REVIEW ON DETECTING BRAIN TUMOUR USING CLUSTERING APPROACH

Archana D A[1] **Dr Chidananda Murthy M V[2]** **Dr M Z Kurian[3]**

Publication
Tumbe
Group of International Journals
A Peer Reviewed Multidisciplinary Journal

Volume - 5 ; Issue – 1
January - April : 2022
ISSN : 2581-8511
Pages : 9 - 14
Article ID : TUMBE050102

Author/s

[1]M.Tech Student, Dept of ECE,
Sri Siddhartha Institute of Technology,
Tumkur, Karnataka, India
archanashetty977@gmail.com

[2]AssociateProfessor, Dept of ECE,
Sri Siddhartha Institute of Technology,
Tumkur, Karnataka, India
chidanandamurthymv@ssit.edu.in

[3]HOD, Dept of ECE,
Sri Siddhartha Institute of Technology,
Tumkur, Karnataka, India
mzkurianvc@yahoo.com

Abstract

Image segmentation place prominent role in image processing and computer vision disciplines. It means that process of segregating a digital image into multiple non-overlapping regions. There are so many image segmentation techniques like edge base, clustering and region based segmentation technique. Although of the variety of image segmentation techniques, still the selection of an appropriate technique for a special type of images is a most difficult task. Not all techniques are appropriate for all types of images. The main obstacle in segmentation algorithms is the difficulty of balancing the over-segmentation and under-segmentation. But still medical image segmentation is one of hot research topic in research area. Though it's quite challenging problem because of images with poor contrasts, noise, and missing or diffuses boundaries. The magnetic resonance images (MRI) scan is comfortable for diagnosis. It will not upset the human body because it uses magnetic field and radio waves and it doesn't use any of the radiation which is harmful.

Keywords: Segmentation, clustering, MRI

ISSN: 2581-8511 Volume-5(1)2022

INTRODUCTION

Brain is an organ which acts as master of each individual; any malfunction of brain may leads to serious hazardous to lead a life. One of the major diseases related to brain is brain tumor. A brain tumor means it is considered as unusual progression of the cells inside the brain. Brain tumors are of two types i.e., primary and secondary. Primary tumors are again classified as benign and malignant tumors. Benign tumors can be removed easily as they usually have a border or an edge. Malignant tumors are more serious as they grow rapidly in crowd and also occupy the nearby healthy tissue. Physician will usually concentrated in treating strokes not in dealing with tumor. As a result tumor detection plays very vital role in diagnosing of brain tumor. It is possible to augment the lifespan of the brain tumor affected patient if it is detected as early as possible. Hence the development of a proficient medical image segmentation technique is evolved with the benefits of least possible user interaction, fast computation, accurate, and robust segmentation results will help physicians to diagnose precisely. The most extensively used techniques in image segmentation are clustering techniques. Clustering means it is an unsupervised learning technique which requests the user to determine the number of clusters in advance to categorize the pixels. Thus, the cluster can be defined as it is a collection of similar pixels and it is dissimilar to the pixels which are belonging to other clusters. Clustering techniques carried out by performing clustering in 2 methods, either by partitioning method or by grouping similar pixels.

In any living organisms it is very much necessary to control and co-ordinate overall body parts. To do this each individual has a brain. Brain acts as master to all other organ systems, if it undergoes to any of the disorder then it will leads to critical condition. Among those brain tumor is one of the dangerous disorder.

A brain tumor, in generally called as an intracranial tumor. In other words it is a condition of growing abnormal cells and then starts to multiply uncontrollably, apparently unchecked by the mechanisms that regulate normal cells. Till now it’s clear that there are more than 150 different types of brain tumors are been characterized, but the two main types of brain tumors are named as primary and metastatic. [1]

Primary brain tumors are characterized based on its spreading i.e., it will originate from the tissues present in the brain or the brain's immediate surroundings. Primary tumors are again classified as glial which means that they are composed of glial or non-glial i.e., they are grown on or in the brain, including nerves, blood vessels and glands and then benign or malignant.

