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A Review On Brain Tumor Classification By Machine Learning

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Abstract- The successful early diagnosis of brain tumors plays a major role in improving the treatment outcomes and thus improving patient survival. Manually evaluating the numerous magnetic resonance imaging (MRI) images produced routinely in the clinic is a difficult process. Thus, there is a crucial need for computer-aided methods with better accuracy for early tumor diagnosis. Computer-aided brain tumor diagnosis from MRI images consists of tumor detection, segmentation, and classification processes. Over the past few years, many studies have focused on traditional or classical machine learning techniques for brain tumor diagnosis. Recently, interest has developed in using deep learning techniques for diagnosing brain tumors with better accuracy and robustness. These detection and segmentation approaches are reviewed with an importance placed on enlightening the advantages and draw backs of these methods for brain tumor detection and segmentation. The use of MRI image detection and segmentation in different procedures are also described. Here a brief review of different segmentation for detection of brain tumor from MRI of brain has been discussed.

Key words – Brain tumor, MRI, CNN, Feature extraction, GLCM

I. INTRODUCTION

Magnetic resonance imaging of brain image computing has very increased field of medicine by providing some different methods to extract and visualize information from medical data, acquired using various acquisition modalities. Brain tumor segmentation is a significant process to extract information from complex MRI of brain images. Diagnostic imaging is a very useful tool in medical today. Magnetic resonance imaging (MRI), computed tomography (CT), digital mammography, and other imaging processes give an efficient means for N detecting different type of diseases. The automated detection methodology have deeply improved knowledge of normal and diseased examination for medical research and are a important part in diagnosis and treatment planning when the number of patients Increases [1].Segmentation has spacious application in medical imaging field such as MRI of brain, MRI of human knee, etc. for analyzing MRI of brain, anatomical structures such as bones, muscles blood vessels, tissue types, pathological regions such as cancer, multiple sclerosis lesions and for dividing an entire image into sub regions such as the white matter (WM), gray matter (GM) and cerebrospinal fluid (CSF) spaces of the brain automated delineation of different image components are used.

Thus in the field of MRI of brain tumor segmentation from brain image is significant as MRI is particularly suitable for brain studies because of its excellent contrast of soft issues, non invasive characteristic and a high spatial resolution. Brain tumor segmentation partitions a portion into mutually special and pooped regions such that each region of interest is spatially contiguous and the pixels within the region are homogeneous with respect to a predefined criterion. Mostly,

homogeneity conditions include values of concentration, texture, color, range, surface normal and surface curvatures. Through past many researchers have prepared important research in the field of brain tumor segmentation but still now it is very important research fields. Medical history, biopsy–whereby a small amount of brain tissue is excised and analyzed under the microscope–and imaging studies are all important to reach a diagnosis of brain tumor.

Standard x-rays and computed tomography (CT) can initially be used in the diagnostic process. However, MRI is generally more useful because it provides more detailed information about tumor type, position and size. For this reason, MRI is the imaging study of choice for the diagnostic work up and, thereafter, for surgery and monitoring treatment outcomes [2]. Thus here short introduction with MRI, brain tumor and automated system also discussed. Rest of the part organized as follows:

Magnetic resonance imaging (MRI) : A magnetic resonance imaging instrument or MRI Scanner [3] uses powerful magnets to polarize and excite hydrogen nuclei i.e. proton in water molecules in human tissue, producing a detectable signal which is spatially encoded, resulting in images of the body [4]. MRI mainly uses three electromagnetic fields they are : i) A very strong static magnetic field to polarize the hydrogen nuclei, named as the static field, ii) A weaker time varying field(s) for spatial encoding, named as the gradient field, iii) A weak radio frequency field for manipulation of hydrogen nuclei to produce measurable signals collected through RF antenna. The variable behaviour of protons within different tissues leads to differences in tissue appearance.

