Implementing Tumor Detection and Area Calculation in Mri Image of Human Brain Using Image Processing Techniques

Article · May 2015

CITATIONS
9

READS
1,281

4 authors, including:

Sunil Bangare
K L University
30 PUBLICATIONS **86** CITATIONS

SEE PROFILE

S. T. Patil Patil
Vishwakarma Institute of Technology
26 PUBLICATIONS **47** CITATIONS

SEE PROFILE

RESEARCH ARTICLE OPEN ACCESS

Implementing Tumor Detection and Area Calculation in Mri Image of Human Brain Using Image Processing Techniques

Sunil L. Bangare, Madhura Patil, Pallavi S. Bangare, Dr. S. T. Patil
Research Scholar, Dept. of Computer Science & Engineering, K. L. University, Vijaywada, A. P., India
Dept. of Information Technology, Sinhgad Academy of Engineering, Kondhwa-Bk, Pune, Maharashtra, India
Assistant Professor, Dept. of Information Technology, Sinhgad Academy of Engineering, Kondhwa-Bk, Pune, Maharashtra, India
Professor, Dept. of Computer Engineering, Vishwakarma Institute of Technology, Pune, Maharashtra, India.

Abstract
This paper is based on the research on Human Brain Tumor which uses the MRI imaging technique to capture the image. In this proposed work Brain Tumor area is calculated to define the Stage or level of seriousness of the tumor. Image Processing techniques are used for the brain tumor area calculation and Neural Network algorithms for the tumor position calculation. Also in the further advancement the classification of the tumor based on few parameters is also expected. Proposed work is divided in to following Modules:
Module 1: Image Pre-Processing
Module 2: Feature Extraction, Segmentation using K-Means Algorithm and Fuzzy C-Means Algorithm
Module 3: Tumor Area calculation & Stage detection
Module 4: Classification and position calculation of tumor using Neural Network
Keywords: Magnetic Resonance Imaging (MRI), CT-Scan, Brain tumor, K-Means, Pre-Processing, Fuzzy C-Means, Thresholding, Neural Network

I. INTRODUCTION

Medical Image processing is an important filed of research as its results can be used for the betterment of health issues. This proposed work deals with the Brain tumor segmentation and its area calculation along with its classification using Neural Network. To capture the MRI image and CT scan are the available techniques. This work is based on the image MRI input image. CT Scan is having the drawback of radiation so this work is based on only MRI image. MRI technique is widely used in the Hospitals for diagnosis of diseases etc [1].

Image processing is having the power to perform a good research in this field of Medical Sciences.

II. MOTIVATION

J. Selvakumar et al have given in their work that Tumor is due to the uncontrolled growth of the tissues in any part of the body. The tumor can be at Origin or it can be spread at another location. Brain tumor affects CSF (Cerebral Spinal Fluid). It causes for strokes. The physician gives the treatment for the strokes rather than the treatment for tumor. So detection of tumors important for that treatment [1]. In this work Initial and Critical stages of the tumor will be identified along with its position and shape. Neural Network and Image processing is used for the implementing this proposed work.

III. EXISTING SYSTEM

J. Selvakumar et al have given in their work that The existing method is based on the

1. Thresholding: This method was not including the Spatial characteristics which are important for the malignant tumor detection. Also bit map images from 0 to 255 gray scale values were not involved and the tumor cells may were wrongly interpreted.

2. Region growing: This method is having problem of Seed selection and dependency on User interaction. It does not work for all types of images.