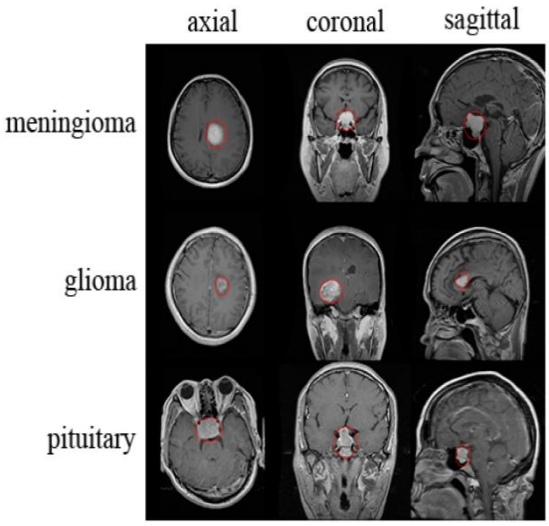
Metastatic brain tumors are characterized into another type of brain tumor since it arises anywhere in the body (may be in the breast or lungs) and then they move on to the brain, via bloodstream. Metastatic tumors are recognized as cancer which is malignant in nature.

The World Health Organization (WHO) has evolved a grading system that indicates a tumor's malignancy or benignity formulated on its histological features seen under a microscope.

- Most malignant
- Rapid growth, aggressive
- Widely infiltrative
- Rapid recurrence
- Necrosis prone

Symptoms [2]

- Patient feels migraine especially in the morning or at night time.
- Seizures or convulsions.
- Patient faces obstructive in thinking, speaking or pronouncing.
- Variation in personality.
- Weakness or paralysis in either side of the body.
- Vision fluctuations.
- Hearing deviations.
- Facial impassiveness.



- Nausea or vomiting, difficulties in swallowing.
- Confusion and disorientation.

Image courtesy by MDPI

Diagnosis

Brain tumors are easy to find by using well defined imaging techniques. Those imaging techniques are computed tomography scan in simple words CT scan and magnetic resonance imaging scanning (MRI). Except this other MRI sequences will aid the surgeon to plan assist

in surgeon to segment the tumor which is basically depends on the location of the normal nerve pathways of the brain. Intraoperative MRI is also implemented in the course of surgery to guide the tissue biopsies and tumor exclusion. It is common to use Magnetic resonance spectroscopy (MRS) because it inspects the tumor's outline and thus defines the nature of the tumor seen in MRI. Along with that Positron emission tomography (PET scan) will be used to detect recurrent brain tumors.

RELATED WORKS

1. K-Medoids clustering

K-Medoids algorithm is also known as partitioning around medoid algorithm. Initially it was proposed by Kaufman and Rousseeuw in 1987. Medoid is a point in any cluster whereas the dissimilarities with other points present in that cluster must be as less as possible. To achieve this clustering it is necessary to initiate the algorithm with all necessary requisites [3].

Algorithm:

- At first, there is need of selecting ‘k’ random points among the available ‘n’ data points by the name called medoids.
- After that, assigning each data point to the nearest medoid by using any of the distance measurement techniques.
- For the given medoid, if the data point to other nearest medoid. Again it is necessary to recalculate the cost of medoid.
- If the total cost is more when compared to previously calculated cost then re-swapping is needed.

As K-Medoids algorithm is simple to understand also it is easy to implement so it is used in medical image segmentation. But K-Medoids algorithm is not much applicable to cluster non-spherical or irregular objects. Also the results will keep on varying on applying same dataset repeatedly. Since the medoids are selected randomly at first.

2. Spatial Fuzzy C means clustering

If the Fuzzy C means is combined with the spatial constraints then the resultant algorithm is suitable for image segmentation process. It is effective because the SFCM algorithm utilizes fuzziness to cluster each pixel and also it exploits the information related to spatial context. But this spatial context can raise its sensitivity into some sort of noise up to some extent. Spatial is one type of function which integrates the membership function of each pixel with some considerations. This method produces the regions into homogeneous region also it reduces noise. This technique is recognized because it works well with noisy image while segmenting the image. SFCM algorithm can be applied to both singular feature data image and multiple feature data embedded with spatial information [4][5]. One of the brain tumor images is used as input to Spatial Fuzzy C means algorithm and the result shown below.

