Automated Brain Tumor Detection in Medical Brain Images and Clinical Parameters using Data Mining Techniques: A Review

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ABSTRACT
Data mining is a growing field of research that intersects with many other fields such as Artificial Intelligent, Statistics, Visualization, Parallel Computing and Image Processing. Data mining techniques are good for Brain MRI image classification that can diagnose brain tumor and other diseases. In this paper we present an overview of the current research being carried out using the data mining techniques for the diagnosis of brain tumor. The goal of this study is to identify the most well performing data mining algorithms used on medical brain MRI and Clinical parameters. The following algorithms have been identified: Decision Trees, Support Vector Machine, Artificial Neural Networks and their Multilayer Perceptron model, and Fuzzy C-Means. Analyses show that it is very difficult to name a single data mining algorithm as the most suitable for the brain tumor detection or classification. At times some algorithms perform better than others, but there are cases when the properties of some of the above mentioned algorithm are combined together, they provide effective result. This paper also provides a critical evaluation of the literature reviewed, which reveals new facets of.

General Terms
Data Mining, Brain Tumor.

Keywords
MRI Brain Images, Feature Extraction, Neural Network, Support Vector Machine (SVM), Fuzzy C-Means.

1. INTRODUCTION
Data mining is an essential step in the process of knowledge discovery in databases in which intelligent methods are applied in order to extract patterns. Parallelism offers a natural and promising approach to cope with the problem of efficient data mining in large databases. There has been considerable interest in parallel processing of data mining algorithms [1, 2]. The Curing cancer has been a major goal of medical researchers for decades, but development of new treatments takes time and money [3]. The growth of abnormal cells in the tissues of the brain called brain tumor. Brain tumors can be benign (not cancer) or malignant (cancer). According to the national cancer institute, estimated new cases 23,380 and deaths 14,320 from brain and other nervous system cancers in 2014 [4]. Human brain tumors are complex and often aggressive pathologies of low prevalence but significant social impact. The accurate diagnosis of these tumors is essential in order to provide a prognosis of tumor development [5]. In medical field the brain tumor detection is done with data mining techniques, this is an emerging field. Data mining techniques such as neural networks, decision tree, Support vector machine, Fuzzy c-means, many other algorithms are very helpful for finding the medicinal decision to diagnose brain tumor and cancer diseases and help in their decision. Data mining can be used to explore many data sets in diagnosis of various types of tumors. Data mining is concerned with building the model, a model is simply an algorithm. Data mining is the most effective when large data sets are available. Most data mining algorithm are used to build and train the data mining model which has large amount of data these are to perform classification, prediction and other data mining tasks. Brain is a complicated structure. In today's world, it's still a challenging task for detecting brain tumor disease to classify accurately and efficiently. Classification of images of data sets can be divided into classes based on their images features.

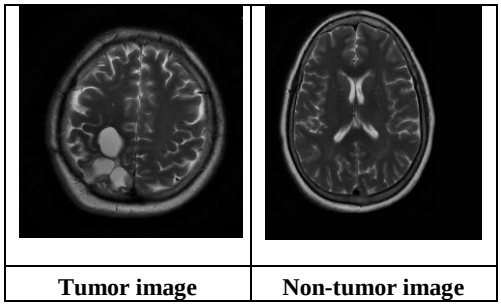

Fig 1: Classification of tumor and non-tumor MRI images

This study evaluates many techniques that play a vital role within the classification of medical images. This paper is organized in four sections. After this introductory section, the next section highlights the major techniques that have been studied as part of the literature review. Section third outlines the critical evaluation of the techniques discussed in the related work section. Finally, we conclude in the last section.

2. LITERATURE REVIEW
D. S. Gupta *et al.* applied Association rule mining based study for identification of clinical parameters akin to occurrence of brain tumor, which led to the occurrence of brain tumor. Their path involves the collection, cleaning and storage of data, followed by mining of knowledge frame, It associate it with the 'STATE' of brain, using association rule for data mining. They used such parameters like high values of Creatinine,

Blood Urea Nitrogen (BUN), SGOT & SGPT to be directly associated with tumor occurrence. A normalized regression model is based on these parameters along with Hemoglobin content, Alkaline Phosphatase and Serum Bilirubin for prediction of occurrence of STATE (brain tumor) as 0 (absent) or 1 (present). They proposed prediction model for the early diagnosis of brain tumor, but for its robustness and high accuracy the model proposed need to be further validated by including data sets of patients suffering from different kind of tumors [6].

