

Detecting Brain Tumor using K-Mean Clustering and Morphological Operations

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Abstract:- Brain tumor is inherently serious and life-threatening problem because of its character in the limited space of the intracranial cavity (space formed inside the skull). Tumor is the one of the most common brain disease and this is the reason for the diagnosis & treatment of the brain tumor has vital importance. CT scan is the technique used to produce computerized image of internal body tissues. Cells are growing in uncontrollable manner this leads to mass of unwanted tissue that is termed as neoplasm. Normally the anatomy of the Brain can be viewed by the CT scan. It is not affect the human body. Because it doesn't use any radiation. In this paper we proposed segmentation of brain CT Scan Image using K-means clustering algorithm followed by morphological filtering which avoids the misclustered regions that can be formed after segmentation of the brain CT Scan Image for detection of tumor location.

Key Words: CT scan, Brain Tumor, Benign, Malignant, Preprocessing, Feature extraction.

1. INTRODUCTION

Image process could be a technique to convert a picture into digital kind and perform some operations on that, so as to induce AN increased image or to extract some helpful information from it. Image processing is widely used for diagnosis of diseases in agriculture as well as in biomedical. The main idea behind this paper is to study the design of a computer system able to detect the presence of a tumor in the digital images of the brain, and to accurately define its borderlines. Among different types of methods we focus on choosing appropriate method. Brain tumor is AN abnormal growth of cells within the bone. Normally the growth can grow from the cells of the brain, blood vessels, nerves that emerge from the brain. There are 2 kinds of growth that are benign (non-cancerous) and malignant (cancerous) tumors. The former is delineate as slow growing tumors which will exert doubtless damaging pressure however it'll not unfold into close brain tissue. However, the latter is delineate as fast growing growth and it's ready to unfold into close brain. Tumors will injury the conventional brain cells by manufacturing inflammation, exerting pressure on parts of brain and increasing pressure within the skull. In this project, CT SCAN scan images are used for the analysis. CT SCAN is a very powerful tool to diagnose the brain tumors. It gives pictures of the brain and requires no radiation. The noninheritable image is analyzed mistreatment image process strategies. Image segmentation and bunch

procedure are introduced to estimate the world of the growth.

1.1 STRUCTURE OF BRAIN

The human brain is that the central organ of the human system and with the medulla spinalis makes up the central system. The brain is protected by the os, suspended in liquid body substance, and isolated from the blood by the blood-brain barrier. However, the brain continues to be prone to injury, disease, and infection. Generally, human brain includes three major parts which controls different activities of human.

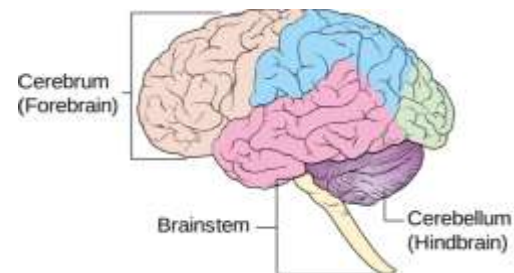


Fig - 1.1: Structure of Brain

1.1.1 Cerebrum

The neural structure is connected by the brain stem to the neural structure. The brain stem consists of the neural structure, the pons, and therefore the bulb. The neural structure controls learning, thinking, emotions, speech, drawback determination reading and writing. It has divided into right and left cerebral hemispheres of the brain. Muscles of left aspect of the body management by right cerebral hemispheres and muscles of right aspect of the body management by left cerebral hemispheres.

1.1.2 Cerebellum

The neural structure controls movement, standing, balance and sophisticated actions. The neural structure is connected to the neural structure by pairs of tracts. Within the neural structure is that the cavity system, consisting of 4 interconnected ventricles during which humor is made and circulated.

1.1.3 Brain stem

The brain stem, resembling a stalk, attaches to and leaves the neural structure at the beginning of the neural structure space. The brain stem includes the neural structure, the pons, and therefore the medulla. Behind the brainstem is the cerebellum. Brain stem joints the brain with spinal cord. Brain stem controls blood pressure, body temperature and breathing and controls some basic functions Fig.1.1 Indicate the brain structure.

1.2 CT SCAN

An X-raying scan (CT or CAT scan) uses computers and rotating X-ray machines to make cross-sectional pictures of the body. These pictures offer additional elaborate data than traditional X-ray pictures. They can show the soft tissues, blood vessels, and bones in varied elements of the body. A CT scan may be used to visualize the head, shoulders, spine, heart, abdomen, knee, and chest.

During a CT scan, you dwell a tunnel-like machine whereas the within of the machine rotates and takes a series of X-rays from totally different angles. These footage square measure then sent to a laptop, where they're combined to create images of slices, or cross-sections, of the body. They may even be combined to supply a 3D image of a selected space of the body.