IV. PROPOSED SYSTEM

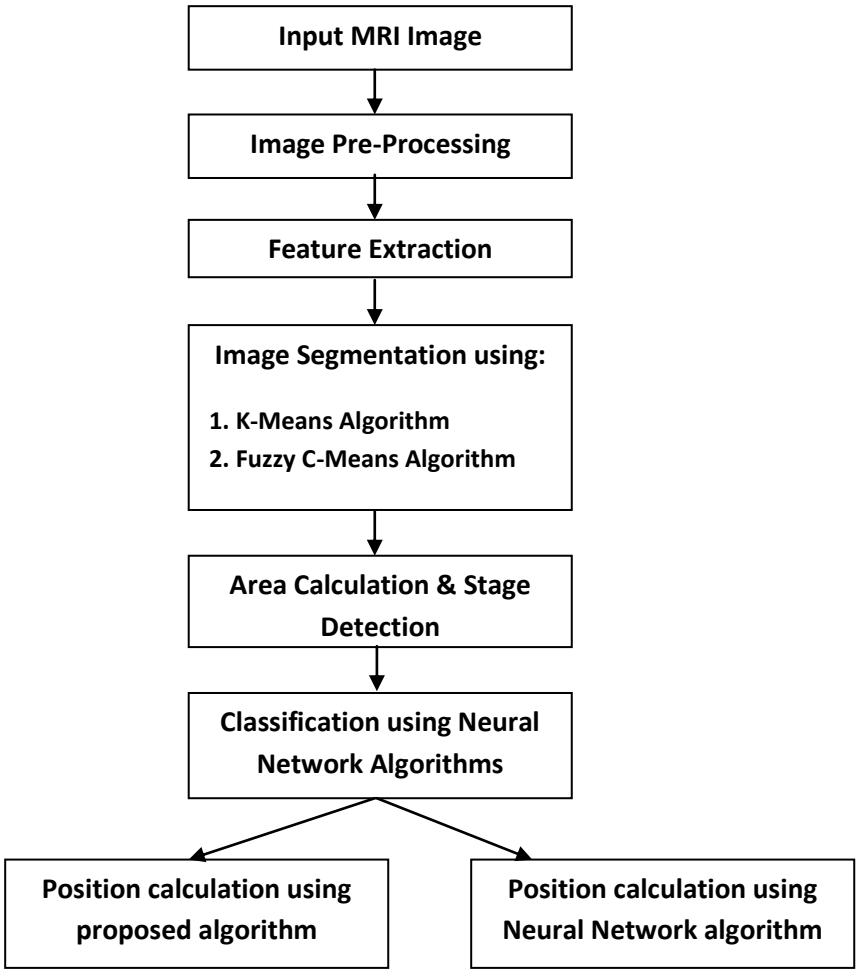

Fig.1: Proposed System

IV. MODULE DESCRIPTION

Module 1: Image Pre-Processing

Generally captured image is of poor quality so Image pre processing is required for Noise filtering in the image and also for sharpening the image. RGB to grey conversion and Reshaping is also done in this step. It includes median filter for noise removal. Image Pre-processing step is useful before going for the Segmentation of the image.

Module 2: Feature Extraction, Segmentation using K-Means Algorithm and Fuzzy C-Means Algorithm

The Feature extraction is extracting the cluster which shows the group of the abnormal tissues. The extracted cluster is given to the thresholding process it applies binary mask over the entire image which gives the output as dark pixel becomes darker and white becomes whiter.In threshold coding, each transform coefficient is compared with a threshold.

If (transform coefficient) < (threshold value) then the value assign to them is 0. In this case the it is treated as "Background" which will be neglected.

If (transform coefficient) > (threshold value) then the value assign to them is 1.In this case the it is treated as "Foreground" which will be highlighted.

Image segmentation is used to convert the image in to more meaningful image. The main objective of image segmentation is to extract various features of the images that may merge or split in order to build objects of interest on which analysis and interpretations Performed. Image segmentation is the process of partitioning an image into groups of pixels that are identical with respect to some criterion. The result of segmentation is the splitting up of the image into connected areas. Thus, segment is concerned with dividing an image into meaningful regions [2]. In this work the K-Means and Fuzzy C-Means algorithms are used for the segmentation. Both these algorithms are well known for the tumor Segmentation.

K-Means Algorithm:

K-Means is mostly used method based on the concept of Centroid.

The K-Means Algorithm Process:

1. The dataset is partitioned into K clusters and the data points are randomly assigned to the clusters resulting in clusters that have roughly the same number of data points.
2. For each data point:
   a. Calculate the distance from the data point to each cluster.
   b. If the data point is closest to its own cluster, leave it where it is. If the data point is not closest to its own cluster, move it into the closest cluster.
3. Repeat the above step until a complete pass through all the data points results in no data point moving from one cluster to another. At this point the clusters are stable and the clustering process ends.
4. The choice of initial partition can greatly affect the final clusters that result, in terms of inter-cluster and intracluster distances and cohesion [1] [5].

