An Analysis on Brain Tumor Segmentation Techniques

Dr. Santosh Kumar Singh, Assistant Professor

Department of Health & Allied Science, Arka Jain University, Jamshedpur, Jharkhand, India

Email Id-dr.santosh@arkajainuniversity.ac.in

ABSTRACT: ***Medical image segmentation is the essential need for preplanning of surgical treatments that may assist the pathologists to complete effective surgical operations upon that human brain. In modern scenario brain tumor surgical procedures are advanced in the manual method on hospitals that consumes extra time. Manual brain tumor segmentation is laborious and much relies on the particular operator that may not really an advisable one. The research on brain tumor segmentation comprises of numerous articles relevant to tumor identification. There are number of techniques previously given for segmentation of brain tumor effectively. However it's still essential to detect the brain tumor using MR pictures. The segmentation procedure involves extraction of various tumor tissues including active, tumor, necrosis, and edema first from normal brain tissues. This research is a comprehensive review to evaluate the current five publications related to human brain tumor segmentation. This article examines them invariant possible methods to assist green researchers to choose their research topic.***

KEYWORDS: Brain Tumor, Diagnosis, Deep Learning, Magnetic Resonance Image, Segmentation.

1. INTRODUCTION

Brain tumor segmentation is a given to living creatures for preparation and planning their surgical procedures. The brain tumor illness is a hazardous disease for human life-cycle since it develops as a dominating disease in all over the globe. The sophisticated medical diagnostic method identifies the brain tumor in patients via MRI scanning, however in certain instances, the radiologist can't identify cancers even if they might be expert pathologist [1]. The major difficulties of brain tumor classification are its varied sizes, forms, and presentation in different places. The distortion of surrounding structures in the brain owing to mass effect or edema further complicates the brain tumor segmentation. The artifacts and noise are additional difficulties in brain tumor segmentation. For such segmentation pattern recognition method is frequently utilized. The tumor may be segmented as the segmentation of the tissues. The tumor mass impact may alter the normal tissues. The subdivision of gliomas is essential for therapy. Images may be checked by utilizing magnetic resonance imaging or Computed Tomography scan [2]. Accurate categorization of medical imaging is required for clinical diagnosis. Many articles are examined on this subject with answers but many of the researchers don't really know about which would be the greatest paper to begin their fresh study. This article proceeded with a solution to expand on the information about the latest state-of-the-art publications which may assist new researchers [3].

1.1. Brain tumor segmentation methods:

- Brain tumor recognition in fuzzy C-Means clustering using local information and kernel metric for picture segmentation.
- In this work, picture segmentation is done by utilizing Fuzzy C-Means Algorithm (FCMA) (FCMA). FCMA is excellent for noise-free pictures and BTS performance. FCMA divided into two components weighted fuzzy factor and kernel metric factor.
- By the balanced fuzzy relative importance index neighbor pixels may be calculated correctly. The input MR image is of 128 × 128 pixels. The kinds of the pictures include synthetic images, natural images, and medical images. To weight the pixel in two situations.

1.2. Multi-fractal texture estimation for detection and Segmentation of Brain Tumors:

This technique suggested a brain tumour MR Image texture. To assess a texture of brain cancer multi logarithmic resolution technique is developed. The pattern is developed that used a Multifractional Brownian Motion (MFBM) (MFBM). The drawback is atlas-based segmentation. The suggested segmentation technique is Discriminative Random Field (DRF) (DRF). By this technique multiscale picture and alignment of the imaging are segmented. Conditional Random Field (CRF) model has used for cascading the classification, each classification use set of characteristics[4]. Nonetheless, the suggested method explored to construct a statistical model for tissues. The new approach is initialized for boundary leakage artifacts. Standard Classification Forest (CF) and Random Forest (RF) method are utilized for Brain Tumor Segmentation (BTS) (BTS). For texture

feature extraction fractal analysis method has demonstrated a success rate. To choose various texture pattern Multi Fractional Brownian Motion (MFAM) method is provided. In this study, we present a Multi Fractural Dimension (MFD) for texture extraction and the intensity of the tumor and non -tumor tissues. AdaBoost (Adaptive Boosting) is the technique which is highly trained to enhance the texture of different patients. To improve the AdaBoost algorithm relies on the weight of the classifier. Tumor pictures show significant variety in their borders[5].