S.K. Bandyopadhyay and T.U. Paul worked on Automatic Segmentation of Brain Tumor from Multiple Images of Brain MRI. Their detection of brain tumor through the image segmentation, first they took a system image registration and data fusion of MRI. It consists of registration of multiple MRI of brain taken along adjacent layers of brain image intensity in MRI. it depends upon four parameters one is proton density (PD) which is determined by relative concentration of water molecules and other three parameters are T1,T2,T2* relaxation, which reflect different features of the local environment of individual protons. After that segmentation was performed on image for GM, WM and cerebra-spinal fluid (CSF) and tumor region extraction, then meaningful information about of image can be obtained. different analysis can be performed on segmented image, extract the brain tumor region, they used the image processing segmentation technique for detection of position of objects and boundaries in images .they used pre-processing method of image processing for image enhancement, then k-means algorithm. And finally obtain the most optimal segmentation [7].

Z. Shi *et al.* study on survey on neural networks used for medical image processing, in their study, key features of medical image preprocessing, segmentation, and object detection and recognition were used. The study employed Hopfield and feed-forward neural networks. The feed-forward and Hopfield neural networks are simple to use and easy to implement. The advantage of Hopfield neural networks is that it does not require pre-experimental knowledge. The time required to resolve image processing difficulty is substantially reduced by using trained neural network. In this review, neural networks can solve the problem of medical image processing [8].

C. W. Hsu *et al.* had demonstrated a Practical Guide to Support Vector Classification They had described this support vector machine (SVM) is a popular classification technique. In their guide, they had proposed a simple procedure which usually gives reasonable results. They had explained SVMs (Support Vector Machines) are useful technique for data classification. A classification task usually involves separating data into training and testing sets. Each instance in the training set contains one "target value" (i.e. the class labels) and several "attributes" (i.e. the features or observed variables). Their Proposed Procedure consists of several steps like: Firstly, Transform data to the format of an SVM package. Secondly, randomly try a few kernels and parameters and then test. Further they also discussed the data preprocessing by using the methods of categorical features as SVM requires that each data instance is represented as a vector of real numbers and then by Scaling. Applying Scaling before SVM is very important. After this Model Selection is done .Though there are only four common kernels mentioned, it has to be decided that which one to try first. Then the penalty parameter *C* and kernel parameters are chosen and it was followed by Cross-validation and Grid-search. After identifying a "better" region on the grid, a finer grid search on that region can be conducted. The above approach works well for problems with thousands or more data points. For very large data sets a feasible approach is to randomly choose a subset of the data set, conduct grid-search on them, and then do a better-region-only grid-search on the complete data set. In some situations the above proposed procedure is not good enough, so other techniques such as feature selection may be needed. Thus it can be stated that this procedure works well for data which do not have many features. If there are thousands of attributes, there may be a need to choose a subset of them before giving the data to SVM [9].

K.P Shanmugapriya *et al.*, A study on applications of data mining techniques in brain imaging. In their paper these techniques are effective for predicting and preventing a disease. In their work they have described the data mining methods that have employed in the analysis of brain images and introduce statistical methods for brain patterns discovery. In data mining, data pre-processing was done by them which aids in normalization. The brain objects are stored in database and mined later. In data mining, they have tried to find association between structure and formation through task activation and lesion deficit studies. the methods that can be, applied for both structural and functional imaging like functional images uses the technologies such as PEI, SPECI etc., SPM (statistical parametric mapping) is used in structural imaging of brain, they said that lesion deficit data can be analyzed. Atlas based analysis can be used where anatomical structures represent functional units or voxel based system can be used. Their main aim was to classify shapes of brain structure, such as nerve fiber and abnormalities such as tumor and searching for similarity and finding associations between gene expressions, morphology and function. Thus their work used data mining method for knowledge discovering from brain images along with other clinical data [10].