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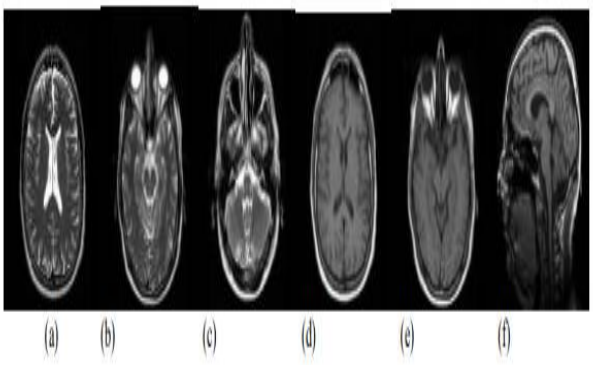

Figure 1 : MRI of brain

T2 weighted MR image (a) brain shows cortex, lateral ventricle, and falxcerebri, (b) brain shows eyeballs with optic nerve, medulla, vermis, and temporal lobes with hippocampal regions, (c) head shows maxillary sinus, nasal septum, clivus, inner ear, medulla, and cerebellum. T1 weighted MR image (d) brain shows cortex, white and grey matter, third and lateral ventricles, putamen, frontal sinus and superior sagittal sinus, (e) brain shows eyeballs with optic nerve, medulla, vermis, and temporal lobes with hippocampal regions,(f) brain shows cortex with white and grey matter, corpus callosum,

lateral ventricle, thalamus, pons and cerebellum from the same patientsFig. 1 shows the bimodal histogram of an image f(x, y) with threshold as T. MR Imaging (MRI) Magnetic Resonance Imaging (MRI) is a non invasive method and can be used safely as often as necessary for brain imaging. MRI images are used to produce detailed and accurate pictures of human organs from different angles for diagnosing abnormalities. There are two types of MRI high field for producing high quality images and low field MRI for smallest diagnosis condition [2].

MRI images can be used by physicians for visualizing even hair line cracks and tears in injuries to muscles, ligaments and other soft tissues. The main principle of MRI is based on the absorption and emission of energy in radio free range of electron magnetic spectrum. Magnetic resonance imaging (MRI) is excellent for showing abnormalities of the brain such as tumor, multiple sclerosis or lesions, stroke, hemorrhage. Fig.1 shows an MRI image of brain tumor. Accurate anatomical three-dimensional (3D) models derived from 2D MRI medical image data helps in providing accurate and precise diagnostic information about spatial relationships between critical anatomical structures such as vascular structures, eloquent cortical areas, etc and other pathological findings which otherwise were indistinguishable by the naked eye (X. Hu et.al 1990).

MRI is commonly used for brain tumor imaging because of the following reasons: i. it does not use any ionizing radiations like CT, SPECT and PET. ii. Its contrast resolution is higher than above mentioned techniques. iii. Ability of MRI devices to generate 3D space images enables them to have superior tumor localization. iv. Its ability in acquisition of both anatomical and functional information about the tumor during the same scan. Segmentation is the

process of dividing or partitioning an image into several segments. The main difficulties in the process of segmentation [2] are: a. Noise b. The bias field (the presence of smoothly varying intensities within tissues) c. The partial-volume effect (a voxel contributes in multiple tissue types).

II. LITERATURE SURVEY

The important process in the automated system is brain image classification. The main objective of this step is to differentiate the different abnormal brain images based on the optimal feature set. Several conventional classifiers are available for 14 categorization but most of the earlier works depend on Artificial Intelligence (AI) techniques which yield highly accurate results than the conventional classifiers. Ronald et al (2000) have clearly illustrated usage of Artificial Neural Networks (ANN) to improve the accuracy of the classifiers.

This report was based on head and neck carcinoma detection and a comparative analysis was performed with the Linear Discriminant Classifier to show the superior nature of neural networks. Michael et al (2001) have proposed an interactive tool to classify the healthy and the tumorous MR brain images. But the accuracy proposed in this system is very low compared to the AI techniques. Though this approach claimed a faster convergence rate, it may not be much useful because of its low accuracy. This report mainly concentrated on improving the convergence rate only.

LaxmiNarayanaPondhu et.al (2018)we have various machine algorithms for gender classification but choosing best one is important task. For selecting best algorithm we conducted experimental study on machine learning algorithms for gender classification. In this experimental study of machine learning algorithms, we analyzed performance of various algorithms for gender classification using voice dataset. From this study we concluded that SVM and ANN are giving best results. After tuning parameters ANN outperforms SVM giving accuracy 99.87% on test data.[1]

Halil Ibrahim Bulbul et.al (2017) The ECG uses some methods to diagnose these cardiac arrhythmias and tries to correct the diagnosis. ECG signals are characterized by a collection of waves such as P, Q, R, S, T. These five waves are preformed, wave transformed, and classified. In the current literature, the P, Q, R, S, T waves in ECG signals are classified using some machine learning techniques. In the work to be done, MLP (Multi Layer Perceptron) and SVM (Support Vector Machine) classification techniques which are not compared with each other using these signals will be compared.

