IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 9, Issue 6, June 2021

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.542

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.542 |

|| Volume 9, Issue 6, June 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0906019 |

Brain Tumour Segmentation Based on SFCM using Back Propagation Neural Network

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ABSTRACT: Data in MR images are blurred boundaries, tumour segmentation and classification is very hard because of high quality of image but automatic defects detection in MR images is important in many diagnostic and therapeutic applications. This work has introduced one automatic brain tumour detection method to increase the accuracy, yield and decrease the diagnosis time. The goal is classifying the tissues to three classes of normal, begin and malignant. In MR images, the amount of data is too much for manual interpretation and analysis. In past few years, brain tumour segmentation in Magnetic Resonance Imaging (MRI) has become an emergent research area in the field of medical imaging system. Accurate or exact detection of size and location of brain tumour plays a vital role in the diagnosis of tumour. The diagnosis method consists of four stages, pre-processing of MR images, feature extraction, and classification of tumour. The features are extracted based on Dual-Tree Complex wavelet transformation (DTCWT) after the histogram equalization of image. To classify the Normal and abnormal brain Back Propagation Neural Network(BPN) is used in the last stage. An efficient algorithm is proposed for tumour detection based on the Spatial Fuzzy C-Means Clustering(SFCM).

KEYWORDS: Brain tumor segmentation, Spatial Fuzzy C-Means Clustering (SFCM), Magnetic Resonance Imaging (MRI), Dual-Tree Complex wavelet transformation (DTCWT), Back Propagation Neural Network (BPN)

I.INTRODUCTION

Generally, there are two different types of tumours one is primary tumour and second one is secondary tumour. If the tumour is present is present and grows within the skull is known as primary tumour. Primary tumours are Malignant tumours or Benign tumours. If the tumour arises anywhere in the body and migrate to the skull is known as secondary tumour. Secondary tumours are Metastatic tumours[1]. The tumour forms in the body and interferes with the normal functioning of the brain. Brain is shifted towards the skull by the tumour and increases the pressure on the brain. Tumour detection is the first step in the treatment. Tumour is an intracranial solid neoplasm or abnormal growth of the cells within the brain and lung or the central spinal canal. Now-a-days tumour is known as most common and deadly diseases in the world. The tumour is cured easily if it is detected in its early stage. There are more than 150 brain tumours have been documented and this makes the decision more complicated. As there are different types of tumour classification of tumour is very important, in order to classify which type of tumour really suffered by the patient. So, good classification process leads to the right decision and it will help the doctors to provide good and right treatment. Malignant brain tumour do not have distinct border[2]. Treatments are different for each type and usually the brain contains more no of cells that are interconnected to another cells that control the different parts of the body. Some cells control the hand movement while some cells control the leg movement. Similarly, other cells of the brain control other parts of the body. There are different types tumour of symptoms ranging from headache to stroke, so symptoms will vary according to the location of the tumour. Tumours at different locations causes different functioning disorders.

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The general symptoms of tumour

1. Headache
2. Speech difficulty.
3. Slowly the sensation in arm is lost.
4. Vision is lost in one or both eyes.
5. Gradually loss of movement in leg.

Usually Magnetic Resonance Image (MRI) is used in scanning because of their high quality in image. The quality of image is important in tumour detection. MRI provides an un-paralled view inside the human body. Using MRI we can see detailed information of the tumour when compared to other scanning techniques like C.T scan, X-ray. In MRI brain images, after completing segmentation of brain tumour classification of tumour whether it is malignant or benign is very difficult due to complexity and variations in tumour characteristics like it's size, shape, intensities gray level and location[3].When compared to the other brain cells tumour cell have high contrast. Generally used treat techniques for tumour are radiation therapy, surgery, chemotherapy.

In radiation therapy the gamma rays or beta rays are passed into the brain and applied on the tumour and kills the tumour cells. In surgery process doctors remove as many as tumour cells from the brain. In chemotherapy we are using medicines which can control the reach of the tumour cells to blood and blood barriers. The patients face side effects in chemotherapy as it stops the growth of tumour cells along with normal brain cells. Most of the tumour work is related to segmentation and detection of tumour.[4]

The rest of the paper is organized as follows. Proposed embedding and extraction algorithms are explained in section II. Experimental results are presented in section III. Concluding remarks are given in section IV.

