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Outline in Image Processing techniques for Brain Tumor detection

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Abstract: In ancient period, detection of brain tumor has been a tedious process. Today tumors are dealt with many different types of imaging methods such as CT scan, X-Ray & MRI. These technique allow us to detect the presence of some abnormalities in the body. Out of these techniques MRI is more efficient & safe because it doesn't involve exposing human body to any sort of harmful radiation. The MRI is pre-processed using filters and tumor is detected by means of Neural Network algorithm based on Image Processing. The process of detecting the tumor can be classified as Pre-processing, Segmentation, Feature extraction, Post-pre-processing etc. This survey paper involves reviewing the research by various professionals.

KEYWORDS: NEURAL NETWORK, IMAGE PROCESSING, FILTERS, PRE-PROCESSING, SEGMENTATION, FEATURE EXTRACTION, POST-PRE-PROCESSING.

I. Introduction

The brain is an amazing organ that controls and co-ordinate all functions of the body. It is made up of more than 100 billion nerves that communicate in trillions of communications which is termed as Synapses. Brain cells consist of nerve cells as well as supportive tissues such as glial cell & meninges. These parts controls the activity like breathing, helps in movement, senses, emotion, memory, thinking and personality etc. Tumor is the abnormal growth of the cell that serves no purpose. Tumor can be classified as malignant or cancerous tumor and benign tumors. Cancerous tumor can be sub-divided into primary tumors and secondary tumors. Studies have found that the risk factor for brain tumor which includes ionizing radiation from X-rays. Diagnosis of tumor is carried out by Neurological exam,CT(Computer Tomography scan), Magnetic Resonance Imaging(MRI), angiogram, spinal tap and biopsy. Coming to cancerous cells, they are very aggressive in nature and could threaten the life of an individual. While comparing with other technique such as CT scan, X-rays, MRI provides sufficient information & finds the abnormalities in body when other test fails. An MRI scan uses the properties of magnetism and radio waves and it is efficient because it doesn't expose body into any sort of harmful radiation. Now we have scanned MR images which helps to detect the exact size, location of the tumor. This is how Image processing comes into picture. Now the scanned MR images undergo different phases such as image segmentation, feature extraction and post-preprocessing in order to detect the tumor accurately.

II. Literature Survey

Detection of tumor is a tedious process in which it involves some elementary steps. Processing the images play a vital role in tumor detector. Before processing the images, the image has to be undergone through several techniques inorder to remove the noisy data or simply called as unwanted artifacts. Only after removing the unwanted datas the level of accuracy for tumor detection works efficiently. There are 2 main phases or modules that are available to detect the tumor. First one involves Preprocessing technique in which the medical image is been converted to gray scale image, and filtering

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techniques are included to remove away noisy data. The second phase include segmentation and morphological operations inorder to determine the type, size, location of tumor by using several techniques. The general phases are listed below,

A. Image Pre-processing

Before processing the images, it is recommended to pre-process the image so that the noisy unwanted artifacts can be removed easily. This process is carried out so that to yield better accuracy rate. This Pre-processing involves processes such as converting the medical image into gray scale, noise reduction, noise removal, image reconstruction, image enhancement etc.

Most widely used processing technique is converting the image in gray scale image in which it holds black and white image. It has 2 shades black and white at that point it may hold a intensity of 1 or 0. It doesn't hold any apparent colors. Gray scale is important because it provides more accurate color information which helps during segmentation.

Once the image is processed, the converted image is processed once again with filters to remove excess noise. There are 2 types of filters available, one that allows the low-end frequencies to pass and other which allow high-end frequencies to pass. There are filters available which flatten the image or sharpen the image. When a filter is used to flatten the image, the noise is blurred and obtains a smooth image. On the other hand,the filter enhance the finer details but it leads to increase the noise in the image.

