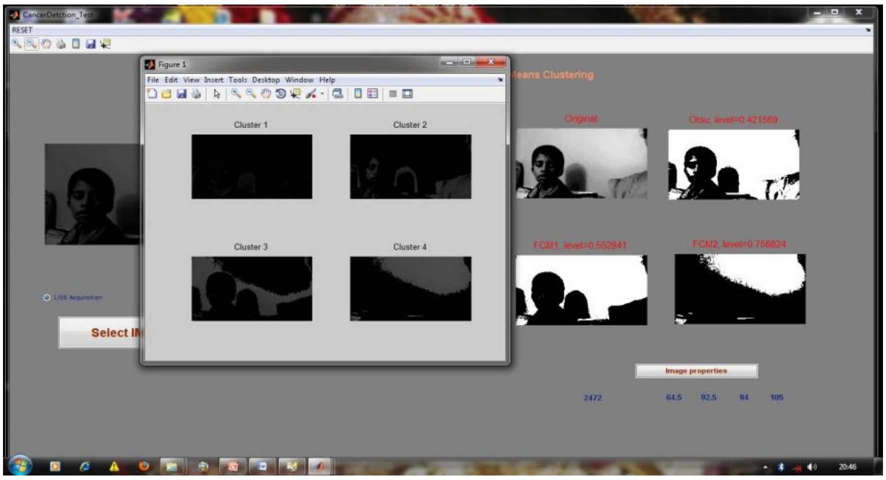

Figure.7 Comparison of k-means and fuzzy c-means algorithm for real time image

The proposed algorithm has been successfully implemented and tested using wide range of images. The algorithms are similar when compared to the time taken to segment the tumor. The tumor segmented using K-means clustering is faster and shows the tumor boundaries more prominently when compared to tumor segmented using Fuzzy C-Means clustering.

V. CONCLUSION

The main technique used was segmentation which is based on thresholding and morphological operators. Segmentation algorithms used were k-means and fuzzy c-means which made segmentation process easy. Samples of human brains were taken which were scanned by using MRI process and then processed through segmentation methods both k-means and fuzzy c-means clustering methods, thus giving efficient end result. After the detection of the tumour in given MRI image the area of the tumour is calculated. Proposed method is easy to execute with less execution time and thus can be managed easily.

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