II. LITERATUREREVIEW

As per the view of E. Ben George, H. Jeba Rosline, [5] The most potent for optimisation are nature enthused algorithms among them are one of the algorithm is Cuckoo Search(CS) algorithm which is efficient in solving optimisation problems in various fields. In this we can see the basic concept of Cuckoo search (CS) algorithm and its applications for brain tumour segmentation from Magnetic Resonance Image (MRI). It is extremely challenging to identify tumour like diseases in most complex structure of human brain because differentiating the components of brain is complex. The sometimes may occur with same intensity as normal tissue. The work of radiologist becomes more complex because tumour, edema, blood clot and some part of brain tissues appear same. Generally, brain tumour is detected by radiologist though comprehensive analysis of MR Images, which takes longer time. Cuckoo Search is one of the best optimisation technique which develops diagnostic system. So, that the radiologist will have second opinion regarding the presence or absence of brain tumour. Thus, Cuckoo Search (CS) algorithm performs efficiently in detecting tumour and also it compares the results with other optimisationtechniques.

According to Shanmuga Priya and Valarmathi A,[6] In identifying different kinds of tumour image segmentation plays a vital role and gives valuable information. There are various techniques deployed for tumour detection by comparing reference image and extracted image features points of the image under study. However, it is a very difficult task to build a reliable data for brain tumour detection by training due to the variations of brain image in terms of intensity and shape. This work mainly focus on tumour segmentation and edema using kernel based fuzzy c-means approach and skull stripping. By combining multiple kernels clustering process is improved on spatial information, global matching information between the image distribution and avoids the need of pixel information that relies on the multilevel segmentation approach and reduces the computational complexity. Here we are using graph cut algorithm as a co-segmentation to identify exact cut point between edema and tumour. So, the edema is removed from tumour. By using this method clearer visualisation of edema is possible and tumour is identified with extra space for proper removal. In this proposed method the simulation results reveal that our approach outperforms the other existing methods for edema and complete tumour detection.

According to S.AlaEldin and Zhang Yun,[7] Using the Artificial Neural Networks(ANN) Remote Sensing image processing are identified. It is also proven that Back Propogation Neutral Network (BPNN) have high attainable classification accuracy. Due to different network designs and implementations, there is noticeable variations in the achieved accuracies. Hence, researchers need to conduct proper research and several experimental trails before they finalize the proper network design. This significantly reduces the effectiveness of using BPNNs as, this is a time consuming process

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and the final design may still not be optimal. Hence, there is a need to observe whether there are any common guidelines for effective design and implementation of BPNNs. This paper work attempts to find the common design guide lines suggested by different authors through literature review. To provide readers with contextual information, some ANN fundamentals are alsointroduced.

According to Hum Yan[8], Doctors inspect the X-ray images with their experience and knowledge in bone fracture analysis. There are multitude drawbacks in manual examination of X-ray and this is a time consuming process. Since it is very important to detect the features for orthopaedics and radiologists a Computer Aided Detection (CAD) system should bedeployedinthisscenario.Inthisworkthecurrentlyusingmanualinspectionof X-rayimagesystemcouldimproveusing fracture detection CAD based on GLSM recognition system. For fracture and non-fracture bone GLSM is computed and analysis is made. Features like Contrast, energy, correlation, Homogeneity are calculated to classify the manufactured bone. Here we've tested the 30 images of femur facture, the result shows that CAD can differentiate between X-ray bone into fractured and non-fractured femur. The accuracy obtained is 86.67. In this, the CAD system is proved to be effective in classifying the digital radiograph of bone fracture. However, the accuracy is still not satisfied, the system can be further developed using multiple features ofGLCM.

As per the view of I.W. Selesnick and R.G. Baraniuk,[9] This paper discuss about the theory behind the dual-tree transform, shows the design of the complex wavelets with good properties. The author used the complex number 'C' in CWT to avoid confusion with the often used acronym CWT for the continuous wavelet transform. The four fundamentals and some of solutions are discussed in intertwined shortcoming of wavelet transform. Filter design for dual-tree CWT using several methods demonstrated with selectively short filters, dual-tree approach can be implemented using analytic wavelet transform with effective invertible method.

III. PROPOSED SYSTEM

The proposed system is an efficient way for detection and classification of tumour for the given MRI images. In proposed system we are using ANN-BPN network method for classification and Fuzzy clustering method for tumour detection and structure analysis.

BLOCK DIAGRAM:

The block diagram describes:

- The main objective of this project is to detect the brain tumor using different techniques to increase the accuracy and decrease the analysis time.
- Different techniques include preprocessing, DWT, GLCM, BPN classifier, SFCM.
- Preprocessing is performed to remove noise from the input MR image.
- Morphological operators can be applied to Gray level, e.g. to reduce noise or to brighten the image.
- DWT is used to filter edges information from the preprocessed image.
- GLCM is used extract features from the DWT processed image.
- BPN classifier is used to classify whether GLCM processed image is normal or abnormal.
- If the classified image is normal then no further processing is required.
- If the classified Image is abnormal then SFCM is used to cluster the tumor cells.
- The purpose of this Project is to spot the tumor from MRI scanned medical images using clustering model and morphological process.