Fig-1.2: Structure of CT scan Machine

2. LITERATURE REVIEW

Rohini Paul Joseph, C. Senthil Singh, M.Manikandan proposed segmentation of brain CT SCAN image using K-means clustering algorithm followed by morphological filtering which avoids the misclustered regions that can inevitably be formed after segmentation of the brain CT SCAN image for detection of tumor location. In this paper they use the different morphological operations like opening and closing which remove the misclustered regions. [1]

Alan Jose, S.Ravi, M.Sambath describe the Pre-processing, segmentation using k-means and fuzzy c-means, and approximate reasoning .preprocessing is done by filtering filtering, Segmentation is done by advanced K-means algorithm and fuzzy c means algorithm. Approximate

reasoning method is used to recognize the tumor shape and position in CT SCAN image using edge detection method. This methodology scans the RGB or grayscale, converts the image into binary image by binarization technique and detects the edge of tumor pixels in the binary image. Also, it calculates the size of the tumor by calculating the number of white pixels (digit 0) in binary image. [2]

Ms.Chinki Chandhok, Mrs.Soni Chaturvedi, Dr.A.A Khurshid presents a new approach for image segmentation by applying k-means algorithm. This paper uses color-based segmentation method that uses K-means clustering technique. They provide a standard K-Means algorithm produces accurate segmentation results only when applied to images defined by homogenous regions with respect to texture and color since no local constraints are applied to impose spatial continuity. [3]

M. Sasikalal and N. Kumaravel provided brief overview under the subject of comparison of feature selection technique for detection brain images. This paper presents and compares feature selection algorithms for the detection of tumor in brain images. Texture options square measure extracted from traditional and growth regions (ROI) victimisation spacial grey level dependence methodology and moving ridge remodel. The feature optimization problem is addressed using a genetic algorithm (GA) as a search method. [4]

3. PROPOSED SYSTEM

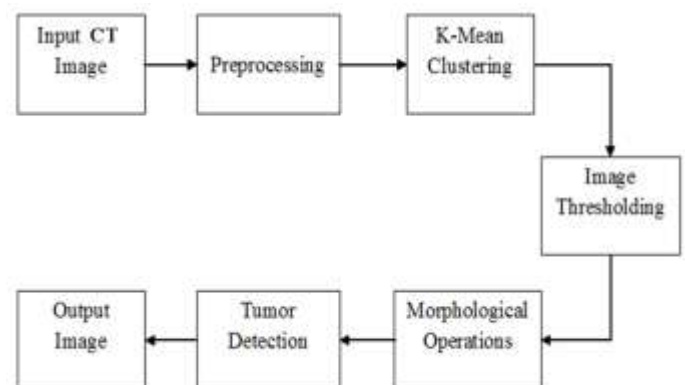


Fig-3: Block Diagram of Proposed System

3.1 Input CT Scan Image:

The CT SCAN Image represents white and grey color pixel elements. White color pixel data points are related to tumor cells and the Graycolor pixel data points relate to normal cells. This Image is normally RGB image, converted it in to Gray Scale image. Normally, the anatomy of tumour will be examined by. CT scan provide accurate visualize of anatomical structure of tissues.

- **Feature Extraction-**

The feature extraction is extracting the cluster. The extracted cluster is given to the edge method. It applies a binary mask over the complete image. In the approximate reasoning step the neoplasm space is calculated mistreatment the binarization technique. It makes the dark component become darker and white become brighter.

- **Sobel Operator-**

The Sobel operator is associate algorithmic rule for edge detection in pictures. It's a very important a part of sleuthing options and objects in a picture. Simply put, edge detection algorithms. Help North American nation to see and separate objects from background, in a picture. The Sobel operator calculates the approximate image gradient of each pixel by convolving the image with a pair of 33 filters. These filters estimate the gradients within the horizontal (x) and vertical (y) directions and therefore the magnitude of the gradient is solely the add of those two gradients.

- **Vertical Gradient-**

When we mask on the image it prominent vertical edges. It merely works like as 1st order derivate and calculates the distinction of picture element intensities in an exceedingly edge region. As the center column is of zero therefore it doesn't embody the first values of a picture however rather it calculates the distinction of right and left picture element values around that edge. Also the middle values of each the primary and third column is two and -2 severally. This offer a lot of weight age to the picture element values round the edge region. This will increase the total edge intensity and it become enhance comparatively.

- **Horizontal Gradient-**

This mask can outstanding the horizontal edges in a picture. It conjointly works on the principle of higher than mask and calculates distinction among the constituent intensities of a selected edge. In the center row of mask is consist of zeros so it does not include the original values of edge in the image but rather it calculate the difference of higher than and below constituent intensities of the actual edge. Thus increasing the fulminant modification of intensities and creating the sting additional visible.

- **Median Filter-**

Median filter is used for removing noise from an image. The median filter may be a nonlinear digital filtering technique, is usually accustomed take away noise. Median filtering is wide employed in digital image process as a result of, underneath sure conditions, it

preserves edges whereas removing noise. The median filter is generally accustomed scale back noise in a picture, somewhat just like the, mean filter. The median should truly be the worth of 1 of the pixels within the neighbourhood, the median filter doesn't produce new impossible component values once the filter straddles an edge.

