

# Diagnosis and Classification of Brain Tumor

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**Abstract:** The aim of this paper is to provide an outline on cerebrum (brain) tumor diagnoses for folks that are new to virtual medical image processing. The strange improvement of cells within the brain is brain Tumor. Detection of brain tumor at early stage is feasible with image processing and the development of device learning. For early detection of extraordinary adjustments in tumor cells, Computer tomography, Magnetic resonance imaging strategies are used. Early detection and identification of tumor is the handiest manner to get remedy. Brain tumor is classed into two kinds benign and malignant tumor. Various imaging processing strategies had been proposed in latest couple of years for detection and class of brain tumor. Automatic segmentation method the usage of clustering and convolution neural community gives nice consequences. The PCA has been used for reducing the features from the segmented area gives superb outcomes compared to other techniques. For classification of brain tumors diverse algorithms any such Support Vector Machine, Artificial Neural Network, K-Nearest Neighbor are reviewed. These strategies correctly paintings on CT and MRI images

**Keywords:** Computer tomography (CT), magnetic resonance imaging (MRI), Principal Component Analysis (PCA), Support Vector Machine (SVM), Artificial Neural Network (ANN), K-Nearest Neighbor (KNN).

## I. INTRODUCTION

Tumor can be cancerous (Malignant) or non-carcinogenic (Benign). A brain tumor occurs whilst anomalous cells frames within the cerebrum i.e. Brain. Anatomical medical snap shots are having many kinds of photos that are specific from one to another in terms of the way is produced and how it's far appearance. Common sort of imaging consists of are: Plain X-Ray- X-rays is a type of radiation known as electromagnetic waves. Pictures of the inside of our body are created by using X-ray. The frame parts are shown by the black and white sunglasses of photos. Extraction of beneficial natural records from x- ray mind photo isn't very powerful due to their quandary of poor photograph nice and now not stronger interaction with the light detail. X-rays are utilized by Computed Tomography to create cross-sectional images of the internal of our body. These pictures are used to generate 3-D images. Computer Tomography imaging is very useful for viewing changes in tough tissues [1]. Brain tumor includes gentle tissues therefore soft tissues are not very cleared in CT test image of brain tumor. MRI is said to be most sensitive, powerful, successful and widely used technique.

A radiology take a look at, MRI uses magnetic fields and radio waves to supply 3-D pictures [2]. Magnetic resonance imaging scanners and a computer gives images of the internal frame structures, such as the coronary heart, breast tissue and the mind and other inner organs. In diagnostic have a look at of mind tumor, MRI assumes an exceedingly possible component keeping in thoughts the stop goal is to separate delicate and tough tissues probably i.e. Actually. Radiologist strongly recommend MRI photo of cerebrum tumor for analysis.

**TABLE I: Comparisons of Medical Imaging**

|                  | X-Ray              | CT-Scan                 | MRI             |
|------------------|--------------------|-------------------------|-----------------|
| Resolution       | Normal             | Moderate                | Best            |
| Speed            | Short              | Moderate                | Long            |
| Cost             | Low                | High                    | Relatively High |
| Data Acquisition | Low                | High                    | High            |
| Effects          | Ionizing radiation | Ionizing radiation      | No              |
| Availability     | Maximum            | Without much Difficulty | Less than CT    |

The regular techniques, utilized for classification are Biopsy, Human examination, Expert assessment and so forth [3]. The biopsy strategies are time ingesting, it takes round 8-112 days of period to take selection approximately form of tumor. The human decision is not always constantly correct and accurate. The human can also wrong but computer cannot. The expert can't take choice by using himself on tumor kind. The expert wishes to talk about with other professional for his opinion, this is once more a time-ingesting method. Now a day there's a brief improvement in Artificial Intelligence (AI) in bio-scientific area. Further segment covers the overview of various image processing algorithms for the tumor analysis.

