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A REVIEW ON RECENT TRENDS IN DEEP LEARNING METHODS FOR MEDICAL IMAGE ANALYSIS

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ABSTRACT--*In this paper we are discussing about deep learning for medical image classification and analysis. First, we will discuss the importance of the deep learning and then the basic steps involved in deep learning. To evaluate tumours manually a very difficult task. Now a day's in many applications medical image processing plays an important role. A significant increase was observed in medical cases associated with a brain tumour. MRI and CT images are mostly used to detect tumours and to examine abnormalities in terms of shape, size and location of the tumour. There are different techniques implemented for brain tumour diagnosis. Recent study focuses on 3D-based Convolution neural network (CNN), SVM and Multi-class Support vector machines (MCSVM), ANN (Artificial Neural Networks), for Deeper Segmentation.*

Keywords--*MRI image, CT image, Convolution neural network (CNN), SVM and Multi-class Support vector machines (MCSVM), ANN (Artificial Neural Networks), Deep learning techniques, Stationary Wavelet Transform (SWT), GCNN (Growing Convolution Neural Network*).

I. INTRODUCTION

Now a days in many applications we are using MRI and CT images to analysis, diagnosis the diseases, features extraction. To analyse this, we are using image segmentation and classification to determine the tumour and to find the desises.in case of segmentation process we are mainly using segment the region of interest (ROI) and to divide them into classes. MRI and CT images are also used to find the abnormal growth of cells in brain tumours and these are categorised in to primary and metastatic tumours. Here we are discussing about different techniques for classification and segment of brain tumours of MR images. Here we are discussing different deep learning techniques and algorithms to analysis and classify the MR images. Brain tumours are mainly occurring due to uncontrolled multiplication of cells. These tumours will cause abnormal neurosystems. Now a days the most attacking brain tumour is glioma.to treat glioma we have different techniques like, radiotherapy, chemotherapy [1]. By using computerised diagnosis, we will get information about tumour location and shape, type etc. At the beginning stage it is important to diagnosis to give better treatment. In case of MR images, we are using radio frequency to generate tissues of human beings [2,3].

II. MAGNETIC RESONANCE IMAGING (MRI)

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It is one of the most important scan to observe the detailed information in the brain and other body parts. Fig.1 [4] and Fig.2 [5] shows different existences of MRI brain images. MRI image is more effective than CT image because its high contrast and low radiation features [6] .

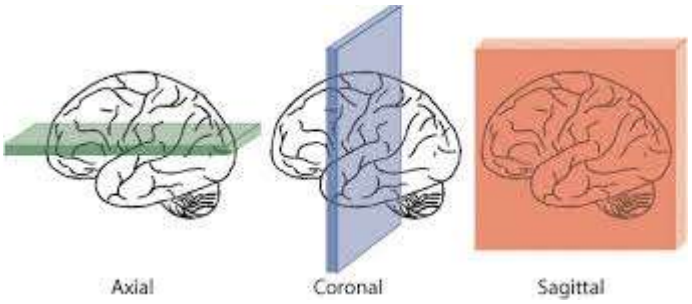

Figure 1: (a) Axial plane, (b) Coronal plane and (c) Sagittal plane of the brain image

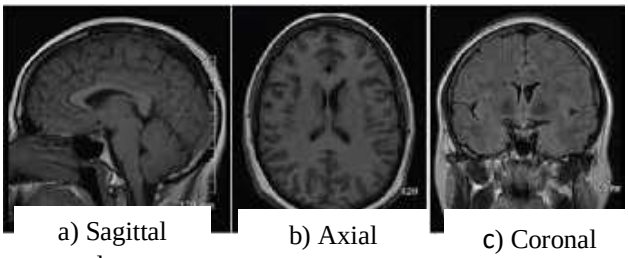

Figure 2: (a) Sagittal plane, (b) Axial plane and (c) Coronal plane of the brain observed by MRI

III. OVERVIEW OF DEEP LEARNING METHODS

MRI scan can also be used to determine different kinds of diseases related to brain such as Dementias [7], Parkinson's disorder [8], Alzheimer's disease [4], and many more. In Brain tumours diagnosis we are mainly consists of three tasks those are tumour detection, tumour segmentation, tumour classification. To perform these three methods, we are using traditional machine learning algorithms and deep learning. In modern computing we are using machine learning in the field of medical imaging. To perform registration and skull stripping [9], image reconstruction [10-12], and denoising algorithms [13,14], we are using advanced algorithms to simplify and enhance the brain information.