T. Jesmin *et al.* worked on brain cancer risk prediction tool using data mining. Initially they took the data of 150 people of brain cancer and non-cancer patient information. They considered 16 factors, like age, heredity, gender, cell phone usage, color of body, skin, etc. for data mining. They initially used data pre-processing method to make an appropriate analysis and suitable for data clustering. In this they categorize the data in different sub groups. They used k-mean clustering, where k is positive integer holding number of clustering. They pre-processed data clustered using k-mean algorithm with the value k=2 which represented two clusters, where one cluster contain relevant data to brain cancer and another non relevant data. Later they discovered frequent pattern using decomposition algorithm and using it they found the weight-age significant patterns. They further separated the results in two sections, one which they held the significant frequent patterns discovering part and another one prediction tool to brain cancer. This proposed method was implemented using java and can efficiently and successfully predict the brain cancer [11].

L.S. Kumar and A. padampriya discussed that technology of data mining as a user oriented approach, used for collecting, searching and analyzing large amount of data-base. They determined that data mining algorithm can be efficiently used in medicine domain. Their research work is related to prediction of system designed with the aid of neural network, where data is extracted and then clustering is performed on pre-processing data, using k=means clustering algorithm with k values so as to extract data relevant to common disease.

They also gave review of some of the related work on common disease like malaria, mental diseases and typhoid. The main method used in their study is the ID3 algorithm. Their research started by screening of clinical data, pre-processing and then clustering it using k-means clustering algorithm with k=2. Their result contained two data, one contains the data that are most-relevant to disease and other which is remaining data or non-relevant disease diagnosis system using ID3 algorithm. As it has easy understanding of table prediction tools, and builds the farter tree, their common disease procedures. Result were obtained using this diagnosis system, using data mining techniques, namely, ID3, neural network. It is web-based, user-friendly, scalable reliable and expandable system. It reveals the decision tree out-performs and Bayesian classification having similar accuracy as of ID3 but other predictive methods like neural network and classification based on clustering are not performing well [12].

W.H. Ibrahim, A.A.A Osman and Y.I. Mohamed proposed the classification of brain tumor using MRI, they used neural network for classification of MRI. Their neural network consists of three stages, preprocessing, dimensionality reduction, and classification. In preprocessing, import the images into MATLAB platform and through the image processing converted images into binary form according to threshold, MATLAB stored an intensity image as a single matrix for each image, those images are converted into [64 by 64] after preprocessing. In the next step dimensionality reduction MR images using principal component analysis (PCA) for reducing the dimensionality of those images, they used those images after preprocessing was [64 by 64] as a input to PCA algorithm and output of PCA has been [64 by 1]. Now those images ready to enter the ANN for training. Last stage they have classified MRI using the neural network, their ANN architecture consist of the back-propagation feed-forward network. They found classification of MRI. Their output phase involves the application of model to observe how well model react to untrained data and also detection of abnormal tissue based on data. Now they have classes for each (r), there are 4 classes normal, edema, cancer, and not classified. Finally they have experimental result indicates that the technique was workable with accuracy of 96.33%, fast in execution [13].

F. Amato *et al.* discussed on medical diagnosis using artificial neural network, in their work they have reviewed and discussed the philosophy, capabilities, and limitations of artificial neural networks in medical diagnosis through selected examples. They used ANN to handle clinical parameters. ANNs are useful in the analysis of blood and urine samples of diabetic patients, diagnosis of tuberculosis, leukemia classification, analysis of complicated effusion samples, and image analysis of radiographs or even living tissue. Their aim is to present the general philosophy for the use of ANNs in diagnostic approaches through selected examples, documenting the enormous variability of data that can serve as inputs for ANNs and attention was not only be given to the power of ANNs applications, also to evaluation of their limits, possible trends, and future development and connections to other branches of human medicine. They describe the structure of neural network "input" layer, one or more "hidden" layers, and the "output" layer. The number of neurons in a layer and the number of layers depends strongly on the complexity of the system studied. Therefore, the optimal network architecture was determined. After they found optimal architecture, network training uses the suitable database, there database as a table form of patients for whom diagnosis (positive or negative) about a certain disease was already known [14].