B.Filtering

Inorder to preserve the edges of the image Median Filters are most commonly used today. This Filter is efficient in removing salt and pepper noise and poisson's noise. Gray scale image can be converted to pseudo color image by assigning a color value to each intensity. Another type of filter which removes noisy data fro MRI image is Gaussian filter which uses Gaussian Function(low pass filter). By this filter smooth image that looks like translucent image. Sobel filter is used to detect edge of tumor. By these filtering methods the excess noise can be removed efficiently.

C.Segmentation

The process by which spitting the image into sub modules is termed as Segmentation. It play a vital role in detection because it helps to analyze and extract meaningful information. It uses pixel sharing as a common property.

D. post-processing

This include processing the image such as determining the shape , size, location if the tumor is found. Based upon the result, suggestions are made. Tumors could be determined exactly based on shapes.

In this paper the equivalent notions of neuroanatomy and CNN model has been showed and added the subcortical phenomena are also studied.This method eliminates the standard errors occurring in symbol models of retinal illusion.The main aim of this algorithm is to translate the known into CNN models and gives the good framework.[16]

Based on the unsupervised hopfield neural network,the segmentation of magnetic resonance images are formulated.Minimization of energy function are in two terms:one is the cost term as a sum of squared erroes and the other one is temporary noise added to the cost term with the result of local minima.To ensure the convergence of the network and its utilization in the clinic with useful results, the minimization is achieved with a step function that permits the network to reach stability corresponding to a local minimum close to the global minimum in a prespecied period of time. By the previous work hopefield neural network is compared with the Boltzmann machine, and the conventional ISODATA clustering technique.[12] [6] proposed a system in which this study presented the implementation of two fully automatic liver and tumors segmentation techniques and their comparative assessment. The described adaptive initialization method enabled fully automatic liver surface segmentation with both GVF active contour and graph-cut techniques, demonstrating the feasibility of two different approaches. The comparative assessment showed that the graph-cut method provided superior results in terms of accuracy and did not present the described main limitations related to the GVF method. The proposed image processing method will improve computerized CT-based 3-D

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visualizations enabling noninvasive diagnosis of hepatic tumors. The described imaging approach might be valuable also for monitoring of postoperative outcomes through CT-volumetric assessments. Processing time is an important feature for any computer-aided diagnosis system, especially in the intra-operative phase.

It is a new way of detecting brain tumour boundaries by using Hopfield neural network.based on the active contour model inseeds the boundary points to minimize an energy function.it needs minimum computing time.It also implemented for real time processing .The different Magnetic resonance imaging(MRI) show the effectiveness of our approach.It consists of detecting the boundary of brain tumour and isolate the tumour from brain tissue.Once seprated the tumour can be further

processed in three dimensional rendering.[18]

In this method an extention to the fuzzy C means clustering algorithm was proposed,a robust segmentation technique .A neural network model optimizes the degree of attraction,which is dependent on neighbouring pixels and relative location.For demonstrating the superiority of this technique ,simulate and brain images with multi noise levels are segmented.The noise can changes the intensity of the pixels.The work will focus on the image based classification system using data mining for brain tumour.[15]

The classification for humanbody postures based on the neural fuzzy network and it is applied to detect emergencies that caused by accident falls.Sillhoute is extracted for classification features,after the human body is segmented from the background.For each and every histograms fourier transform is applied.Neural fuzzy network desinged for classifer.This experiments used to performed to home care emergency detection for person.It reduces illumination influence and eliminates shadows.This feature is based on DFT horizontal and vertical projection.In a home care system, heuristic rules based on classified postures thar are used to detect alarm situations.[4]

The detction of brain tumour is based on the different algorithms.The algorithm are preprocessing,feature extraction and classification based on neural networktechiques.For reducing noise in images ,gabor filter is uesd.the accuracy of the image is 89.9% and it will improve the accuracy rate of the image.[1]