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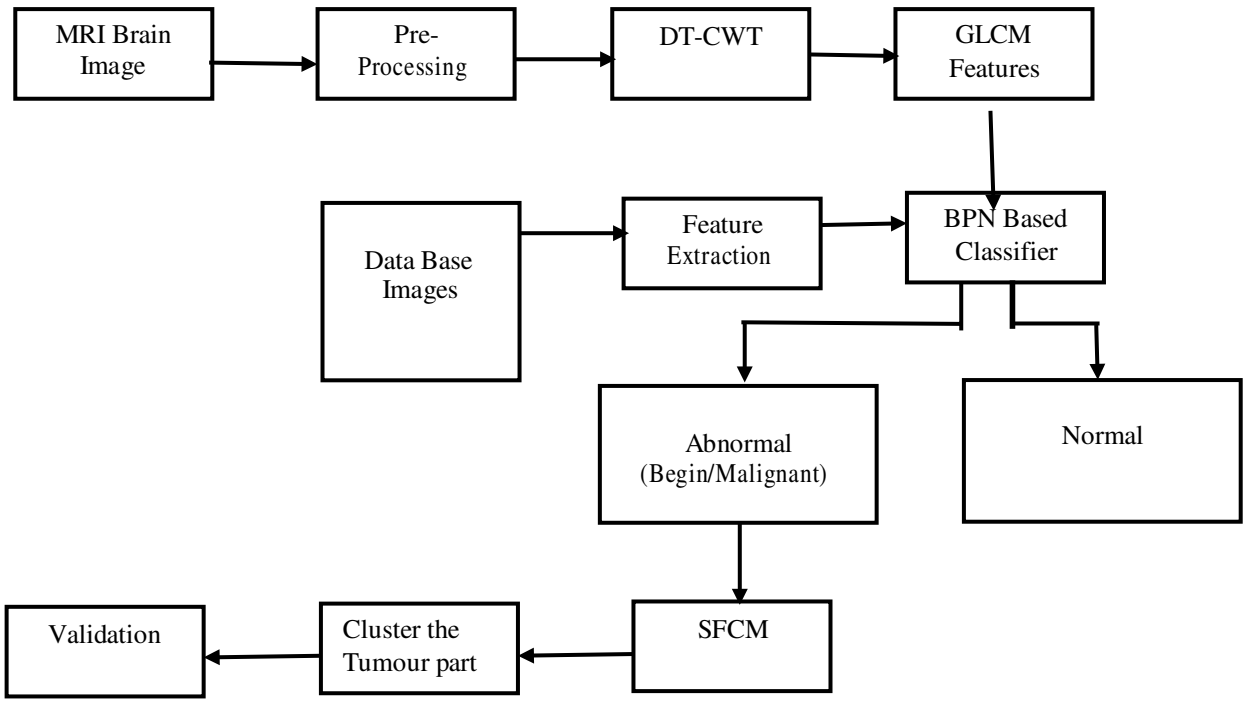

Figure 1.Block Diagram

Pre-processing-

For suppose take a clean image and removing the noise image in that is called image restoration. Motion blur, camera misfocus and noise are some of the format corruption. Image enhancement is one of the form of image restoration. From the observer point of view to make image more clear, designing for emphasize characteristic of a image is done. From the nearest neighbour procedure, the image like focus or contrast extend and from previous model it also provides image packages not used in previous model. By taking our some resolution, the improvement of noise in a image will be present, whereas It is not used in all various application. In fluorescence microscope the resolution is bad. From reviving the image in advanced format, the Image processing technique is used. This technique not only removes the incremented noise contrast but also increases resolution, mainly in axialdirection.

Dual-Tree Complex Wavelet Transform (Dt-Cwt)-

By adding some additional properties to the discrete wavelet transform makes DT-CWT as an advanced version. We are using wavelet transform to find the extract shape. The advantage of using this we can get information horizontal, vertical, diagonal information and can extract features. DT-CWT shows a range of signal in image processing with good properties. DTCWT is underneath than the undecimated discrete wavelet transform which is invariant and directional selective. In two dimensional signals by the dismissal factor additional dimensions are achieved. Dual tree complex wavelet transform which is established on computational efficient and filter bank of multidimensional is not an independent.