3.2 k-mean clustering-

We are using k-means clustering to segment the brain tumor CT SCAN image. In this method, we are grouping the data and to select the mid value, then we are cluster the data in k-means cluster the grouping data are also present in another group of data, but fuzzy and c-means method it is not possible to group same data present in another cluster so By avoiding fuzzy c-means and c-means clustering algorithm, instead we used k-means clustering method. It produce good result in segmentation techniques.

3.3 Image Thresholding-

Image thresholding is the simplest non-contextual segmentation technique. With one threshold, it transforms a greyscale or color image into a binary image thought of as a binary region map. The binary map contains 2 probably disjoint regions, one in all them containing pixels with input file values smaller than a threshold and another concerning the input values that are at or above the threshold. The former and latter regions are sometimes labeled with zero (0) and non-zero (1) labels, severally.

3.4 Morphological Operations-

Morphology chiefly deals with the contour and structure of the item. So this is often accustomed perform object extraction, noise removal procedure etc. For identical purpose we have a tendency to are applying these operations to reinforce the item boundary and to get rid of the noise from the image.

3.5 Tumor Detection-

Detection of brain tumor is incredibly common fatality in current situation of health care society. Here we have used CT SCAN (magnetic resonance imaging) which has become a particularly useful medical diagnostic tool for diagnosis of brain and other medical images. In this step we detect a tumor. K-means clustering and morphological operation techniques are used to detect tumor in CT SCAN of brain images.

3.6 Output Image-

Output image is output representation of CT SCAN input image which show the result of the given input.

4. OBJECTIVE

Brain tumor analysis is finished by doctors however its grading provides totally different conclusions which can vary from one doctor to a different. So for the ease of doctors, a research was done which made the use of software with segmentation methods, which gave the segment of brain and brain tumor itself. Medical image segmentation had been a significant purpose of analysis, because it transmissible advanced issues for the correct diagnosing of brain disorders.

5. METHODOLOGY

The Methodology used here to extract brain tumor from CT SCAN Images are as follows:

Step 1: Input RGB CT SCAN images are taken.

Step 2: Pre-processing:-

- i. The RGB image is converted to grayscale image.
- ii. Noise is removed by using median filter.
- iii. Enhancement of image is done by using high-pass filter.

Step 3: Application of K-Mean Clustering algorithm.

Step 4: Thresholding of image.

Step 5: Morphological Operations are performed such as erosion and dilation.

Step 6: Detection of the Tumor Portion from the image.

6. RESULT ANALYSIS

We have implemented K-Means Algorithms in MATLAB to estimate the presence and position of tumor. The proposed K-Means algorithm has shown better results than the other methods and is able to optimize the computation time and hence improved the precision and enhanced the quality of image segmentation. Hence we concluded that using this algorithm computation time required gets minimized and it gives satisfactory result. The segmented image provides the clear picture about the affected portions. The area of the tumor and the location of the tumor is very important for treatment of the chemo therapy,

Here we have design GUI in MATLAB. By using this one can easily identify tumor in CT SCAN images. GUI makes system user friendly and anyone can easily access system using GUI.

In future one can extend this work for area calculation to determine stage of tumor. It will help doctors and radiologist for diagnosis. So that doctors can recognize Patient is going through which stage.

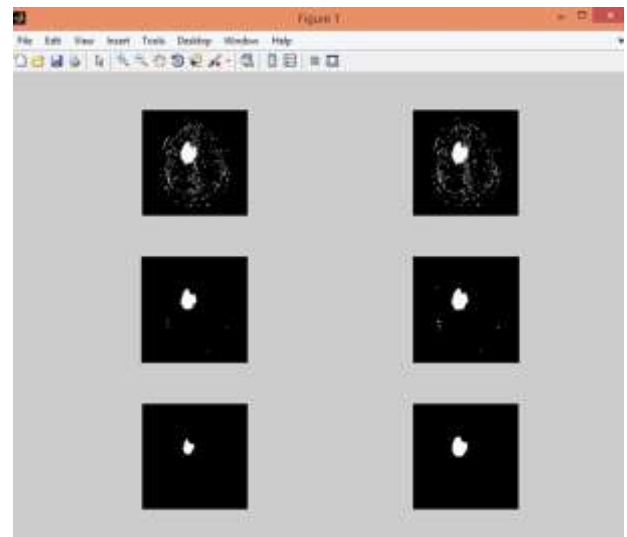


Fig-6.1: Result

7. CONCLUSION

By implementing proposed K-Means algorithms in MATLAB to estimate the presence and position of tumor. K-Means formula has shown higher results than the opposite strategies and is ready to optimize the computation time and thus improved the preciseness and increased the standard of image segmentation. Using this algorithm computation time required gets minimized and it gives satisfactory result. The segmental image provides the clear image concerning the affected parts. The area of the tumor and the location of the tumor is very important for treatment of the chemo therapy. We have design GUI in MATLAB. By using this one can easily identify tumor in CT SCAN images. GUI makes system user friendly and anyone can easily access system using GUI.

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