The magnetic resonance (MR segmentation) algorithms are used to analyze tissues and diagnose tumour.in this method we give a new segmentation algorithm that separate the Magnetic resonance images into tumour, white matter,edema,gray matter and cerebro spinal fluid .Before the segmentation process starts we develop an algorithm for striping the skull.The algorithm combines both thershold and morphological operations for the process of stripping the skull.The input to the som is performing spatial filtering method on the subbands to feature vector. It is performed by an unsupervised som network.It shows a moderate and comparable operation on this dataset.It increases the accuracy of the segmentation.[3]

For Disease diagnosis computer tomography is used now a days,based on artificial intelligence.The image learning for lung nodule through unlabeled data is supported by convolutional autoencoder deep learning framework.It also extended for similarity measurement of lung nodule images.Because of segmentation and handcraft features is time consuming and labour intensive.This proposes a CANN based approach for data driven feature learning.This method is superior through comphernsive experiment when compared to other datadriven approaches.The role of expert is ignored thats why the system performance and feasibility may be affected.so we combine the domain knowledge and datadriven feature learning.[11]

It is an innovative framework model to provide human like informative automated medical consultation and comhernsive for hospitalization guidance.This method achieve state of the art performance when compared with others .This technology involves self checking of the users health condition based on their symptoms.it also provides risk of warning by pre diagnosis of possible disease .first we extracted the disease described by the users in actual language by named entity recognization (NER).[5]

Magnetic resonance imaging (MRI) is a technique used to identify the presence of tumor cells. An automatic segmentation method based on the convolutional neural network (CNN)was proposed gliomas are the most common and aggressive brain tumour leads to short life expectancy.the process such as basis field intensity and patch normalization have been started initially.according to spatial localization and structural composition the

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brain tumours are highly variable.[13]

The human detection and actvity classification uses deeep convolutional neural networks based on doppler radar. The previous schemes are based on the design of handicrafted features.It achieves high accuracy and each problem limits the scalability of proposed schemes. The raw micro doppler spectrogram is applied by DCCN,one of the most successful deep learning algorithms for both human detection and activity classification problem.It is used extract and recognize microdoppler features efficiently.The computational complexity of DCNNs require real time processing.[20]

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Ref-Paper	Technique	Algorithm	Organ	Limitations	Accuracy	Training parameters
[2][12]	DCNN	Deep Learning algorithm	Finger print	Over filtering problem. Needs more time for pore intensity.	86.06%	Convolutional layers-4 No.of filters-40 30 20 10 Filter Size-32 16 8 6 Sigmodial layer size-500
[3][4][5]	CNN	-	Eye Brain	Average accuracy. Difficult task for clinical experts. Can't detect small size of dataset.	71-84%	10 folds Cross validation and it gives 71.1% acuuracy
[17]	HNN	Simulated annealing & ISO DATA algorithm	Brain	Less accuracy.		0.859mm*0.859mm
[8]	DNN	Deep learning algorithm	Brain	Low performance due to irregularity in motion.	97.6%	256*256 training images
[9]	SOM			Complexity	91%	0.2 for window learning and0.3 for relative learning algorithm
[15][16]	ANN	Bootstrap aggregating or bagging algorithm	Brain	Can't accept regression analysis. worst on abnormal brain edema.	81%	
[18]	SVM	Chain code algorithm & fuzzy classification	Human body			

Fig 1: Comparison table for different neural network.

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In the field of interictal epileptiform discharge(IED) detection for electroencephalography(EEG) data utilises the specific neural responses.In the consideration of deep learning of epileptic subject to combine the feature generation from intracranial EEG data.It also provide clinical insight.To evaluate the treatement of a patient, the morphology of IED found in filters helped.First ,have to demonstrate the deep learning can be used for feature generation and also match the accuracy of models by experts using handicrafted features.[2]

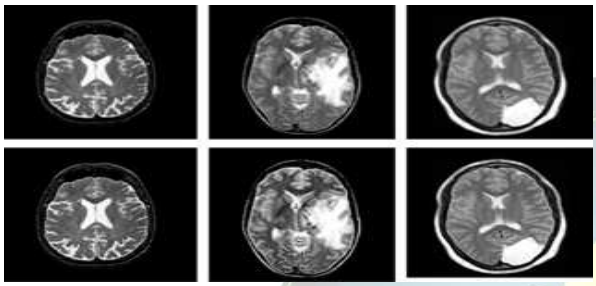

Fig 2: Brain tumor detection in each phases.