Is study, BP (Back Propagation) algorithm with MLP classifier and K-A (Kernel-Adatron) algorithm with SVM classifier were used. In addition, the use of these methods is new in the field of ECG classification. It will try to find a more effective method with new uses in the study and the literature will contribute to this area. In addition, wave transformation techniques such as DWT, DCT, and CWT will be used to increase the success of the classification used in the study. This will lead to the most effective classification method in the existing data set. In the work to be done, it is aimed to bring improvements to the classification methods used in existing studies. It is aimed to develop a method to improve the calculation time and standard classification performance of MLP and SVM, and it is aimed to contribute to the informed consciousness of this work.[2]

Mittal Bhatt et.al (2019) Lower Back Pain (LBP) is not a disease, but it is condition of spine, and now days it becomes very common irrespective of age. An Expert System (ES) is an intelligent tool used in medical field for various roles like prediction, diagnosing, interpreting. LBP can be caused by so many reasons and its identification in early stage will make the management of it very effective and also prevent it to become chronic. In this research, an Advanced Kernel is designed in Support Vector Machine (SVM)-Supervised Learning, gives more accurate results. After that the efficiency is compared with effectiveness of the different attributes from the dataset.[3]

Ma. Madecheen S. Pangaliman et.al (2018) The trend of technology nowadays requires massive machine-to-machine communications and this can be done only through the application of artificial intelligence, deep learning, and machine learning to different devices through wireless sensor networks. One of the applications is through the development of acoustic disdrometer. Acoustic disdrometer is a tool that measures the amount of rainfall through the sound produced as the raindrops hit the

piezoelectric sensors. With this, the main purpose of this study is to develop predictive models through the application of machine learning algorithms that can be used to categorize the intensity of the amount of rainfall from ambient noise. In the study, there were three machine learning algorithms that were used, namely: support vector machine (SVM), k-nearest neighbors and Naïve-Bayes classifier. All models obtain confusion matrix (CM) accuracies of 99.14%, 99.14% and 89.27%, respectively. These predictive models were successfully implemented and validated through cross validation (CV) and out-of-sample accuracies[4]

Sachin Shetty et .al (2016)Parkinson's Disease (PD) is a neuro-degenerative disease which affects a persons mobility. Tremors, rigidity of the muscles and imprecise gait movements are characteristics of this disease. Past attempts have been made to classify Parkinsons disease from healthy subjects but in this work, effort was made to focus on the specific gait characteristics which would help differentiate Parkinsons Disease from other neurological diseases (Amyotrophic lateral sclerosis (ALS) and Huntingtons Disease) as well as healthy controls.

A range of statistical feature vector considered here from the Time-series gait data which are then reduced using correlation matrix. These feature vectors are then individually analysed to extract the best 7 feature vectors which are then classified using a Gaussian radial basis function kernel based Support vector machine (SVM) classifier. Results show that the 7 features selected for SVM achieves good overall accuracy of 83.33%, good detection rate for Parkinsons disease of 75% and low false positive results of 16.67%.[5]

Mircea Gurbină et.al (2019) The brain is one of the most complex organs in the human body that works with billions of cells. A cerebral tumor occurs when there is an uncontrolled division of cells that form an abnormal group of cells around or within the brain. This cell group can affect the normal functioning of brain activity and can destroy healthy cells. Brain tumors are classified as benign or low-grade (grade 1 and 2) and malignant tumors or high-grade (grade 3 and 4). The proposed methodology aims to differentiate between normal brain and tumor brain (benign or malign). The study of some types of brain tumors such as metastatic bronchogenic carcinoma tumors, glioblastoma and sarcoma are performed using brain magnetic resonance imaging (MRI). The detection and classification of MRI brain tumors are implemented using different wavelet transforms and support vector machines. Accurate and automated classification of MRI brain images is extremely important for medical analysis and interpretation.[6]