## II. OVERVIEW OF DIFFERENT METHODS AND TECHNIQUES USED IN BRAIN TUMOR DIAGNOSIS

Brain tumors are odd tissues developing inside the mind which can also create various conditions including sickness. Different brain tumor detection algorithms were proposed amid maximum latest couple of years as mentioned below.

### A. Brain Tumor Detection Algorithms

Asra Aslam et al. [2] had proposed an enhanced edge detection algorithm for tumor segmentation. They had supplied a approach that used a mix of Sobel approach with photo impartial Thresholding technique. Close contour approach is applied which decrease the rate of fake edges. Finally, tumor extracted from the image primarily based on depth of pixels with in closed contours. Tumor extracted from proposed method is higher than the tumor extracted from sobel side detection. Jose Alex et al. [3] provided a technique for abnormality extraction from MRI. They had used place-based segmentation for abnormality extraction. This technique defined the algorithm for threshold detection for abnormality extraction. The technique efficaciously determines the tumor using thresh holding method. Dharshini et al. [4] had proposed Self-Organizing Map (SOM) for clustering of voxels that includes the unsupervised learning algorithm and Learning Vector Quantization (LVQ) with high diversity data instead of Multimodal MRI images. They had used Discrete Wavelet Transform coefficients to perceive the tissue types that encompass White Matter, Grey Matter and Cerebrospinal Fluid. They have simulated the results which display the better accuracies of classifier and segmentation on evaluating with the preceding techniques. Taie et al. [5] had presented an automatic framework consists of four steps: segmentation, feature extraction and features reduction. They had used Chicken Swarm Optimization (CSO) set of rules to optimize the parameter values of the classifier and Particle swarm optimization (PSO) optimizer to maximise the classification accuracy. They had shown the results of an automatic frame work that tested the performance of the system to appropriately stumble on the tumor in MRI. Rao et al. [6] presented an automated approach to hit upon and segment the mind tumor areas. The presented method includes 3 steps: initial segmentation, modelling of energy functions and optimizes the power feature. They had used the facts present in T1 and FLAIR MRI snap shots. They had used Conditional random field (CRF) based framework to mix the data found in T1 and FLAIR in probabilistic area. The benefits of CRF based totally framework are they can version complex shapes without problems and they incorporate the observations in power feature. The machine confirmed the promising consequences for detection and segmentation of tumor. George et al. [7] had labored at the simple concepts of cuckoo search set of rules for segmentation of mind tumor from the Magnetic Resonance Images (MRI). They had advanced a diagnostic gadget the usage of the first-rate optimization method known as the cuckoo search, which could assist the radiologist to have a 2d opinion. They had explored the CS set of rules to go looking mechanisms that suggests how it is green in detecting tumors and the results are as compared with Artificial Bee Colony (ABC) and Bacteria Foraging Optimization (BFO) algorithms. The experimental effects display that CS performs superior segmentation of tumors from MRI. Shree and Kumar [8] had focused on noise removal methods and feature extraction using DWT-based region growing segmentation, accompanied by way of morphological filtering that gets rid of the noise which was fashioned after segmentation. They had used a probabilistic neural community classifier to educate and take a look at the overall performance accuracy in the detection of tumor area in brain MRI images. The experimental effects confirmed that