To improve accuracy in CNN for segmentation of brain tumour, [15] proposed hybrid technique combination of SWT, GCNN. By using SWT we will get better results in feature extraction when compared with Fourier transform. Random Forest Classifier is used for segmentation, to train the model they used GCNN. This hybrid method improves 2% in SSN and PSNR when compared with conventional CNN.

From MRI images the brain abnormalities can be detected by using supervised method [16] this can be performed by three steps. Those are first one is to develop a model; second one is division of MRI images and last one is classification. For classification of normal and abnormal MRI images automated deep transfer learning method is proposed [17]. In this they have used Harvard Medical School MR dataset. A novel method [18] adaptive fuzzy K-mean clustering proposed for segmentation of MR images. To obtain of multi scale features they proposed

segmentation technique multi-modality aggregation network [19]. Hybrid technique SVM and fuzzy C-mean proposed for MRI brain tumour segmentation [20]. Using CNN a method proposed for segmentation, In this method 3x3 kernels used for architecture [21] of CNN model. In [22] author proposed two steps to diagnosis the tumour. Tsallis entropy is used for pre-processing and for segmentation they used water shed algorithm.

The author in [23] to section the tumour from MR images, proposed Cuckoo Search Algorithm. Tumour classification and segmentation is performed by support vector machine (SVM) [24]. In this method adaptive thresholding is used for segmentation and features are extracted by using FFT. By using this method, we will get approximately 99% accuracy. Another method [25] is Support Vector Machine (SVM) for classification and Berkeley wavelet transform (BWT) for feature extraction used for automated segmentation of MR Images. For brain tumour classification the authors in [26] proposed FCM clustering and multimodal PSO.

IV. PERFORMANCE MEASURES

To estimate performance of classification or segmentation methods researchers used different quality metrics to validate their results. Such as Peak Signal to Noise Ratio (PSNR), Mean Square Error (MSE), Confusion matrix, Dice Similarity Coefficient (DSC) or Dice-overlap- index (DOI), Jaccard Index (Tanimoto Co-efficient), Accuracy metric, Sensitivity, Specificity, Recall and Precision. To provide required information we are using confusion matrix.

CS = Correct Separation of Tumour WS = Wrong Separation of Tumour Tissue

WC = Wrong in Classification CP = Correct Estimation

Accuracy can be measured as

$$Accuracy = \frac{CP + CS}{CS + WS + CP + WC}$$

Specificity can be measured as

$$Specificity = \frac{CP}{CP + WS}$$

Sensitivity can be measured as

$$Sensitivity = \frac{CS}{CS + WC}$$

Precision can be measured as

$$Precision = \frac{CS}{CS + WS}$$

Mean Square Error can be measured as

$$MSE = \frac{1}{m \times n} \sum_{i=1}^{m} \sum_{j=1}^{n} [x(i, j) - y(i, j)]^2$$

Peak Signal to Noise Ratio can be measured as

$$PSNR(dB) = 10 * \log_{10}\left[\frac{(255)^2}{MSE}\right]$$

The below figure shows different types of segmentation methods that we are using in deep learning.