To identify the tumor edge is the difficult job in the medical profession. The binary picture is categorized into edema area then it is entered using the connected component method. So we develop the automatic segmentation method. To enhance the resilience multi-resolution framework are suggested. In current patch based method is utilized for picture extraction. In upcoming cubic patch based method may be utilized for MRI imaging. The LIP technique is used for numerically solving weight reconstruction. Many algorithms have been proposed to identify the brain tumor. Intensity-based technique, surface assessment method, asymmetric analysis, interactive algorithm, atlas-based method, supervised and unsupervised instructional methods. The benefit of this approach is to decrease computing cost; because multiresolution framework is integrated and enhances the resilience. It classifies the voxels for processing. Voxel-based is implemented for multi-core CPUs, thus, the processing time reduces. For evaluating the algorithm run on a single thread.

1.3. Segmentation of tumor and edema along with healthy tissues of the brain using wavelets and neural networks:

In this work, a segmentation method is tough to evaluate the tumor tissues and edema. We propose a novel Tissue Segmentation Algorithm. TSA identify the sick tissues and healthy tissues independently. We design an algorithm utilizing Self Organizing Map (SOM) (SOM). SOM algorithm segment edema, white matter, gray matter, and cerebrospinal fluid, the accuracy of white matter is 91 percent, gray matter is 87 percent, and cerebrospinal fluid is 96 percent. Input Gaussian filter to soften the picture. Configure a global given threshold for the intensity of the pixels. Convert black/white pictures using Otsu techniques. In adulthood, most of the instances glial tumor arises with a high death rate. Glial cells of the brain demonstrate the gradual development in healthy tissues. Picture segmentation is the process of separating the image into subclasses based on the feature enhancing background area. The input brain picture is of 512x512 sizes, computerized algorithm diagnoses the illness of the brain tissues and structure. In the case of glial tumor segmentation is a more laborious procedure to distinguish dead cells and active cells. Existing we utilize wavelets and SOM for segmentation. In proposed we segment healthy and diseased tissues[6].

The benefit is its tolerance fault and optimal searching. The non-linear filter is used to remove the noise. Skull stripping is the essential procedure to remove the non-cerebral tissue. SOM is being used for multilayer segmentation. SOM contains two layer input in the first layer and output in the second level. The result produced by the machine is compared manually chosen by the physician. The disadvantage discrete wavelet transform for the variation. The BRATS2012 dataset is utilized. In the hereafter, we can modify the form and model of the picture. In the upcoming, the segmentation ratio may be done correctly and efficient by altering the forms and models. During skull stripping IBRS data algorithm is employed. Skull stripping algorithm is created by a Brain Surface Extractor, Brain Extraction Tool.

1.4. Brain tumor segmentation using convolutional neural networks in MRI images:

In this work, we presented an automatic segmentation technique use of 3x3 kernels. The drawback is manual segmentation is needed if a variety of MRI image is utilized. The databases utilized is BRATS2013 which find the core and region of the dice. It is a difficult job for a dataset of BRATS2015. Neoplasm is classified into Low-Grade Gliomas and High-grade Gliomas. Nowadays therapy requires surgery, chemotherapy, and radiation. Several techniques utilize the parametric or non-parametric model of data. The tumor may be segmented like the contour of the tissue and forms of the tumor. The growth of the tumor is assessed by its bulk, better atlases surrounding voxels. Histogram-based estimate is utilized for segmentation of super voxel images.

Evaluation is done through usage of two-pathway networks one network is utilized for greater patches and the one for larger background view. Examine each component by analyzing increasing performance. CNN utilizes two layers for separation fully - connected layers and Sofmax layer. The outputs of the FC layer with Sofmax layer is separated by RF classifier. There in from before the step, MRI picture is adjusted by bias field distortion. The intensity of the tissues varies in pictures. By normalizing technique, we determine the intensity and standard deviation of the series of patches. Convolutional layer train the FC layers. Since the kernel is utilized for all the

pictures, various location of the same substance is detected. By the usage of kernel, neighborhood information is taken as context information. The foregoing are the collective data initialization, activating, grouping, Adjustment, decreased function, and data contribution. The suggested architecture adds additional layers and weight. To train the CNN Gradient optimization technique is utilized for MRI picture. Brain tumors are extremely varied in spatial location.

1.5. MRI brain image segmentation methods:

Purpose of this overview segment will provide systematic review on picture segmentation techniques. The primary aim is to illustrate benefits and limits of various methods [3]. Key image processing approaches for brain MRI image segmentation is categorized as thresholding, region-growing, clustering, soft computing, atlas-based, image/symmetry analysis, other methods etc. as can be seen in figure 1.