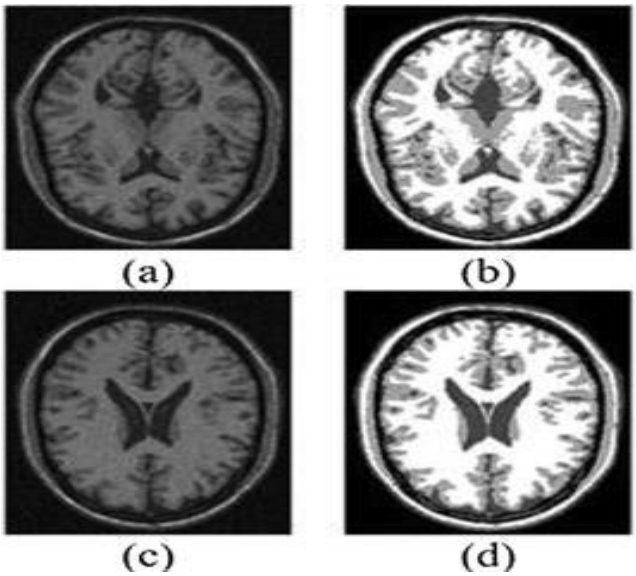


Image by Egyptian informatics journal

In above figure (a) and (d) shows the original MR image with some noise, (b) and (c) shows SFCM clustered image.

3. Fuzzy K-C means Clustering

Fuzzy K-C means algorithm is one type of hybrid clustering algorithm where it involves some of the properties from Fuzzy C means and K-Means algorithm [6]. This algorithm involves various steps they are as follows.

- At first the MR image is taken and then number of iteration required will be identified.
- Using distance checking methods number of iterations is minimized.
- Then the image size is calculated.
- If the possible distance is achieved then the repeating structure is reduced.

One of the brain tumor images is used as input to Fuzzy K-C means algorithm and the result shown below.

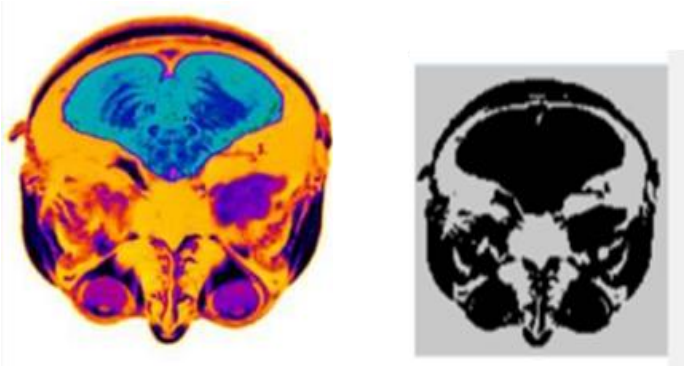


Image courtesy by IISTE

First image is input image and latter image shows the Fuzzy K-C means clustered image.

There are various clustering techniques to cluster the image properly. Also every clustering technique has its own advantages and limitations. Based on the information to be extracted, the appropriate clustering technique can be selected.

REFERENCES

[1] Patient health and care, Brain tumour disease and condition, Accessed 06 Aug 2021, <https://www.mayoclinic.org/diseases-conditions/brain-tumor/symptoms-causes

[2] Brain tumour symptoms and signs, Accessed on September 2021, https://www.cancer.net

[3] K-Medoids clustering with solved example, Accessed 07 August 2020, https://www.geeksforgeeks.org/ml-k-medoids-clustering-with-example/

[4] Yanling Li, Gang Li, Fast Fuzzy C-Means clustering algorithm with spatial constraints for image segmentation, In: Zeng Z., Wang J. (eds) Advances in neural network research and applications. Lecture notes in Electrical Engineering, Vol 67. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-12990-2_49

[5] Keh-Shih Chuang et.al., Fuzzy C-Means clustering with spatial information for image segmentation, Computerized medical imaging and graphics, Vol 30, Issue 1, ISSN 0895-6111, https://doi.org/10.1016/j.compmedimag.2005.10.001

[6] Ajala Funmilola A, Fuzzy k-c-means clustering algorithm for medical image segmentation, Journal of Information Engineering and applications, ISSN 2225-0506, Vol 2, 2012.

[7] Yogeesh N, "Study on Clustering Method Based on K-Means Algorithm", Journal of Advances and Scholarly Researches in Allied Education (JASRAE),17(1),2020,2230-7540

[8] Yogeesh N, "Mathematical Approach to Representation of Locations Using K-Means Clustering Algorithm", International Journal of Mathematics And its Applications (IJMAA), 9(1), 2021, 2347-1557

[9] Yogeesh N, Dr. P.K. Chenniappan, "Illustrative study on intuitionistic fuzzy hyper-graphs and dual-intuitionistic fuzzy hyper-graphs", International Journal of Engineering, Science and Mathematics, 2(1), 2013, 255-264.