S. Shah and S. Parikh discussed Issues in Medical Diagnosis Using computational Techniques. In their paper they give emphasis on various techniques presented by researchers for medical diagnosis and their performance issues are discussed. Research has been carried out to diagnose medical images using techniques like Classification, Association Rule Mining, Clustering or combination of algorithms. They mainly suffer either because of lower classification accuracy or memory constraint to process large set of medical images. So, parallel algorithms which can process large set images as well as algorithms which give higher classification accuracy are required. Novel hybrid classifier to classify medical images is proposed. Proposed method first extracts features from images and converts them into transaction database. Then they applied parallel Frequent Pattern (FP) Growth to mine association rules and are classified by Decision Tree classifier. They further combined the two methods of Parallel FP Growth Association rule mining and Decision Tree classification to get more efficiency and accuracy for proposed system. Their proposed method consists of unique combination of two powerful algorithms and they are Parallel FP Growth for association rule mining and Decision Tree classifier for classification. It is expected to diagnose medical images accurately, efficiently and in user friendly way because Decision Tree represents results which can be easily interpreted with utmost accuracy as per the experimental results tested on UCI dataset in WEKA. Also Parallel FP growth algorithm divides tree in parts and reduces the height of the tree, doesn't generate candidate item sets, increases efficiency and reduces I/O overhead. Thus by Early diagnosis of disease may save patient's life in case of detection of brain tumors and Cancerous tissues, Prediction of Cardiovascular Disease and many more. Computer Aided Diagnosis can assist physician to diagnose disease like cancer early and help consult specialist for further treatment [15].

P. Rajendran *et al.* did their work on An Improved Pre-Processing Technique with Image Mining Approach for the Medical Image Classification. In pre-processing technique, they have used to isolate the desired object from the image. In their work, a great effort to apply association rule mining techniques to solve feature selection problems, and attempt to produce a small size feature subtypes that is acceptable for classification tasks. They used the Decision tree as a powerful and attractive tool in the field of classification. The feature selection from the brain image has been done using the association rule mining. The rules generated for extracted features are stored in the transactional database have been classified using the data mining concept called Decision Tree Classification. The combination of both the association rule mining and the decision tree classification gives the high degree of accuracy and efficiency for the proposed system. In their proposed system CT-Scan brain images has been proven to be a significant way to detect the brain tumor. The new technique called Shape priori algorithm for pre-processing of images has given the efficient features to be stored in the transactional database. The feature selection using Association rule mining algorithm has given the best way of identifying the rule to be used for classification phase. Decision tree classifier classifies the rules according to the class labels and it assists the physicians for taking the better decision [16].

R. Isola *et al.* determined the Knowledge Discovery in Medical Systems Using Differential Diagnosis, LAMSTAR, and *k*-NN. They proposed in this paper vast storage of information so that diagnosis based on these historical data can be made. They focused on computing the probability of occurrence of a particular ailment from the medical data by mining it using a unique algorithm which increases accuracy of such diagnosis by combining the key points of neural networks, Large Memory Storage, and Retrieval, *k*-NN, and differential diagnosis all integrated into one single algorithm. This algorithm can be used in solving a few common problems that are encountered in automated diagnosis these days, which include diagnosis of multiple diseases showing similar symptoms, diagnosis of a person suffering from multiple diseases, receiving faster and more accurate second opinion, and faster identification of trends present in the medical records. In this system, by using Hopfield networks, LAMSTAR, and *k*-NN, an attempt has been made to assist the doctors to perform differential diagnosis As a result of their study the current system does not give 100% accurate results as not even the doctors can claim to do so however, its results are promising [17].

A. Padma and R. Sukanesh did their research on SVM Based Classification of Soft Tissues in Brain CT Images Using Wavelet Based Dominant Gray Level Run Length Texture Features. In their work they have emphasized on the technique of medical CT imaging as one of the widely applied and reliable technique used for the detection and location of pathological changes efficiently. Their study aimed on the methods of classifying and segmenting soft tissues in brain CT images. Their proposed system was divided into 3 phases (i) Discrete wavelet decomposition in this the researchers have used the Daubechies wavelet filter of order two to yield good result in brain soft tissues in CT scan. (ii) Feature extraction and selection, feature extraction by the DGLRLM and Then the feature values are normalized by subtracting minimum value and dividing by maximum value minus minimum value. Normalized feature values are then optimized by MDEE and BDM algorithm. (iii) Classification and Evaluation, they used SVM classifier. Hence it is concluded that the SVM supported by this texture analysis method can be effectively used for classification and segmentation of brain soft tissues in CT images. Finally they obtained 98% accuracy [18].

N. Abdullah, U.K. Ngah, S. A. Aziz, their topic is Image Classification of Brain MRI using support vector machine. They proposed a method which used SVM to automatically classify brain MRI, normal and abnormal. They took 32 patients with in the age group of 20 to 40 years old. Pre-processing technique, wavelet transform was first applied to the images and free from noise. Then feature extraction and classification of the images feature extraction was implemented by using 17689 wavelet approximate coefficients for each of the images. SVM classifier was applied to the completion of those experiment their system classify 657, which was not a good accuracy [19].