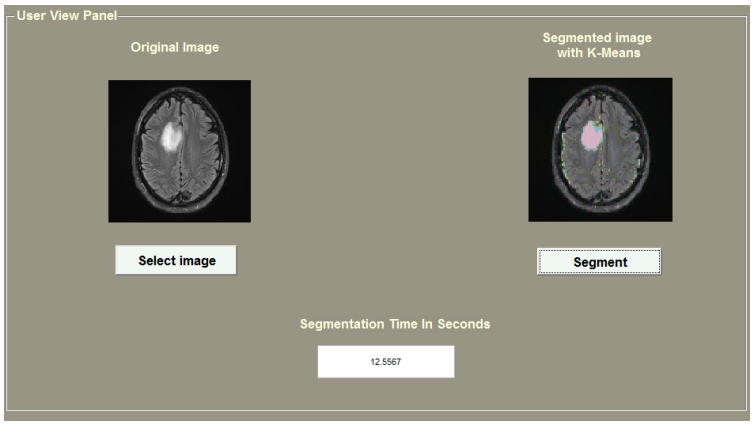

Fig.2: Pre-Processing and K-Means Algorithm output

Fuzzy C-Means Algorithm

The output of the K-Means algorithm is used as input to this Fuzzy C-Means algorithm. In Fuzzy C-Means a value is given to the each pixel in image, this value ranges from 0 to 1. Fuzzy clustering is basically a multi valued fuzzy set can also be member of other fuzzy sets in the same image.

Let $X = \{x_1, x_2, x_3 ..., x_n\}$ be the set of data points and $V = \{v_1, v_2, v_3 ..., v_c\}$ be the set of centers [1] [6].

1. Randomly select *'c'* cluster centers.
2. Calculate the fuzzy membership $'\mu_{ij}'$ using:

$$\mu_{ij} = 1 / \sum_{k=1}^{c} (d_{ij} / d_{ik})^{(2/m-1)}$$

3. Compute the fuzzy centers $'v_j'$ using:

$$v_j = (\sum_{i=1}^{n} (\mu_{ij})^m x_i) / (\sum_{i=1}^{n} (\mu_{ij})^m), \forall j = 1, 2, ...c$$

5. Repeat step 2) and 3) until the minimum *'J'* value is achieved or $||U^{(k+1)} - U^{(k)}|| < \beta$. Where, *'k'* is the iteration step.

'β' is the termination criterion between [0, 1]. *'U = $(\mu_{ij})_{n*c}$'* is the fuzzy membership matrix. *'J'* is the objective function.

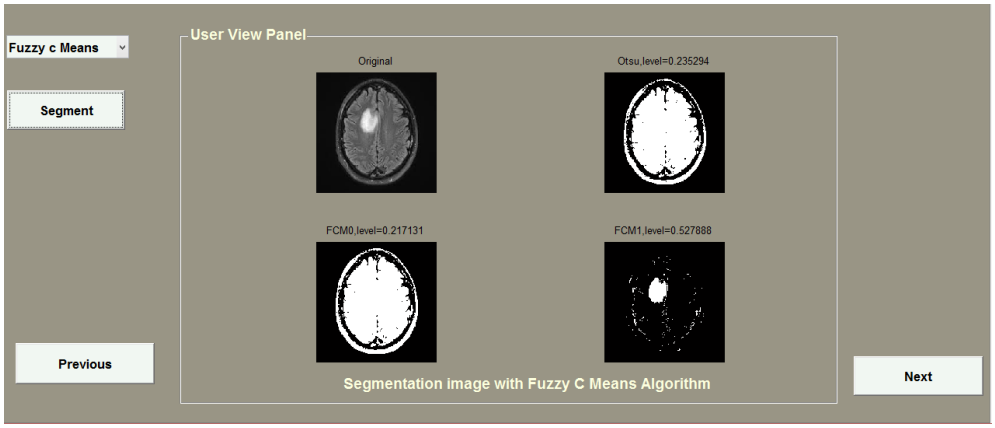

Fig.3: Fuzzy C-Means Algorithm output

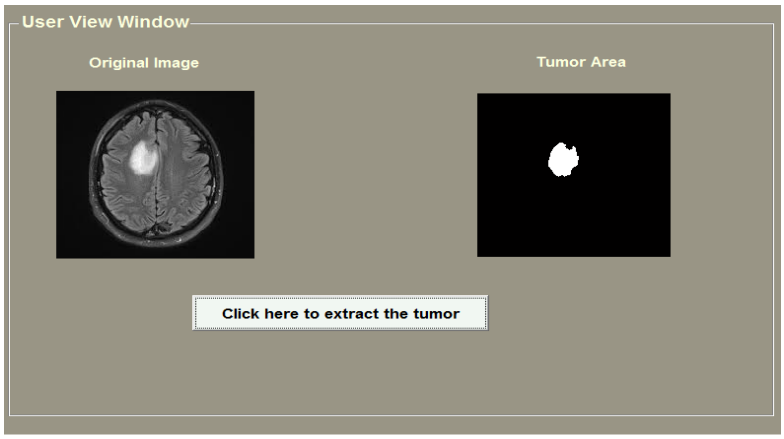

Fig.4: Tumor area output

Module 4: Tumor Area calculation & Stage detection

In this step the tumor area calculation using binarization method is done. That is the image having only two values either black (0) or white (1). Here 256x256 jpeg image is a maximum image size. The binary image can be represented as a summation of total number of white and black pixels [1].