nearly one hundred% accuracy in figuring out normal and abnormal tissues from mind MR pictures. Dhage et al. [9] had worked on brain tumor segmentation based on Watershed transformation. The method acknowledges the anomalous tissues from cerebrum tissues. The proposed framework includes four modules: pre-processing, segmentation, multi parameter estimation and Connected Component Labeling (CCL). Watershed set of rules characterizes the road isolating the standard and abnormal tissues. The parameters of brain tumor which includes perimeter, size, eccentricity, entropy and centroid achieved through proposed body work. Watershed segmentation algorithm provides better segmentation consequences with perimeter, eccentricity, entropy, region with cost (238, 0.62735, 0.33625, and 3983.35). Lee et al. [10] had presented unsupervised clustering techniques for the segmentation of CT brain images. The machine has been divided into degrees of clustering. The first clustering approach turned into for the detection of the ordinary regions. The 2nd clustering approach was for the segmentation of the CSF and brain depend. The gadget has been examined with several actual CT head images and has completed first-class outcomes. Lashkari [11] had proposed an automated tumor detection method that uses that uses T1, T2\_weighted and PD. The proposed technique has following tiers-function extraction, function choice, and category. For function extraction a non-statistical approach i.e. Gabour wavelet is used and the function choice is finished by way of kernel-F score technique. These decided on functions have been at once sent to the neural network for in addition class. The machine become having a few difficulty of the usage of all 3 modalities consisting of PD MR Images, T1 and T2 weighted. Though device can justify by its accuracy, excessive power and yield in detecting each sort of abnormalities. Corso et al. [12] had used an automated segmentation of heterogeneous photo information that taken a step towards bridging the space among top-down generative model-primarily based techniques and bottom-up affinity-based totally segmentation techniques. They had provided a Bayesian formulation for incorporating tender model into the calculation of affinities, which have been model loose. Their quantitative consequences show the gain of incorporating version-conscious affinities into the segmentation approach for the tough case of glioblastoma mind tumor. Hsieh et al. [13] had used an integrating fuzzy-c-mean (FCM) and location growing techniques for segmentation. Non-contrasted T1 and T2 -weighted MR photos have been used inside the evaluation. FCM clustering applied to pictures and become put thru the region-developing technique for pixels aggregation. The experimental consequences of automatic segmentation had been compared to the "Ground truth" (GT) on a pixel stage. The parameters, the "percent match" (PM) and "correlation ratio" (CR), acquired a high in shape among proposed device and the Gt. The machine shows excessive potential for medical use. Roy and Bandyopadhyay [14] presented an automatic algorithm to detect brain tumors by using symmetry analysis they have used global threshold and then calculate the area of the tumor. The quantitative analysis of MRI obtained key indicators of disease progression.

The problem of segmentation in MRI can be successfully addressed by modular and multi-step approaches.

Demirhan et al. [15] offered a tissue segmentation algorithm that segments brain MR pictures into tumor, edema, white matter (WM), gray matter (GM) and cerebrospinal fluid (CSF). They had used T1, T2 and FLAIR MR images of 20 subjects tormented by glial tumor. The segmentation was executed the usage of self-organizing map (SOM) that turned into trained with unsupervised studying set of rules and finetuned with getting to know vector quantization (LVQ). They had advanced a set of rules for clustering the SOM instead of the usage of an additional network.

Chaddad [16] presented a method for Glioblastoma (GBM) feature extraction based on Gaussian mixture model (GMM) features. GMM features showed the best performance by using principal component analysis (PCA) and wavelet-based features. Oo Zin et al. [17] had used morphological operation of erosion algorithm to detect the tumor. The presented method extracted the tumor region from the MRI. The experimental results show that the proposed method efficiently detected the tumor region from the brain image. Anitha and Murugavalli [18] had used Discrete Cosine Transform (DCT) on the brain tumor images for various classes. Using DCT, the proposed method offers a fair dimension reduction in feature sets. Finally, K-means algorithm was applied on DCT coefficients to cluster the feature sets. The proposed method helps to adjust and vary the performance of classification based on the count of the DCT coefficients considered. The proposed method has an average of 97% and a maximum of 100% classification accuracy achieved.

El-Melegy et al. [19] had proposed a fuzzy approach for the automatic segmentation. The proposed method had improved fuzzy c-means (FCM) algorithm to take any available information about the class center. The information had served to regularize the clusters obtained by FCM algorithm that boosted its performance. The proposed method has better robustness and segmentation accuracy compared with several other fuzzy and non-fuzzy techniques.

