ISSN:0975-9646

Survey on Algorithms for Brain Tumor Detection

Priyanka Shah[1] , Manila Jeshnani[2] , Sagar Kukreja[2], Priyanka Ailani[2]

[1]*Assistant Professor, Department of Computer Engineering*
VESIT-Mumbai

[2]*Computer Engineering*
VESIT-Mumbai

***Abstract*—A tumor is said to be the growth in the abnormal tissue of the brain which causes damage to the functioning cells. Brain tumor detection is very difficult as there are many techniques available for it. Magnetic Resonance Imaging (MRI) is the active resource for detecting brain tumor. It is necessary to use technique which can give the accurate location and size of the tumor. There are various algorithms proposed for brain tumor detection, this paper presents a survey on the various brain tumor detection algorithms. It gives the existing techniques and what are the advantages and disadvantages of these techniques.**

***Keywords*—Brain tumor, MR Imaging (MRI),segmentation,K-means**

I. INTRODUCTION

Tumor is a mass of cell that is formed by accumulation of abnormal cells. The complex brain tumors can be categorized on the basis of their origin, growth pattern and malignancy. It can be detected as benign the non-cancerous or malignant the cancerous.

The diagnosis of brain tumor is difficult because of the diversity in shape, size and location in the brain. Medical imaging helps in the detection of tumor, there are various techniques available for this.We are taking Magnetic Resonance Imaging (MRI) into consideration.

MRI gives high quality images of the body parts and is often used while treating tumors. To detect the tumor area in the human brain, separation of cells from the nuclei is necessary which can be done by segmenting the image. There are different techniques and algorithms used for segmentation, so we will study some of the algorithms that are proposed for image segmentation.

This paper gives a review of various techniques and algorithms to detect brain tumor using segmentation of MRI images which includes

Now, let us discuss the various techniques of clustering and segmentation to detect brain tumor.

II. ALGORITHMS

A. K-means Clustering

It is one of the simplest learning algorithms to solve the clustering problems. It is an easy way to classify a given dataset through a number of clusters. The basic idea is to define k centroids, one for each cluster, they are determined using heuristics.

The steps for this algorithm as follows:

1. Define the number of cluster and the position of the centre is selected randomly for each cluster.
2. Assign a data point to the nearest centre of the cluster.
3. Calculate the cluster centres for receiving new data points.
4. Repeat the step 2 and 3 till convergence is met.
5. The distance function is

$$J = \sum_{j=1}^{k} \sum_{i=1}^{n} \left\| x_i^{(j)} - c_j \right\|$$

Where $\left\| x_i^{(j)} - c_j \right\|$ is the Euclidian distance between $x_i^{(j)}$ and the centre of the cluster c.

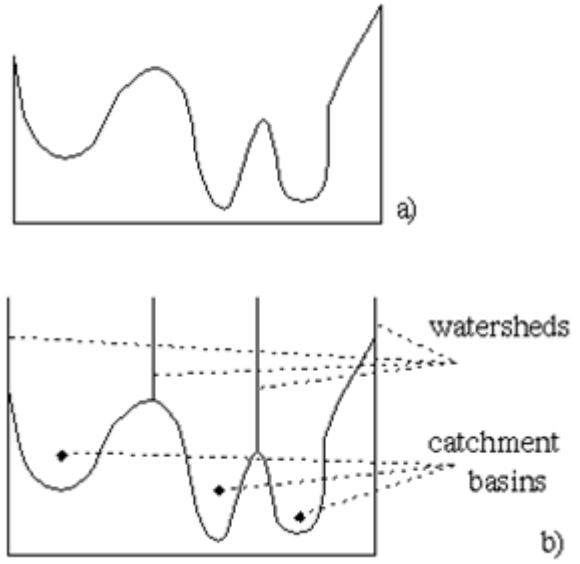
The advantage of this algorithm is that it runs efficiently on large datasets, it is simple, computational cost is low. It produces tighter clusters, especially in the cases where the clusters are globular. The disadvantage is that it will give different result every time the algorithm is applied. The value of k is difficult to predict.