T. A. Jemimma et.al (2018) Brain tumor detection is a tedious task in the field of medical imaging. Detection or identification of brain tumor involves segmentation of brain image, extraction of brain features and classification of abnormality in the MRI brain image. This paper proposes the state of art tumor detection techniques using the Watershed Dynamic Angle Projection - Convolution Neural Network (WDAPP-CNN). The watershed algorithm accurately segments the tumor region. The dynamic angle projection pattern extracts the textured features of the brain and the convolutional neural network classifies the tumor and non-tumor regions of the MRI brain image. The abnormality of the brain image is detected and testing is achieved through the BRATS dataset in an efficient way.[7]

Manu Gupta et.al (2015) Brain tumor segmentation is an important procedure for early diagnosis of brain tumor and planning of its treatment. However it is still a difficult task due to variations in size, shape and location of tumor. In this paper, we propose a novel brain tumor segmentation method using T2-weighted brain MR images by integrating symmetry property of brain with region growing approach. Bilateral symmetry property of brain is used in our method to identify various regions having probability of presence of the tumor. Identification of exact tumor location and its segmentation is then performed by using region growing technique. Qualitative and quantitative evaluation of proposed approach was performed and promising results have been demonstrated when compared with ground truth and other state of art method. The segmented tumor region obtained in our work can assist the doctors and radiologist in the diagnosis of brain tumor and treatment planning.[8]

V. Zeljkovicet.al(2014)The MRI or CT scan images are primary follow up diagnostic tools when a neurologic exam indicates a possibility of a primary or metastatic brain tumor existence. The tumor tissue mainly appears in brighter colors than the rest of the regions in the brain. Based on this observation, an automated algorithm for brain tumor detection and

medical doctors' assistance in facilitated and accelerated diagnosis procedure has been developed and initially tested on images obtained from the patients with diagnosed tumors and healthy subjects.[9]

Hayder Saad Abdulbaqiet.al (2014) Brain tumors are created by abnormal and uncontrolled cell division inside the brain. The segmentation of brain tumors which is carried out manually from MRI is a crucial and time consuming task. The accuracy of detecting brain tumor location and size takes the most important role in the successful diagnosis and treatment of tumors. So the detection of brain tumor needs to be fast and accurate. Brain tumor detection is considered a challenging mission in medical image processing.

This paper concerns presenting an approach which will be useful for improved detection of brain tumor using Hidden Markov Random Fields (HMRF) and Threshold methods. The proposed method has been developed in this research in order to construct hybrid method. The aim of this paper is to introduce a scheme for tumor detection in Magnetic Resonance Imaging (MRI) images using (HMRF) and Threshold techniques. These methods have been applied on 3 different patient data sets. They have the property of organizing their soothing effect on the final segment of brain tumor homogeneous tissue regions, while the edges between different tissues constituents are better kept.[10]

Stefan Bauer et.al (2012) Image-based modelling of tumor growth combines methods from cancer simulation and medical imaging. In this context, we present a novel approach to adapt a healthy brain atlas to MR images of tumor patients. In order to establish correspondence between a healthy atlas and a pathologic patient image, tumor growth modelling in combination with registration algorithms is employed. In a first step, the tumor is grown in the atlas based on a new multi scale, multi physics model including growth simulation from the cellular level up to the biomechanical level, accounting for cell proliferation and tissue deformations. Large-scale deformations are handled with an Eulerian approach for finite element computations, which can operate directly on the image voxel mesh. Subsequently, dense correspondence between the modified atlas and patient image is established using no rigid registration. The method offers opportunities in atlas-based segmentation of tumor-bearing brain images as well as for improved patient-specific simulation and prognosis of tumor progression.[11]

HaochengShenet.al (2017) Grid conditional random fields (CRFs) are widely applied in both natural and medical image segmentation tasks. However, they only consider the label coherence in neighbourhood pixels or regions, which limits their ability to model long-range connections within the image and generally results in excessive smoothing of tumor boundaries. In this paper, we present a novel method for brain tumor segmentation in MR images based on fully-connected CRF (FC-CRF) model that establishes pairwise potentials on all pairs of pixels in the images.

We employ a hierarchical approach to differentiate different structures of tumor and further formulate a FC-CRF model with learned data-driven prior knowledge of tumor core. The methods were evaluated on the testing and leader board set of Brain Tumor Image Segmentation Benchmark (BRATS) 2013 challenge. The precision of segmented tumor boundaries is improved significantly and the results are competitive compared to the start-of-the-arts. With the increasing use of Computed tomography (CT), and Magnetic resonance imaging (MRI), the use of computers in facilitating their processing and analysis has become necessary.