#### B. Brain Tumor Classification Algorithms.

Ramteke and Monali [20] had presented an automatic classification method on medical images. This category became completed with the assist of KNN classifier primarily based on picture capabilities and abnormality detection. They had categorised the snap shots into two instructions named as normal and atypical. A contrast study has been performed among KNN classifier and SVM classifier. The experimental effects proved that KNN classifier has higher class fee than SVM. Kharrat et al. [21] designed a hybrid method which composed of Wavelet transform, Genetic set of rules (GA) and SVM, to categorise the brain tissues in magnetic resonance snap shots. They had used spatial grey stage dependence technique (SGLDM) to extract an most effective texture feature set from normal and tumor areas. The gadget correctly classifies tumors into regular, benign and malignant with high sensitivity, specificity and accuracy rates. Singh and Verma [22] had offered a complicated category method primarily based on Support Vector Machines. This classifier has compared with other pre-store pictures for detecting the anomalies. The performance of SVM classifier changed into evaluated in phrases of classification accuracy.

Nanthagopal et al. [23] presented the Wavelet-primarily based statistical texture analysis method for the type of mind tissues into everyday, benign, malignant tumor of CT photos. Genetic Algorithm (GA) and foremost factor analysis (PCA) had been used to pick the most efficient texture capabilities from the set of extracted features. SVM is used as a classifier. The results of SVM for the feel evaluation strategies were evaluated using statistical evaluation and receiver operating feature (ROC) analysis. Veeramuthua et al. [24] had evolved a Computer Aided Diagnosis (CAD) to examine the shape of the brain pics. They had used multi-stage DWT to decomposed mind snap shots and then extracted image capabilities. They had used PNN RBF training and class technique to categorise brain pix. They had reduced the computational price with the aid of the usage of Fisher Discriminant Ratio (FDR) technique and used Morphological Filter technique to section the pictures consistent with the Region of Interest, was implemented to ordinary snap shots. The proposed technique has better accuracy and sensitivity to locate the discriminate mind regions. This technique provides an accuracy of 98% sensitivity of a 100% for the mind pictures.

Vaishnavee et al. [25] had worked on segmentation of MRI picture the usage of SOM clustering. They had used Histogram Equalization for extraction of capabilities that improved the segmentation accuracy. For characteristic choice, Principle Component Analysis (PCA) have been used to improve the classifier accuracy. An powerful classifier Proximal Support Vector Machines (PSVM) was used to automatically hit upon the tumor from mind MRI. The proposed technique has yield higher results the usage of high resolution photos, outperforming the outcomes supplied via other algorithms within the nation-of-the art, in phrases of the average overlap metric.

Anbeek et al. [26] had proposed a method for Completely automatic a couple of sclerosis (MS) lesion segmentation in cranial magnetic resonance (MR) imaging. They have used a T1-weighted and a fluid attenuation inversion recuperation scan. Segmentation was based totally on the K-Nearest Neighbor (KNN) classification method. By applying a threshold on the probabilistic snap shots binary segmentations had been derived. Automatic segmentations were achieved on a hard and fast of exams snap shots and in comparison with guide segmentations. High specificity and lower specificity have been discovered in contrast with the mixed segmentation. KNN-class presents an green approach for probabilistic segmentation of MS lesion tissue. Chang et al. [27] presented a refinement model based totally on neural community for ultrasonography and classify breast tumors in line with texture capabilities. They had implemented a sophisticated aid vector device (SVM) in 250 instances of pathologically proved breast tumors (140 benign and 110 malignant) and as compared its overall performance with that of a multilayer propagation neural network. The Support Vector Machine is helpful in the imaging prognosis of breast most cancers. They had as compared its class ability with MLP neural community model. On increasing length and complexity of records units, SVM is extra ideal to pc-aided diagnosis than MLP neural networks.