B. Watershed Segmentation

Watershed segmentation is a gradient based segmentation, which considers the gradient map of the image. The main result we get from the watershed segmentation is the catchment basins and ridges which give a required result.

The steps involved in this algorithm are:

1. Read the input image.
2. Convert input image into grayscale image.
3. Compute foreground markers(connected blobs and pixels).
4. Compute background markers.
5. Compute the Watershed transform of the segmentation function.
6. Output image.



The above images clearly show the watersheds determined in the image along with the catchment basins.

The advantage of this algorithm is that it is easy to use, the results obtained are efficient and accurate. The disadvantage of this algorithm is that it gives over segmentation.

C. Fuzzy CMeans

Fuzzy clustering method is basically used for pattern recognition, classification and image segmentation. In the fuzzy algorithm the fuzzy set can be a shared set which means a member from one fuzzy set can belong to another set also. Each pixel of the image is given a partial membership value.

The steps included in the algorithm are as follows:

1. Select an image form the database.
2. Check whether the image is in grayscale, if not convert it into grayscale.
3. Covert the image into Double.
4. Predefine the number of clusters and iterations.
5. Convert the matrix of input image into a vector.
6. Select the k-cluster centre randomly.
7. Calculate the fuzzy centre using

$$R_i = \sum_{i=1}^{n} x_i \cdot M_{ij}^{m} / \sum_{i=1}^{N} M_{ij}^{m}$$

8. Using the distance formula, calculate the fuzzy membership function.

$$M_{ij} = \frac{1}{\sum_{k=1}^{c} \left(\left\| \frac{x_i - x_j}{x_i - c_j} \right\| \right)^{\frac{2}{m-1}}}$$

Repeat the steps 7 and 8 until a minimum value is achieved for

$$Ym = \sum_{i=1}^{N} \sum_{j=1}^{C} M_{ij}^{m} \|x_i - c_j\|$$

9. Stop if the condition is achieved.
   Terms used in the equation are:
   m :-any real number greater than 1
   x_i :-data measured in d-dimensional
   R_j :-centre of cluster
   M_{ij} :-degree of membership of x

The advantages of this algorithm are that it gives better results for overlapped datasets. It is better that k-means clustering. The disadvantages are that more number of iteration scan be used which will make it a longer process, it is sensitive to noise.

III. LITERATURE SURVEY

Algorithm	Pros	Cons
K-means algorithm	This method are deterministic nature, which makes it independent of cluster initialization, and the ability to identify nonlinearly separable clusters in input space	This variant has less computational savings,algorithm to graph partitioning needs further investigation and a comparison with spectral methods and other graph clustering techniques is required.
Fuzzy C Means Algorithm	Powerful unsupervised method for the analysis of data and construction of models	Not efficient Time consuming
Watershed Segmentation	Efficient and accurate. Process is divided in 2 parts, hence making it easier to use.	It gives over segmentation, which can be solved using topological gradient.

IV. CONCLUSION

This paper proposes the survey on the various algorithms that can b used for brain tumor detection. It focuses on the clustering and segmentation techniques. The selection of the algorithm will depend on the need of the user. K-means clustering algorithm can be used to classify the objects in an image. Watershed segmentation can be used for the tumor regions that have high intensity values. Fuzzy C means is used to track the tumor objects in MR images.

ACKNOWLEDGMENT

We are grateful to our mentor Mrs. Priyanka Shah for her constant support and guidance.

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'.

[2] Ashima Anand , Harpreet Kaur 'Survey on Segmentation of Brain Tumor: A Review of Literature'

[3] https://in.mathworks.com/help/images/examples/marker-controlled-watershed-segmentation.html#zmw57dd0e3714

[4]https://en.wikipedia.org/wiki/Watershed_(image_processing)

[5] Mr. Vishal Shinde, Miss. Priti Kine, Miss. Suchita Gadge, Mr. Shekhar Khatal 'Brain Tumor Identification using MRI Images'

[6] Jinal A. Shah , S. R. Suralkar 'Brain Tumor Detection from MRI Images using Fuzzy C-Means Segmentation'

[7] Niket Amoda , Ramesh K Kulkarni, 'Image Segmentation and Detection using Watershed Transform and Region Based Image Retrieval'