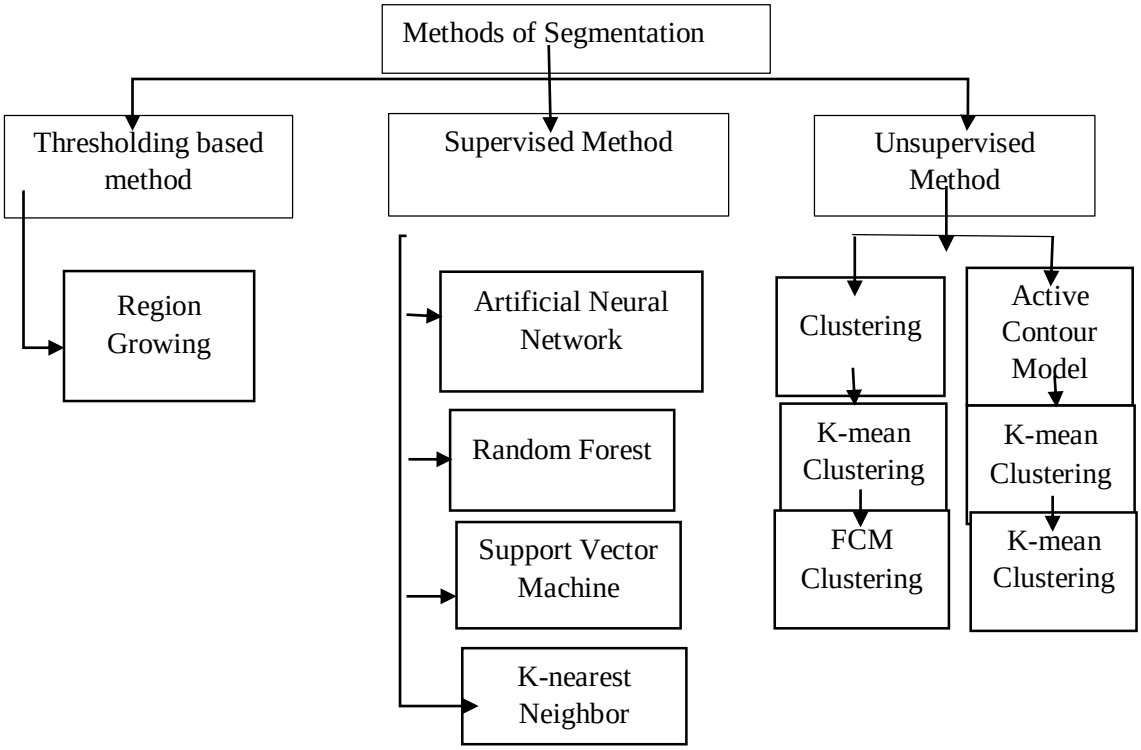

Figure 3: different methods in segmentation

The below figure shows different types of classification methods that we are using in deep learning

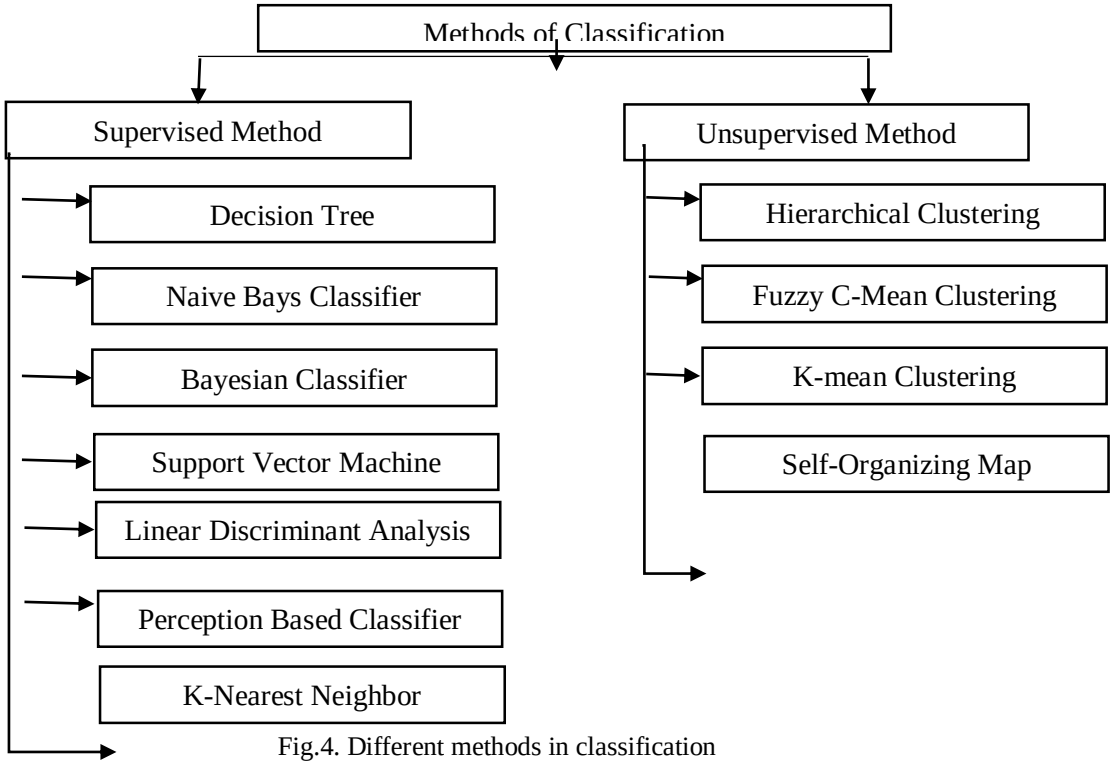

Fig.4. Different methods in classification

Figure 4: different method in classification

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V. CONCLUSION

In this paper we have discussed about different classification and segmentation techniques of MR images. These techniques provide better accuracy, less noise. There are several methods implemented to perform image segmentation and classification. In these methods they have used different deep learning techniques and new algorithms, which will give better response. Some of these will gives better accuracy and some with maximum dice score. For tumour classification we are also using some traditional machine learning techniques which will gives better results. To find tumours we are using some standard datasets like keras etc.

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