## Diagnosis and Classification of Brain Tumor

Larroza et al. [28] had discussed a category version the usage of aid vector device and texture features in evaluation-more advantageous T1- weighted photos. They had proposed a function choice technique based on help vector device to obtain a subset of functions that provide an gold standard overall performance. They have acquired the excessive classification accuracy (AUC>0.9) using texture functions and a aid vector device classifier in an technique based totally on conventional MRI. Vanitha and Venmathi [29] had proposed an Automatic tool to become aware of microbiological sorts without human supervision. Generally, Bacteriophage (phage) typing & Fluorescent imaging techniques were used to extract consultant feature profiles and bacterial kinds had been recognized by means of human professionals by way of reading the function profiles. They have proposed a way in which the features of the bacterial photograph were extracted and Support Vector Machine (SVM) turned into used for classifying the Bacterial kinds. The proposed technique has used SVM as a classifier for category of Bacterial images that supplied an amazing type performance of 97.5% in the course of training section and 93.33% efficiency for the duration of trying out segment. Vani et al. [30] had given a model for mind tumor detection and class to categorise the tumor the usage of SVM algorithm. They have used Support Vector Machine set of rules that worked on structural risk minimization to classify the images. The method has supplied a prototype for SVM-based object detection, which labeled the snap shots and evaluates whether the categorized photo was cancerous or non-cancerous. The method has 82% of accuracy, 81.48% of the high quality predictive values (PPV) and Negative predictive price (NPV). Kumar et al. [31] had presented a hybrid method that blanketed DWT for functions extraction, Genetic Algorithm to lessen the range of features and help vector gadget (SVM) for class. The proposed hybrid approach was implemented in MATLAB 2015a platform. They had used the following parameters for analyzing the photographs given as: entropy, smoothness, root suggest square errors (RMS), kurtosis and correlation. The experimental effects showed that the hybrid approach supplied higher performance by means of improving accuracy and minimizing the RMS blunders. Sukanesh and Padma [32] proposed a technique that mechanically analysis the bizarre tumor area in Computed Tomography (CT) photographs the usage of the wavelet based statistical texture analysis. They had made comparative studies of wavelet-primarily based texture evaluation technique and Spatial Gray Level Dependence Method (SGLDM). They had used the Support Vector Machine (SVM) based totally classifier and the overall performance of classifier turned into evaluated through evaluating the classification consequences of the SVM based totally classifier with the Back Propagation Neural network classifier (BPN). Results showed that the type accuracy of SVM is 96%.

. Calle-Alonso et al. [33] had advanced a CAD machine for the classification of bio-clinical gadgets. A hybrid approach become advanced for K nearest neighbor method, the pair sensible assessment and Bayesian regression. This was used to categorise items in several instructions. The gadgets have features, their pair smart comparison and its numerical vectors and then compute the regression parameters. Content based totally photo retrieval (CBIR) improves the category approach. The proposed gadget has the critical benefit that it

is able to be used for type troubles with both many functions and some numbers of elements.

Zhang et al. [34] supplied a neural community-primarily based method to classify mind MR photo. This proposed technique had used wavelet remodel to extract feature from picture and then decreased the scale of capabilities the use of fundamental aspect analysis (PCA) method. The reduced capabilities at once ship to neural community classifier, the class accuracy of both training and test photograph are 100%. Jain [35] mentioned a technique that classifies mind tumor primarily based on synthetic neural community (ANN). In the pre-processing ranges, histogram equalization and morphological operations were carried out to the image. In subsequent level, Gray Level Co-incidence Matrix (GLCM) become used for characteristic extraction. The extracted functions had been fed as input to the BPN classifier for classification. The picture became categorized into normal or odd photograph. The Classification accuracy is 96%.