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Gray Scale Co-Occurrence Matrix-

Considering the spatial relationship of pixels using statistical method for examining texture is often known as gray level co-occurrence matrix(GLCM). With the help of GLCM we can extract various features like energy, entropy, correlation, contrast and Homogeneity. In this we can able to handle image features whereas in DT-CWT it is only able to handle images. The value which are obtained in the matrix are passed down to neural network. With specific values of pixel in an image it calculates how often pairs and this specific values forms a spatial relationship which will be occurred in an image which tells the texture of image means forming GLCM which extracts statistical measures. GLCM has different features like contrast which measures local variations, correlation which tells that in a specified pixel pairs how much joint probability occurrence will be present, energy which sums of the squared elements, homogeneity tells that how much close the distribution of elements is there in gray level co-occurrencematrix.

Back Propagation Neural Network-

An artificial neural network is designed in this paper to classify and segment the different types of tumor. Artificial neural network is a simple network which consists of multiple layers like input layer, many hidden layers and an output layer. Input layer consists of a group of I/O nodes with connections between them. Each connection in the network has some weight which is associated with computer programs. These computer programs are helpful in building predictive models from largedatabase.

Back propagation algorithm is a supervised learning algorithm which is used train neural networks. It is one of the type of artificial neural network algorithm. It is a short form for backward propagation of errors. It has 4 types of nodes called input nodes, hidden nodes, output nodes and some bias nodes in between.

Firstly, input arrives the input node along preconnected network, that input is sent to the next layer by a connection which has some random weight. Inputs will be modelled by the weights and sent to the next layers. Every node in the network have to calculate the output and send them to the next nodes. At the output node calculate the error based on the actual result and the desired result. If the error is less the output is correct, but if the error is more, travel back from output layer to the input layer and adjust the weights using gradient descent method to reduce the error. Repeat this process again and again till the error getsreduced.

Spatial Fuzzy Clustering Model-

Spatial fuzzy c means clustering means separating the affected pixel in one group and non affected pixel in another group, clustering is nothing but grouping. After grouping the affected area will be in white colour and non affected area will be in black colour, the segmentation is done for the affected area it shows the extract location of the tumor.

Fuzzy clustering has an important role in the process of segmentation of image. In noise free images, fuzzy c means clustering has a good performance. Spatial fuzzy c means clustering segments the spatial data of the image. In fuzzy c means clustering there is a possibility for each and every pixel of an image to stay in two or more clusters unlike k means clustering which allows the pixel of an image to stay in only one group or one cluster. Fuzzy c means clustering model gives a membership degree to the pixels of animage.

IV. EXPERIMENT AND RESULT

The test set for this evaluation experiment brain tumor segmentation based on sfcm using back propagation neural network the images of normal and cured brain MR images randomly selected from the internet. From the above figures the tumor consisting brain was detected by the advanced method sfcm using back propagation neural network. Matlab 7.0 software platform is use to perform the experiment.

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Figure 2.Normal brain MRI scan

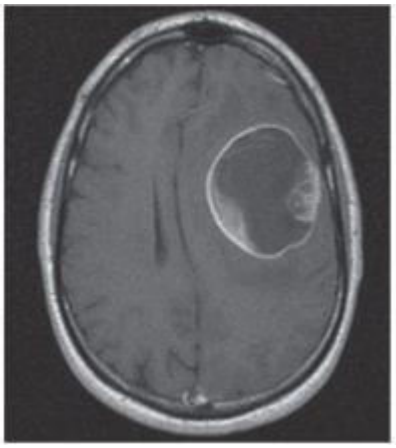

Figure 3.Postgadolinium T1 MRI of a large cystic left frontal giloblastoma.

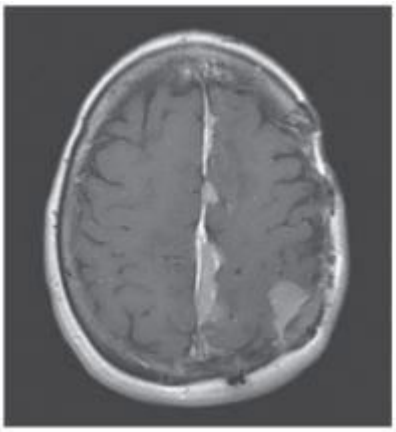

Figure 4. Postgadolinium T1 MRI demonstrating multiple meningiomas along the falx and left parietal cortex.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.542 |

|| Volume 9, Issue 6, June 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0906033 |

V. CONCLUSION

By using the concept of Back propagation neural network, which is a machine learning concept used to identify the defects in MRI images by image processing, in which it identifies and classify where the tumour is obtained in the image. In test image features are extracted to identify the image, through the data set image which is feature of test image used to classify the input image is normal or abnormal. The detection is achieved using Back propagation neural network and location of exact position of tumour is detected with the help of segmentation method.

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