In particular, computer algorithms for the delineation of anatomical structures and other regions of interest area key component in assisting and automating the specific radiological tasks. The image segmentation algorithms play a vital role in numerous biomedical imaging applications. Image segmentation plays an active and dominant role in image analysis, image retrieval, image understanding and image processing. The Image segmentation and classification is the process of dividing the image into regions with similar properties such as gray level, color, texture, brightness and contrast etc. Accurate, fast and reproducible image segmentation techniques are required in various applications.[12]

Haocheng Shen et.al [2017]Assuming specification of the number of clusters. If the value of β is low we get the finer result but at the overhead of more number of iterations (Warfield et al., 2013) Classification time increases linearly with the number

of training samples. (Gur et al., 2014) Less effective for overall extraction of grey matter. (Hsiao et al., 2016) Properties of white matter and grey matter are already provided. (De Boer et al., 2009). Interpretation of output is difficult to understand and takes lot of time. (Mechelli et al., 2017). Several layers of approximation are required. A multivariate analysis assumption is required which is difficult to check. [13]

Divyamary.D [2020] Brain tumor is the most dangerous disease and the detection of brain tumor is very essential to save one's life. The mortality rate of humans caused by the brain tumor was high before the early diagnosis of the brain tumor was identified. After the early diagnosis is found, the mortality rate is significantly decreased. Because of the exact identification of brain tumor at the starting stages, the chances of survival of a patient are increased. The classification accuracy rate is 60% more than existing ones. If the brain tumor is predicted, the position and size of the tumor can be identified and the tumor is removed from the brain. The aim of our project is to develop an efficient method to detect the brain tumor at the early stages. The various steps in the project are noise removal, morphological operation based on segmentation, feature extraction, Naive Bayes classifier initially the brain image is acquired from the patient. The acquired image is subjected to pre-processing and the feature extraction is carried out followed by classification. Therefore, we predict the brain tumor accurately by using Naive Bayes classifier method.[14]

T. M. Shahriar Sazzad[2019] A tumor cell is a form of cell that develops out of control of the ordinary forces and standardizes growth. Brain tumor is one of the major reasons for human death every year. Around 50% of brain tumor diagnosed patient die with primary brain tumors each year in the United States. Electronic modalities are used to diagnose brain tumors. Among all electronic modalities, Magnetic Resonance Imaging (MRI) is one of the most used and popular for brain tumor diagnosis. In this research study, an automated approach has been proposed where MRI gray-scale images were incorporated for brain tumor detection. This study proposed an automated approach that includes enhancement at the initial stage to minimize gray-scale color variations. Filter operation was used to remove unwanted noises as much as possible to assist better segmentation. As this study test grayscale images therefore; threshold based OTSU segmentation was used instead of color segmentation. Finally, pathology experts provided feature information was used to identify the region of interests (brain tumor region). The experimental results showed that the proposed approach was able to perform better results compared to existing available approaches in terms of accuracy while maintaining the pathology experts' acceptable accuracy rate.[15]

A new image segmentation method is proposed for improving the effect of the image segmentation. First, an original image is nonlinear mapped into a higher dimension kernel space, and the data are better separated under the kernel space comparing with that under the original image space then, the number of categories of the image is determined by analyzing the mage histogram using filter method, and the detected peak point is as the initial center of the kernel fuzzy c-means (KFCM) algorithm simultaneously last, the kernel FCM algorithm is used to perform feature cluster.

According to the results of experiments, the new image segmentation method which can adaptively achieve image segmentation and get better segmentation results, has stronger robustness to deal with the noise and the out-layer data comparing with the conventional FCM algorithm and the analysis of image's histogram applied in the kernel FCM algorithm can greatly reduce the computational load. [2] In this paper naïve byes classifier used for the tumor classification but The main limitation of Naive Bayes is the assumption of independent predictor features. Naive Bayes implicitly assumes that all the attributes are mutually independent. In the naive byes classifier .If categorical variable has a category (in test data set), which was not observed in training data set, On the other side naive Bayes is also known as a bad estimator, so the probability outputs from predict_proba are not to be taken too seriously. [3]