Georgiadis et al. [36] had carried out a system for discrimination among metastatic and brain tumor in MRI. They had employed a Modified Probabilistic Neural Network classifier (PNN) and incorporating a nonlinear least square feature transformation (LSFT) into the PNN classifier. LSFT has enhanced the performance of PNN. Classification accuracy was 95.24% that had been achieved by the system for discriminating between primary tumor and metastatic. The proposed approach had carried out higher discrimination accuracies than the SVM-RBF, at both stages of the decision tree, even as in discriminating number one from secondary tumors its precision become near the ANN classifier. Kalbhani et al. [37] presented a way for the class of MR snap shots into ordinary and ordinary. Initially, two-dimensional discrete wavelet transforms (2D DWT) of the image became calculated and wavelet coefficients were modelled by means of Generalized Auto Regressive Conditional Heteroscedasticity (GARCH) statistical version. After function vector normalization, to extract the functions and to reduce the redundancy from the number one function vectors the predominant component analysis (PCA) and Linear Discriminant Analysis (LDA) have been used. To decide the everyday or unusual kind photos, the extracted capabilities have been despatched to the K nearest neighbour (KNN) and aid vector machine (SVM) classifier one by one. The classification accuracy accomplished for SVM and KNN classifier are approximately 98.21% and 97.62% respectively. Bong and Rajeswari [38] had offered a comprehensive evaluation of nature-stimulated techniques used in photograph segmentation. They had focused on multi-goal clustering and class processes. In the use of multi-goal nature-stimulated strategies in category, they had defined issues associated with, accuracy measures, range measures, coping with uncertainties and rule manipulation. The implementation of a brand new method must recall factors together with interactivity, generality, robustness and simplification.

. Meng et al. [39] provided a Chicken Swarm Optimization (CSO) that's a bio-stimulated optimization algorithm, and particle swarm optimization (PSO) optimizers to maximize the type accuracy. RajKumar and Niranjana [40] had proposed a segmentation of MRI mind tumor using cell automata and category of tumors using Gray stage



Co-occurrence matrix functions and artificial neural network. In proposed technique, seeded tumor segmentation based on mobile automata on magnetic resonance (MR) photographs, that uses seed selection and volume of hobby (VOI). Seed primarily based segmentation become accomplished for detecting the tumor area and then acquiring the vicinity the usage of degree set approach. For non-information based automated category, Artificial Neural Network and

photograph texture functions were used. Decision making became performed in degrees: the classification using Radial basis function which is the type of characteristic extraction the use of Gray stage Co-occurrence matrix and ANN. Training performance and class accuracies have been parameters for evaluation of ANN. ANN has completed speedy and correct classification than other neural networks.

**Table II Comparison between different Brain Tumor Analysis Techniques:**

| Sr. No. | Name of Author       | Year | Used Methodology  | Key Points  |
|---------|----------------------|------|---|---|
| 1       | Asra Aslam et al.[2] | 2015 | An Enhanced Edge Detetcion Method   | Tumor extracted is better than sobel edge detection   |
| 2       | Jose Alex et al. [3] | 2011 | Threshold detection   | Thresholding technique detemines tumor effectively.   |
| 3       | Dharshini et al. [4] | 2016 | Self-Organizing Map (SOM) for clustering                                  | The method provides better accuracies of classifier and segmentation than other previous method.  |
| 4       | Taie et al. [5]      | 2017 | CSO and PSO optimization techniques                                       | The Results show that the system effectively detects and classify the tumor in MRI.   |
| 5       | Rao et al. [6]       | 2017 | Conditional random field (CRF) based segmentation                         | The system shows the promising results for detection and segmentation of tumor.   |
| 6       | George et al. [7]    | 2015 | Cuckoo search algorithm for segmentaion                                   | the results are compared with Artificial Bee Colony (ABC) and Bacteria Foraging Optimization (BFO) algorithms. The experimental results show that CS performs superior segmentation of tumors from MRI. |
| 7       | Shree and Kumar [8]  | 2018 | DWT based segmentation, The probabilistic neural network classifier (PNN) | The experimental results achieved nearly 100% accuracy in identifying normal and abnormal tissues from brain MR images.   |
| 8       | Dhage et al. [9]     | 2015 | Watershed segmentation algorithm  | Watershed segmentation algorithm provides better segmentation results with perimeter, eccentricity, entropy, area with value (238, 0.62735, 0.33625, and 3983.35).                                      |
| 9       | Lee et al. [10]      | 2009 | unsupervised clustering techniques  | The system has been tested with a number of real CT head images and has achieved satisfactory results   |
| 10      | Lashkari [11]        | 2010 | T1, T2_weighted and PD, neural network classifier                         | The system classifies the brain tissues to normal and abnormal classes automatically.   |