S.H.S.A. Ubaidillah, R. Sallehuddin, N.A. Ali, discussed on cancer detection using artificial neural network and support vector machine: A Comparative study. They found in their literature SVM and ANN can produce better result for cancer detection, they compared the performance on four different cancer datasets using SVM and ANN classifiers. Those datasets were breast cancer and liver cancer both are based on organ and prostate cancer and ovarian cancer these are based on gene expression data. Those datasets include benign and malignant tumor. They used four different measuring tools, which were accuracy sensitivity, specificity that done comparison between SVM and ANN performance, their study was organized in order to compare the performance of two techniques which were SVM and ANN. They found their result, ANN classifier can obtain good classification performance in the datasets with bigger amount of input features (prostate and ovarian cancer datasets) while SVM gave better performance in that datasets with smaller amount of input features (breast cancer and liver cancer), but finally SVM classifier provided better result for tumor [20].

P. Rajendran, M. Madheswaran, their title is hybrid medical image classification using association rule mining with decision tree algorithm. Their proposed method based on image mining for classification of brain tumor in CT images. They involved few steps such as pre-processing, feature extraction association rule mining and hybrid classifier. In pre-processing they included two techniques median filter and morphological operation that reduced noise and blurring. Their hybrid process included two image mining, association rule mining and decision tree. In edge detection, this process for segmentation using canny edge detection technique, it also called Gaussian function that segmented into number of objects and store in the transactional database. In classification process they used hybrid approach to classify the brain CT images. They compared it with conventional method and found better results. The accuracy of 95% and sensitivity of 97% were found in the classification of brain tumor [21].

M. M. Subhashini and S. K. Shood worked on Brain tumor detection using pulse couple neural network (PCNN) and back propagation network. In their work image segmentation as obtained through sixteen different MRI images and fed to pulse coupled neural network for brain tumor detection in brain MRI images. In pre-processing they loaded images and converted into gray scale, then median filtering was applied to MRI images and finally enhanced images were found using PCNN. The various parameter used for feature extraction were mean area, third moment, entropy, standard deviation. In the image segmentation, thresholding and neural networks were used for segmentation. In the last step first fourteen images were used for training, next two images were used for testing the neural network with back propagation algorithm for MRI images classification of tumor and non-tumor images. The result produced tumor detection in the fifteenth image and normal in sixteenth. Finally they found PCNN can be an effective image analysis tool [22].

Prof. V. Gupta, K. S. Sagale, research tittle implementation a classification system. This paper was an extension in computer aided diagnosis for early detection and prediction of brain cancer using texture features and neuro classification logic and back propagation neural network. This paper was an extension of their previous paper based on locating tumor extracting features from brain cancer affected MRI. They have considered Astrocytoma type of brain cancer in their study. In clustering the samples of 60 MRI, images were processed through histogram equalization, binarization, morphological operations feature extraction neuro-classifier and categorized into 4 classes. The distinct feature was extracted using GLCM. Then they used multilayer feed forward used with back propagation algorithm for classification the output of ANN was compared with the target vector to predict the class of tumor [23].

A.A. Badarnel, H. Nafadat and A. M. Alraziqi, tittle is A classifier to detect tumor disease in brain MRI brain images. In their work shows the effect of neural network and K-nearest neighbor algorithm for tumor and non-tumor MRI classification. In those proposed work the dataset consists of 710, T2 weighted and axial, 256*256 pixel MRI images. In feature extraction they obtained 275 brain MRI texture features, those features were passed to ANN and K-NN classifier. Finally they evaluated the performance of the proposed method in term of confusion matrix, sensitivity, specificity and accuracy. Finally they found 100% classification accuracy achieved by K-NN and 98.92% by neural network [24].

S.N. Deepa and B.A. Devi, their research tittle was Artificial neural networks design for classification of brain tumor. They exploit the capability of BPN and RBFN to classify brain MRI. Their proposed system consists of multiple phases. 42 patient's data sets were used. In preprocessing and segmentation, noise is removed and it involves sequence of steps to image classification. They were histogram equalization, region isolation and feature extraction. In Second phase brain images were classified on the basis of those texture feature using BPN and RBFN classifiers. After classification tumor region was extracted from those images. Finally they found that RBFN performs better with high convergence [25].