First create a set of strategies to learn limited training data in effective and efficient manner, afterwards format a novel loss function to eliminate the need of sample reweighting based on jaccard distance for image segmentation using a cross entrophy as the loss function due to the strong imbalance between the number of fourground and background pixels. this method involves skin lesion segmentation on dermoscopic images.the jaccard distance maximizes the overlap between the fourground and predicted segmentation mask based on loss function.[19]

This method is used to classify the cervical cells withfirst, out any prior segmentation by using convolutional neural network.First,pretrain the convnet on natural image dataset.For predecting the similar set of image patches aggregation is used .the method is based on pap smear and LBC dataset.The accuracy of classification of 98.3%.this method extracts deep features embedded in image patches for clasiification.this patches are considered as a input and transfeered from another model into a new convnet and aggregrates different prediction to form the final output.[10]

In this method a deep multi-channel framework that alleviates heavy design due to the convolutional neural network.It also able to meet many requirements by changing the channels.This is an effective method for this segmentation of gland instance.It not only enable the algorithm to solve segmentation problem but also replaced for a specific task.This algorithm is called deep multichannel neural network.To generate instance segmentation,exploits feature of edge,region,location in a multichannel manner.A sequence of base line experiment are conducted to prove the superiority of this algorithm.[17]

A development of technology enabled high quality finger print scanning,one of the level three features of finger print,sweat pores have been used in automatic recognition system(AFRS).The pore extraction process requires high accuracy,is a critical step for AFRS.This process is difficult because the pore shape depends on the person and region.To overcome this problem using deep convolutional neural network.The demonstration of deep pore out performs the state of the art methods by a benchmark database.

In this method,convolutional neural networks used to identify prostate cancers.The tissue specimen were obtained from microarrays and digitize.For each specimen the epitihelial seeds were identified and form the seed map.From this map convolutional neural network sought to learn the nuclear architecture and to detect cancer cells.This approach helps to improving prostate cancer pathology.CNN helps to find the location of nuclear centroids.[7]

In this paper certain challenges imbalanced medical data was addressed that is a brain tumor diagnosis problem.This paper aims to achieve objective diagnosis and fast response of the oligodendroglioma, one type brain tumour.It combines the future selection and ensemble based classification .A hybrid wrapper filter feature selection is applied to minimize the effect of imbalanced health care.This paper helps to combine a minimum redundancy and maximum relevance filter with heuristic GANNIGMA.[14]

Techinuqes of feature extraction is used by the grey level co-occurence matrix.By using the principal comonent analysis the iamge recognization and image compression is done.In the brain tumour the classification is based on probablistic neural network.In this method,k-means algorithm is used to segmented the images of brain.the good classification accuracy is provided by probablistic neural network.in the preprocessing the noise is reduced by median filter.Probabilistic neural network have a capability of speed learning.[9]

Two stage task deep learning(T^2DL) is a method for detecting anatomical landmarks in real time by using limited training data. In this method consists of two deep convolutional neural networks.in the first stage ,it proposes a cnn based regression model to alliviate the problem of limited trainig data.It uses millions of image patches as input and to learn inherent associations.in the second stage develop another

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cnn model which consists of fully convolutional networks that is similar former stage.In real time local to global task oriented manner and multiple landmarks can be jointly detected and it is effectively trained by T^2DL.[8]

Conclusion

Main objective of this survey is to have a wide knowledge about tumor detection. Our study on tumor detection focuses on the survey in the field covering the concepts of neural network. Various techniques & methods are discussed briefly. Comparing with human detection & scanning techniques, automation helps to detect tumor more effectively. The main motive of this survey is to enhance tumor detection accurately using neural network.

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