## Diagnosis and Classification of Brain Tumor

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|----|-----------------------------|------|--|--|
| 11 | Corso et al. [12]           | 2008 | Integrated Bayesian Model Classification                               | results show the benefit of incorporating model-aware affinities into the segmentation process for the difficult case of glioblastoma multi-forme brain tumor.                   |
| 12 | Hsieh et al. [13]           | 2011 | integrating fuzzy clustering and region growing                        | The system demonstrates high potential for practical clinical use.   |
| 13 | Roy and Bandyopadhyay [14]  | 2012 | global threshold, symmetry analysis                                    | The complex problem of segmenting tumor in MRI can be successfully addressed by considering modular and multi-step approaches.   |
| 14 | Demirhan et al. [15]        | 2014 | Wavelets And Neural Networks   | The results showed that average Dice similarity indexes were 87% for GM, 95% for CSF, 61% for tumor, 91% for WM and 77% for edema.   |
| 15 | Chaddad [16]                | 2015 | Gaussian Mixture Models  | GMM features showed the best performance by using (PCA) and wavelet based features   |
| 16 | Oo Zin et al. [17]          | 2014 | WATERSHED SEGMENTATION AND MORPHOLOGICAL OPERATION                     | The proposed method extracts the tumor region accurately from the MRI brain image.   |
| 17 | Anitha and Murugavalli [18] | 2014 | CLASSIFICATION BASED ON CLUSTERED DISCRETE COSINE TRANSFORM            | The proposed method has an average of 97% and a maximum of 100% classification accuracy achieved   |
| 18 | El-Melegy et al. [19]       | 2014 | fuzzy approach with class center priors                                | The proposed method has better robustness and segmentation accuracy compared with several other fuzzy and non-fuzzy techniques   |
| 19 | Ramteke and Monali [20]     | 2012 | KNN  | KNN classifier obtain better classification rate than SVM.   |
| 20 | Kharrat et al. [21]         | 2010 | A hybrid technique (Wavelet transform, Genetic algorithm (GA) and SVM) | The system effectively classifies tumor with high sensitivity, specificity and accuracy rates.   |
| 21 | Singh and Verma [22]        | 2012 | Linear SVM classifier  | The performance of SVM classifier is evaluated in terms of classification accuracies and the result confirmed that the proposed method has potential in detecting the anomalies. |
| 22 | Nanthagopal et al. [23]     | 2012 | Wavelet-based statistical texture analysis and SVM                     | The system achieves higher classification accuracy.  |
| 23 | Veeramuthua et al. [24]     | 2015 | PNN RBF training, Fisher Discriminant Ratio (FDR) method               | This method yields an accuracy of 98% sensitivity of 100% for the functional brain images.   |
| 24 | Vaishnavee et al. [25]      | 2015 | SOM clustering, Proximal Support Vector Machines (PSVM)                | PSVM is faster and computationally more efficient than SVM.  |