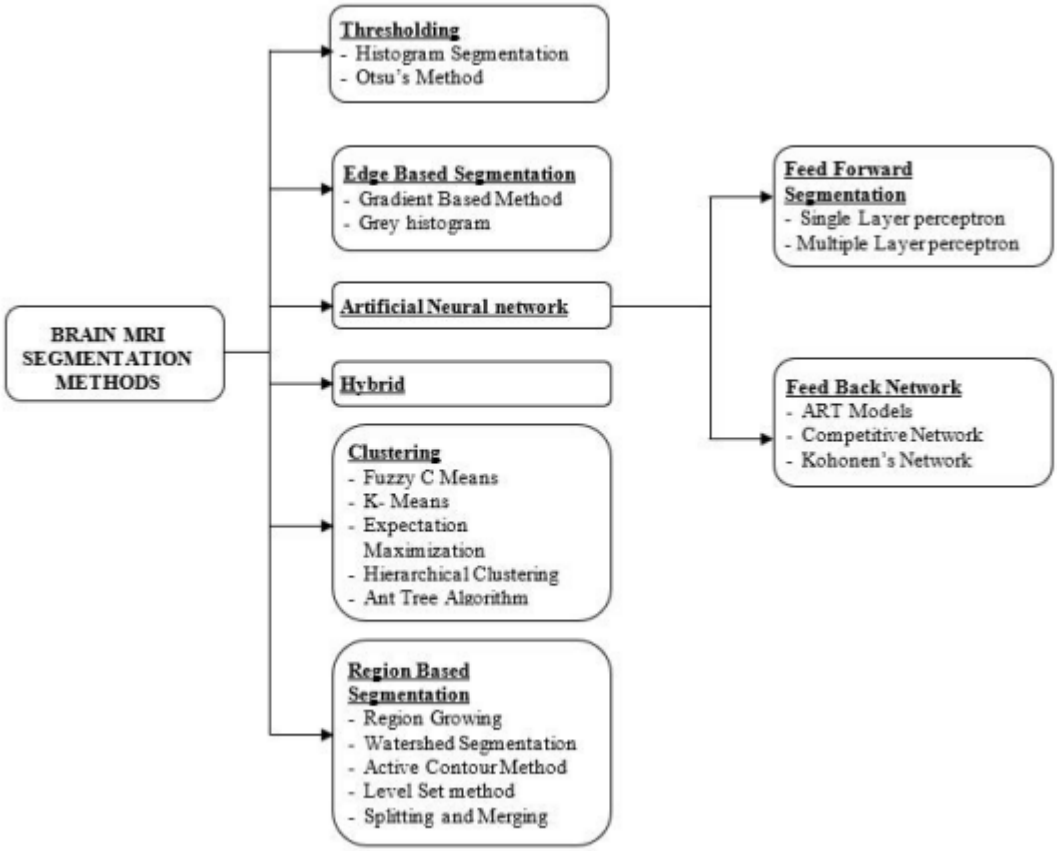

Figure 1: illustrate the different segmentation techniques for brain MRI images

• *Thresholding:*

Thresholding is among the most frequently used and oldest techniques for picture segmentation. In the process of thresholding, picture is required to be formed of areas and so these sections correspond to various ranges of gray scale. Histogram of picture is comprised of ridges and valleys, where every other peak symbolizes one area. The valley between the peaks indicates a threshold value. Histogram thresholding technique is based on a concept that splits the picture into two equal halves and histograms are compared to identify the tumor and cropping approach is used to determine a suitable physical dimension of brain tumor. The threshold method makes judgment depending on the particular raw pixel information. It assists in obtaining the main form of a picture, disregarding the small superfluous details [8].

• *Region-growing:*

In this method the pictures are partitioned by arranging the closest pixel of comparable type. It begins with a pixel (first seed) that has comparable characteristics. Accordingly the adjacent pixels depending on homogeneity criteria are added gradually to the seed. In splitting procedure, area becomes separated into supereons that don't meet a specified homogeneity criteria. Splitting and merging may be employed simultaneously and its performance mainly relies on the chosen homogeneity criteria. Without adjusting homogeneity parameters, the

seeded region growth method is controlled by a number of starting seeds. If the number of areas was roughly known & utilized it to estimate the associated parameters of edge detection.

• *Clustering:*

The technique of clustering arranges the items into groups depending on a few feature, attribute and feature. And therefore a cluster consists of groupings of related items. There are two kinds of clustering, supervised and unsupervised. In supervised type clustering, cluster criteria are provided by the user. In unsupervised type, the cluster criteria are determined by the clustering algorithm itself.

1) K-Means Clustering: K-Means Clustering divide the n observed into k clusters in which each specifically as it relates to the clusters by minimizing an objective function in a manner that within- cluster mean square error is get minimized. It begins with initial K cluster centers and it reallocates the observation to clusters due to the similarities between both the observations and cluster center. Automation of identification and segmentation of brain tumors in MRI images is a particularly difficult job owing to exposure to high level of gray-level similarity in the picture.