$$\text{Image, } I = \sum_{w=0}^{255} \sum_{H=0}^{255} [f(0) + f(1)]$$

Pixels = Width (W) x Height (H) = 256 X 256

f (1) = white pixel (digit 1)
f (0) = black pixel (digit 0)
no_of_white_pixel, $P=\sum\sum[f(0)]$

Where,

P = number of white pixels (width*height)
1 Pixel = 0.264 mm
The area calculation formula is

Size_of_tumor_is, $S=[(\sqrt{P})*0.264]mm^2$

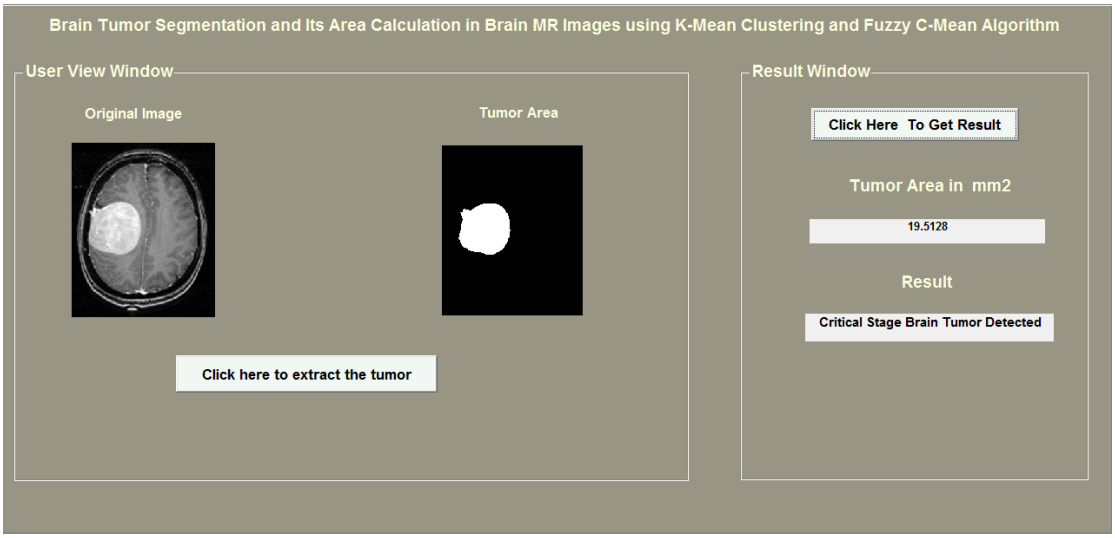

Fig.5: Tumor Area calculation & Stage detection output

Extra Module:

In this work we have created an additional facility for the doctors or patients who are users of this project to access the patient data like MRI image etc through 'Hospital Management System'.