D. Kovacevic and S. Loncaric worked on Radial basis function-based image segmentation using a receptive field. They proposed a segmentation method for brain images that performs a basic segmentation process containing three steps. In the first step, prominent features of images are extracted and normalization is carried out. In the next step, pixels are classified using artificial neural networks. Finally, the results obtained in the second step are labeled. They found in their study RBF network has better generalization capabilities. Moreover, the training algorithm is relatively simple as compared to the iterative back-propagation algorithm used in the multi-layer perceptron (MLP). The proposed algorithm does not perform well on trained data [26].

M.N. Ahmed *et al.* worked on a modified fuzzy c-means algorithm for bias field estimation and segmentation of MRI data. The objective function in the standard FCM algorithm was altered in their proposed algorithm. The alteration of the objective function compensates intensity in homogeneities and allows labeling of a pixel (voxel) to be influenced in its immediate neighborhood. Such a scheme is effective in segmenting scans corrupted by salt and pepper noise. In their work BCFCM algorithm was the introduced, which was faster to converge to the correct classification. There were certain tradeoffs as BCFCM is limited to a single feature input while FCM bears the advantage of employing vectors of intensities. The results presented were preliminary and need proper clinical evaluation. However, this method involves phantom measurement based on global corrections for image non-uniformity. Therefore, further work is needed for localized measurement like impact on tumor boundary or volume determinations [27].

3. CRITICAL EVALUTION

In this study, we have studied different techniques for classification. The well-known models studied in this paper include neural networks, support vector machine, Decision Tree models, ID3 algorithm, and association rules. SVM and ANN give best results for brain tumor detection. Majority of the researchers preferred MR images, and CT scanned images are rarely used by the researchers. A critical review of the studied literature is summarized is table 1.

Table 1. COMPARE AND CONTRAST TABLE.

Author	Dataset Used	Algorithm Used	Benefits	Identified Problems
D. Kovacevic (1997)	CT images	Radial basis function on neural network.	Training algorithm is relatively simple as compared to the back-propagation iterative algorithm used with MLP. RBF network has better generalization capabilities.	The proposed algorithm does not perform well on trained data.
M.N. Ahmed (2002)	MRI images	Modified Fuzzy C-Mean Segmentation	BCFCM algorithm is faster to converge to generate accurate classification.	Technique is limited to a single feature input. Incorporation of spatial constraints into the classification also some fine details.
P. Rajendran (2010)	CT images	Association rule mining and decision tree	They compare with conventional method and found better results. The accuracy of 95% and sensitivity of 97% were found in classification of brain tumor.	They used CT scan images which has its own limitations like blurred boundaries and similar grey level between healthy and non-healthy tissues.

M M Subhashini (2012)	Brain MRI images	Pulse couple neural network (PCNN)) and back propagation network	PCNN can be as an effective image analysis tool	
S.N. Deepa (2012)	Brain MRI.	BPN and RBFN classifiers	They found that RBFN performs better with high convergence.	They used less number of data sets.
W.H. Ibrahim (2013)	MRI images	Back-Propagation Neural Network with Levenberg Marquardt algorithm (LMA), and PCA	Back-Propagation Neural Network with Levenberg Marquardt Algorithm (LMA), and PCA is faster to converge to generate accurate classification. This technique is workable with accuracy of 96.33%.	This technique does not include the clustering technique, that increase the accuracy
F. Amato (2013)	Clinical parameters	Artificial neural networks	ANN, suitable for satisfactory diagnosis of various disease	A review paper.
A.Padma (2013)	CT-Scan images	SVM, DGLRLM, MDEE, and BDM techniques	SVM supported by this texture analysis method can be effectively used for classification and segmentation of brain soft tissues in CT images, with 98% accuracy	They used CT scan images which has its own limitations like blurred boundaries and similar grey level between healthy and non-healthy tissues.
S.H.S.A.Ubaidillh (2013)	Gene expression data	SVM and ANN classifiers	ANN classifier can obtain good classification performance in the datasets with bigger amount of input features (prostate and ovarian cancer datasets) while SVM gave better performance in that datasets with smaller amount of input features (breast cancer and liver cancer), but finally SVM classifier provide better result for tumor	