|    |                           |      |  |   |
|----|---------------------------|------|--|---|
| 25 | Anbeek et al. [26]        | 2008 | Segmentation based on KNN classification   | Segmentation Approach is suitable for brain segmentation problems in a large variety of applications.   |
| 26 | Chang et al. [27]         | 2003 | SVM  | SVM is more suited to computer-aided diagnosis than MLP neural networks.  |
| 27 | Larroza et al. [28]       | 2015 | Texture features and SVM Classifier  | high classification accuracy (AUC>0.9) using texture features and a support vector machine classifier.  |
| 28 | Vanitha and Venmathi [29] | 2011 | SVM  | SVM classifier provides a good classification efficiency of 97.5% during training phase and 93.33% efficiency during testing phase                        |
| 29 | Vani et al. [30]          | 2017 | SVM  | The proposed method has 82% of accuracy, 81.48% of the positive predictive values (PPV) and Negative predictive value (NPV).                              |
| 30 | Kumar et al. [31]         | 2017 | DWT for feature extraction, Genetic algorithm for reduce the no. of features,                        | Hybrid approach offered better performance by improving accuracy and minimizing the RMS error.  |
| 31 | Padma and Sukanesh [32]   | 2011 | wavelet based statistical texture analysis, SVM  | SVM based classifier is compared with the Back Propagation Neural network classifier (BPN) and the classification accuracy of SVM is 96%.                 |
| 32 | Calle-Alonso et al. [33]  | 2013 | A hybrid approach for K nearest neighbor technique, the pair wise comparison and Bayesian regression | The method has the important advantage that it can be used for classification problems with both a large number of features and a few numbers of elements |
| 33 | Zhang et al. [34]         | 2011 | wavelet transform, PCA, neural network.  | the classification accuracy of both training and test image are 100%.   |
| 34 | Jain [35]                 | 2013 | Artificial Neural Network (ANN)  | The Classification accuracy is 96%.   |
| 35 | Georgiadis et al. [36]    | 2008 | non-linear LSFT-PNN algorithm  | The proposed method had achieved higher discrimination accuracies than the SVM-RBF.   |
| 36 | Kalbhani et al. [37]      | 2013 | classification based on GARCH variances series   | KNN and SVM classifiers achieve 97.62% and 98.21% accuracy respectively.  |
| 37 | Bong and Rajeswari [38]   | 2011 | nature-inspired clustering and classification techniques for image segmentation                      | the development of a new method should consider factors such as robustness, interactivity, generality, and simplification                                 |
| 38 | Meng et al. [39]          | 2014 | Chicken Swarm Optimization (CSO) for optimization applications.                                      | The results show that CSO can achieve good optimization results in terms of both optimization accuracy and robustness                                     |



## Diagnosis and Classification of Brain Tumor

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| 39 | RajKumar and Niranjana [40] | 2013 | Cellular Automata and Neural Networks (ANN) | Artificial Neural Network gives fast and accurate classification than other neural networks. |
|----|-----------------------------|------|---|--|

### III. DISCUSSION

MRI is safer and greater powerful test than CT scan and X-Rays There is no harm to human body due to zero radiations It consists of powerful magnetic area, radio frequency and a computer to provide extra detail and clean picture of human organs and gentle tissues [3]. One trouble of the use of MRI photos of brain is that it gives huge amount of records. This massive statistics does now not permit the guide segmentation to technique in reasonable time. So, the dependable and automatic segmentation should need to use for tumor segmentation in brain MRI images [2]. Comparing the performance parameters of various classifiers such KNN, Neural Network (NNs), SVM, the most desirable classifier we are able to pick for the prognosis. It has been determined that a few NNs which include BPNN, MLP and PNN plays better with the improved class accuracy.

### IV. CONCLUSION

One of the maximum critical a part of the human body is Brain and Brain has excessive impact on the overall performance of other body elements. The computer aided algorithms for prognosis of brain tumor have been developed to guide doctors/radiologists to give an accurate diagnosis and to decrease the charge of range of wrong selections of brain diseases. For detection of brain tumor diverse techniques and strategies were advanced. The methods and strategies that have been normally used and those these days advanced has been discussed in this paper. A big improvement in tumor detection has been observed in one-of-a-kind methods, however their performances are still not up to the mark. Possible purpose for, there is lots of structural and spatial variability in mind which creates many challenges in obtaining the perfect place of interest.

For classifiers, the feature choice and extraction will give the exceptional performance effects. Furthermore, the pleasant choice of a classifier plays a important role in classification consequences and brain abnormalities category is not an easy task even for professional like medical doctors/radiologist. The development in every algorithm of classification and detection required an development to attain very correct effects that offers the most beneficial performance of diagnosis algorithms

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