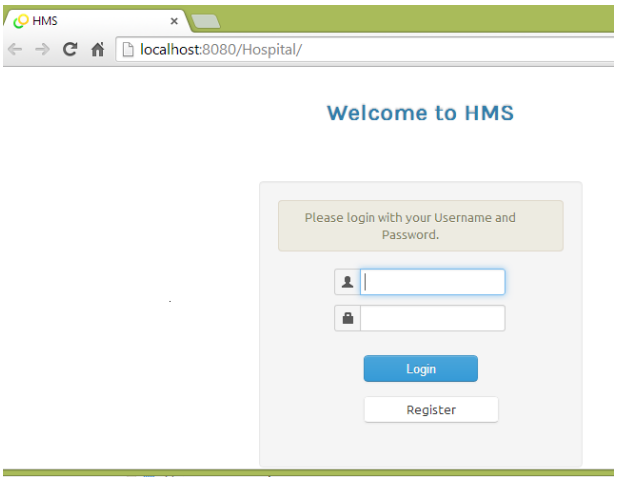

Fig.6 Login for HMS

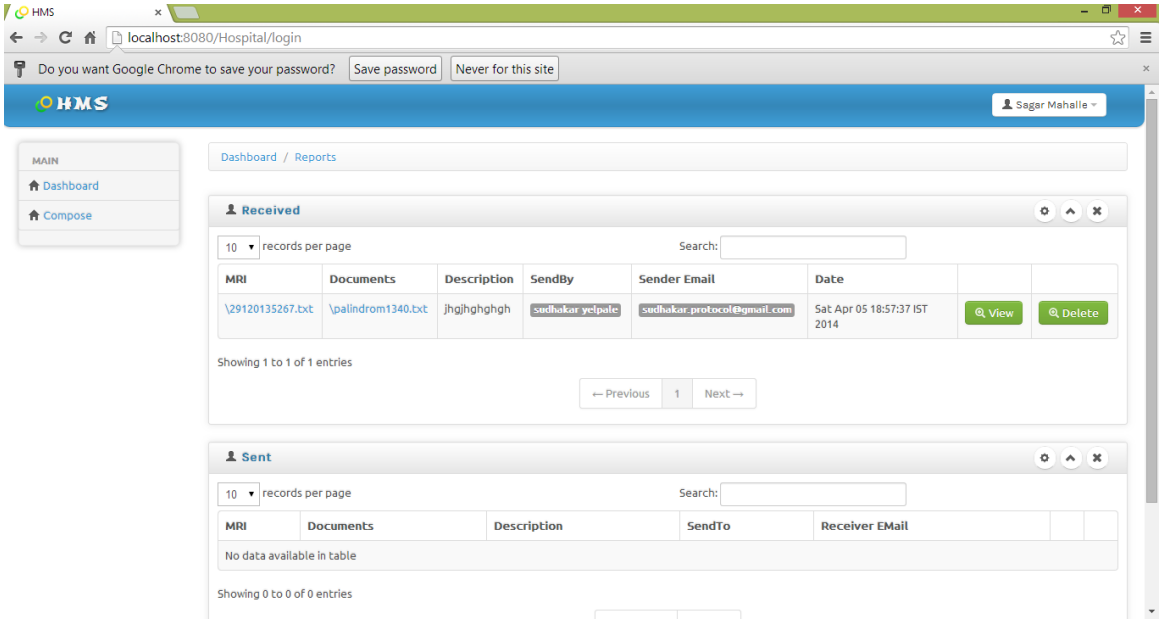

Fig.7 Screenshot of Dashboard required for HMS

V. Conclusion

In this research work K-Means and Fuzzy C-Means are used effectively to calculate the area and stage of brain tumor. Also these algorithms have overcome the drawbacks of thresholding and region growing algorithms. The output of the K-Means algorithm is used as input for the Fuzzy C-Means which leads to accuracy of edge of the tumor. This work shows that the image processing can be used in the Medical imaging field.

In the next manuscript the classification using neural network will be provided.

References

[1] J. Selvakumar, A.Lakshmi, T. Arivoli, "*Brain Tumor Segmentation and Its Area Calculation in Brain MR Images using K-Mean Clustering and Fuzzy C-Mean Algorithm*", IEEE-International Conference On Advances In Engineering, Science And Management (ICAESM -2012) March 30, 31, 2012, ISBN: 978-81-909042-2-3 ©2012 IEEE

[2] S. Valarmathy, R. Ramani, Dr. N. Suthanthira Vanitha, "*A Survey of Recent Image Segmentation Techniques for MRI Brain Images*", ISSN: 0976-8491 (Online), IJCST Vol. 4, Iss ue 1, Jan - March 2013

[3] Dr.S.K.Bandhyopadhyay and Tuhin Utsab Paul, " *Segmentation of Brain MRI Image – A Review*", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 2, Issue 3, March 2012 ISSN: 2277 128X

[4] M. M. Ahmed, D.B. Mohammad, "*Segmentation of Brain MR Images for Tumor Extraction by Combining K-means Clustering and Perona-Malik Anisotropic*

Diffusion Model", International Journal of Image Processing (IJIP), Book: 2008 Volume 2, Issue 1, Publishing Date: 28-02 - 2008, Proceedings ISSN (Online): 1985-2304.

[5] http://www.improvedoutcomes.com/docs/WebSiteDocs/Clustering/K-Means_Clustering_Overview.htm

[6] https://sites.google.com/site/dataclusteringalgorithms/fuzzy-c-means-clustering-algorithm

[7] S. L. Bangare, P. S. Bangare, S. T. Patil, T. V. Rao, "*Various Image Segmentation Techniques- focusing on Brain MRI Images - A Review*", National Conference on Latest Trends in Electronics & Telecomm. (NCLTE-2013).