2) Fuzzy C-Means clustering: Fuzzy C-means (FCM) clustering is a data clustering technique in which each measurement belongs to the cluster to a degree defined by a membership value.

• *Soft-Computing:*

A self-organizing map (SOM) or self-organizing classification model is a kind of convolutional neural network for unsupervised classification. SOMs organize in training and mapping mode. Training method creates map utilizing vector quantization procedure and mappings automatically recognizes a new input vector. SOM map comprises of neurons or nodes. Self-organizing maps each of which are neurons connected with a weighting factor map input files vectors and location in the map space. The personality maps a higher level input space to a lower dimensional map space. Energy, entropy, contrast, mean, median, variance, correlation, maximum and lowest intensity data utilized to give precise description of tumor.

• *Image/Symmetry Analysis:*

Image/Symmetry Analysis is an interactively segmentation technique that in combination to area of the province and edge information utilizes previous knowledge, also its symmetry evaluation which is much more consistent in pathological situations. A theoretically simple supervised block-based, shape, texture; content based method has been utilized to analyze MRI brain pictures with significantly reduced computing needs. Classifying areas by means of their multipara meter readings makes the research of the districts of normal and pathophysiological interest simpler and more defined[9].

Munmun Saha studied the segmented is regarded as one of the key stage in image processing and it performs and vital part in image processing. It's really the technique of subdividing a picture into its component pieces. In this article we have examined different techniques of segmentation and also its use in medical image processing i.e. MRI picture Ultrasound Image etc., we have concentrated on Brain Tumor MRI image. Recent medical imaging research tackles the issue of identifying brain tumor via MRI (Magnetic Resonance Image) (Magnetic Resonance Image). There seems to be a significant variety in the appearances of tumor tissue among various patients and in many instances resemblance with the normal tissue. We have utilized MRI since it give precise visualization of anatomic structures of tissue. In this article different techniques that have been utilized for segments of MRI for identifying brain tumor is discussed[10].

Anjali Wadhwa studied the technique of segmenting tumor from MRI picture of a brain is one of the most targeted topics in the community of medical research since MRI is unobtrusive imaging. This article provides a comprehensive literature analysis of current techniques of brain tumor segmentation using brain MRI data. It covers the effectiveness and statistical analysis of state-of-the-art techniques. Different techniques of picture segmentation are briefly described with the latest input of different scholars. Furthermore, an attempt has been made to offer new aspects for readers to investigate the concerned field of research. Through the whole evaluation process, it has been concluded that the two of Conditional Random Field (CRF) with Fully Convolutional Neural Network (FCNN) and CRF with Deep Medic or Ensembles are more successful for the segment of tumors from either the brain MRI images.

2. DISCUSSION

According to the survey, the brain cancers most of time identified readily from brain MR imaging, but necessary degree of precision, repeatable segmentation, anomalies categorization is not predictable and simple. The segmentation of brain tumor is comprised of several phases. The manual method of performing the segmentation of brain MR images is highly time consuming and laborious job, and therefore it is linked with numerous difficulties. Therefore, we require automatic segmentation technique for brain pictures. There are various methods given to verify the effectiveness of automated computerized brain tumor identification for the medical purpose of analysis. Throughout this review article, our primary aim is to provide the review of various brain tumor segmentation techniques utilizing the MR images. The various techniques for segmentation are examined with their benefits and drawbacks in this article. In current days brain tumor surgical procedures are advanced in the manual method on hospitals that consumes extra time. Manual brain tumor segmentation is laborious and much relies on the particular operator that may not an advisable one. The literature on brain tumor segmentation comprises of numerous articles relevant to tumor identification.

3. CONCLUSION

This study examines the five techniques also including BTS-FCMLINN, BTS-MFTE, BTS-LIP, BTS-WT and BTS-CNN linked to brain tumor segmentation versus Segmentation-accuracy. This research successfully deals with the major contribution, benefit, and downside of the concerned 5 techniques. This research ultimately end-up with the result that the BTS-FCMLINN and BTS-WT techniques are superior for human brain tumor segmentation. Throughout this article we have examined the various elements of medical imaging particularly for the implementation of segmentation of brain tumor utilizing MRI. We have given the overview of various brain image segmentation techniques published thus far and, though too their benefits and drawbacks are addressed as comparative analysis. In addition to this we are providing the information about various types of MRI imaging datasets which are commonly utilized for research projects as well as performance assessment measures. For the future study we propose to provide more accurate, affordable as well as quicker technique for early identification and categorization of brain cancers. This investigation reproduces information among young researchers regarding which type of technique is the best option for tumor segmentation.

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