In this paper In OTSU's thresholding based Segmentation. Used but ostu thresholding doesn't use any object structure or spatial coherence and Generating a large number of regions of interest can lead to performance problems. And It's suboptimal in terms of processing speed. And can't do end-to-end training, like can't train all the components of the

system in one run [1] in this paper automatic segmentation used but this segmentation Does not work well with images in which the edges are not defined clearly or there are too many edges. And It is not a trivial job to produce a closed curve or boundary. And having Less immune to noise Computational cost will be high. Its Very sensitive to noise. In this research, the Hybrid KFCM-CNN method is implemented to overcome the above-mentioned limitations and to improve the performance of the automatic brain tumour detection. In this scenario, the MRI image is segmented using hybrid KFCM algorithm for detecting mass tumour in the brain. This hybrid KFCM retains the more information of the original image to detect tumour cells accurately compared to other segmentation techniques. The identification of the edema growth is performed employing the MRI images. The MRI images are processed and that allows the proposed automatic Hybrid KFCM-CNN method for tumour detection.

III.PROPOSED APPROACH

Segmentation of Region of interests (ROI) The preprocessed image can be segmented into several ROIs. In this research work, the proposed segmentation methods considered are K-Fuzzy C Means clustering (KFCM), and CNN classifier. KFCM clustering has been proven to provide an easy and convenient way to perform the segmentation. KFCM clustering will be produced useful result as the abnormal regions (tumor) are not merged with normal regions. So abnormal tumor regions can be easily distinguished from the normal regions. KFCM clustering a process designed to assign each sample to a cluster based on cluster membership probability. The segmentation of the image into different regions can be defined as the assignment of pixels to different clusters at the same time but in different degrees.

This is an important feature of medical diagnostic systems to increase the sensitivity. The number of clusters determined for KFCM clustering is by , because the image is segmented into four regions such as, White Matter and Gray Matter including the tumor region itself. The second method, CNN classifier is used to classify the shape of tumor information. and new edge features Contrast, angular second moment, correlation, homogeneity are extracted using gray level co-occurrence matrix method, mean, variance, entropy and energy of the gray value are extracted using histogram based method and mean, variance, energy and entropy of the edge matrix are extracted using 2 level discrete wavelet transform method. Implementation of the classifiers Classification is the process where a given test sample is assigned a class on the basis of knowledge gained by the classifier during training.The classification performance of the proposed computer aided diagnostic system is compared between the classifiers such as CNN The result will be shows that the CNN classifier has better classification performance compared with the Other classifiers. In terms of the classification accuracy and computation time, the proposed texture feature extraction methods are compared.

Image Acquisition: Images are obtained using MRI scan and these scanned images are displayed in a two dimensional matrices having pixels as its elements. These matrices are dependent on matrix size and its field of view. Images are stored in Image File and displayed as a gray scale image. The entries of a gray scale image are ranging from 0 to 255, where 0 shows total black color and 255 pure white color. Entries between these ranges vary in intensity from black to white.

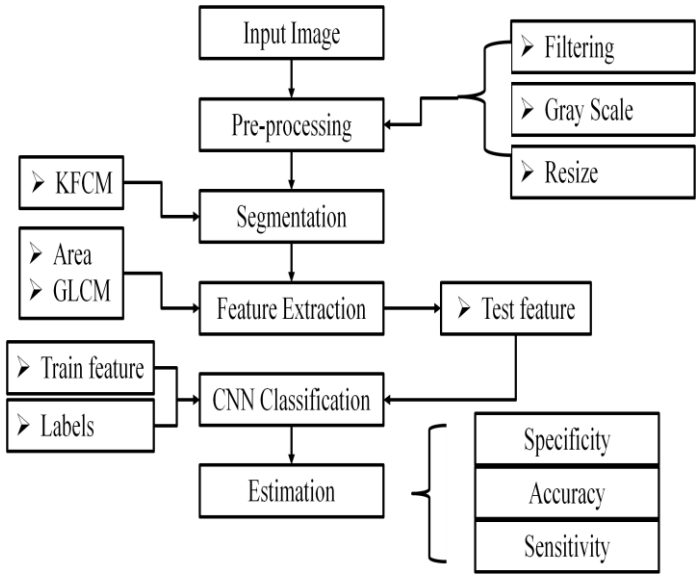

Fig.2 proposed flow chart.

Image To Gray Scale:- An MRI image is chosen from the file to be processed. This image is converted to gray scale image. These images have shades of gray between 0 to 255, where 0 corresponds to black and 255 to white for instance.

Noise Removal: Many filters are used to remove the noise from the images. Linear filters can also serve the purpose like Gaussian, averaging filters. For example average filters are used to remove salt and pepper noise from the image. Because in this filter pixel's value is replaced with its neighborhood values . Median filter is also used to remove the noise like salt and pepper and weighted average filter is the variation of this filter and can be implemented easily and give good results. In the median filter value of pixel is determined by the median of the neighboring pixels. This filter is less sensitive than the outliers.

Image Sharpening: Sharpening of the image can be achieved by using different high pass filters. As now noise is been removed by using different low pass filters, we need to sharpens the image as we need the sharp edges because this will help us to detect the boundary of the tumor. Gaussian high pass filter is used to enhance the boundaries of the objects in the image. Gaussian filter gives very high rated results and used very widely to enhance the finer details of the object.

Preprocessing Most of the real life data is noisy, inconsistent and incomplete and therefore pre-processing becomes necessary. Image preprocessing is one of the preliminary steps that are highly required to ensure the high accuracy of the subsequent steps. The raw MR images usually consist of many artifacts such as patient motions duration imaging times, intensity in homogeneities, cranial tissues, thermal noise and existence of any metal things in imaging environment and film artifacts or label on the MRI such as patient name, age and marks etc. which reduces the overall accuracy. Linear filters reduce noise by updating the pixel values by the weighted average of neighborhood pixels but it degrades the image quality substantially.

On the other hand, non linear filters preserve edges but degrade the fine structures. Several preprocessing techniques have been analyzed and surveyed in this section. Images Enhancement and Filtering: Image enhancement is the improvement of digital image quality without any knowledge about the original source image degradation. The enhancement methods mainly divide into two methods, direct and indirect methods. In direct method is to show the contrast of the image and then enhance the contract but in the indirect method contrast of the image is not essential. Under-enhanced when some regions of the image may be over-enhanced are the great disadvantage of the contrast enhancement methods. Mainly image enhancements are the intensity and contrast manipulation, noise reduction, undesirable background removal, edges Sharpening, filtering etc. Image enhancement methods improve the visual appearance of images from MRI and the contrast enhancing brain volumes were linearly associated. The enhancement activities are removal of film artifacts and labels, filtering the images. Median Filter, Low pass Filter, Gradient Based Method, Prewitt edge-finding filter, Nonlinear Filter, V-filter, and other filter with contrast Enhanced filter are shortly describe below. There are several filtering technology's which can improve the MRI image quality but there are several advantage and disadvantage which describe very shortly individually.

IV. PERFORMANCE ANALYSIS

In this section the works of three classification techniques such as kNN features extracted using GA based feature selection. The factors involved in performance comparison were listed below;

- Accuracy
- Sensitivity
- Error rate
- Specificity

Accuracy: Accuracy is calculating the ratio of number of correct assessment to the total number of assessments. In the entire dataset initially the number of relevant images were extracted and compared to entire dataset by applying the below mentioned formula in which data quality and errors were the important factors which are measure in terms of percentages (%).

$$\text{Accuracy}=TN+TP/TN+TP+FN+FP$$

Sensitivity : Initially total number of true positive and false negative assessments is extracted from that ratio of the number of true positive assessments to the total number is calculated to get the sensitivity result. The correctly identified data's declare the degree of positive values. The calculation part of sensitivity is done by applying the below formula and it's measured in terms of percentage (%).

$$\text{Sensitivity}= TP/TP+FN$$

Specificity: The specificity helps in predicting the impact of changes in the output because of its changes in input dataset. The correctly identified negative values give the Specificity which is also measured in

terms of percentage (%). The representation of the specificity formula is the ratio of the number of true negative assessments to the total number of true negative and false positive assessments.

Specificity= TN/TN+FP

V. CONCLUSION

The proposed classification system with the efficient segmentation technique classifies the normal and abnormal MRI brain tumor.It is implemented will be in MATLAB. The performance of the classifier system in terms of statistical measures such as sensitivity, specificity and classification accuracy will be analyzed.

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