4. CONCLUSION

The brain tumor detection is a complicated and sensitive task; therefore, accuracy and reliability are always assigned much importance. Many brain MRI image segmentation methods and classifiers have been developed in the past several decades for segmenting MRI brain images and classifying it as normal or abnormal. The survey shows that BPNN classifier with increase in nodes gives fast and accurate classification that can be effectively used for segmenting MRI brain images with high level of accuracy and Levenberg-Marquardt algorithm performs better than others. The survey also shows that ANN classifier can obtain good classification performance in the datasets with bigger amount of input features while SVM gave better performance in those datasets with smaller amount of input features. In future work classification of MRI images can also be done using other techniques such as double thresholding and morphological and GLRLM operations with neural network (feed forward neural network).

5. REFERENCES

[1] Freitas, A.A and Lavington, S.H. 1998. Mining Very Large Databases with Parallel Processing. Kulwer Academic Publishers,. ISBN 0-7923-8048-7.

[2] Bayardo R. J. 1998. Efficiently mining long patterns from databases. In ACM SIGMOD Conf. Management of Data.

[3] Joshi, D. M., Rana, N. K. and Mishra, V. M. 2010. Classification of Brain Cancer Using Artificial Neural Network. International Conference on Electronic Computer Technology, pp-112-116.

[4] CancerNet, A service of the National Cancer Institute. [Online]. Available: http://www.cancer.gov/cancertopics/types/brain tumor

[5] Arizmendi, C. , Tamames, J.H., Romero, E., Vellido, A. and Pozo, F. D. 2010. Diagnosis of Brain Tumors from Magnetic Resonance Spectroscopy using Wavelets and Neural Networks. Annual International Conference of the IEEE EMBS (2010), pp-6074-6077.

[6] Gupta, D. S., Sood, M., Vijayvargia, P.S. and Hota, P.K. 2013. Association rule mining based study for identification of clinical parameters akin to occurrence of brain tumor, ncbi.nlm.nih.gov/pmc/articles/PMC3717182/.

[7] Bandyopadhyay, S.K. and Paul, T.U. 2013. "Automatic Segmentation of Brain Tumour from Multiple Images of Brain MRI", International Journal of Application or

Innovation in Engineering & Management (IJAIEM), Volume 2, Issue 1, January.

[8] Shi, Z., He, L., Suzuki, T.N.K. and Itoh, H.2009. "Survey on Neural Networks used for Medical Image Processing", International Journal of Computational Science.

[9] Hsu, C. W., Chang, C.C. and Lin C.J. 2010. Practical Guide to Support Vector Classification. http://www.csie.ntu.edu.tw/~cjlin.

[10] Shanmugapriya, K.P., Srinivasan, B. and Narendran, P. 2013 "A study on applications of data mining techniques in brain imaging", International Journal of Advanced Research in Data Mining and Cloud Computing Vol.1, Issue 1.

[11] Jesmin, T., Ahmed, K., Zamilur and M., Alam, M. B. 2013. "Brain Cancer Risk Prediction Tool Using Data Mining", International journal of Computer Application,volume 61-No.12.

[12] Kumar, L.S. and Padmapriya, A. 2012. "ID3 Algorithm Performance of Diagnosis For Common Disease", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 2, Issue 5.

[13] Ibrahim, A W.H., . Osman, A.A. and Mohamed, Y.I. 2013. MRI brain image classification using neural networks. International conference on computing, electrical and electronics engineering (ICCEEE).

[14] Amato, F., Lopez, A., Mendez, E.M.P., Vanhara, P. , Hampl, A. and Havel, J. 2013. "Artificial neural networks in medical diagnosis", J Appl Biomed. 11: 47–58.

[15] Shah, S.and Parikh, S. 2010. Issues in medical diagnosis using Computational techniques. fourth international conference on computational intelligence and communication networks, IEEE.

[16] Rajendran, P., Madheswaran, M. and Naganandhini, K. 2010. An Improved Pre-Processing Technique with Image Mining Approach for the Medical Image Classification. Second International conference on Computing, Communication and Networking Technologies,

[17] Isola, R. and Carvalho, R. 2012. "Knowledge discovery in medical systems using Differential diagnosis, LAMSTAR, and k-NN", IEEE transactions on information technology in biomedicine, vol. 16, no. 6.

[18] Padma, A. and Sukanesh, R. 2013. "SVM based classification of soft tissues in brain CT images using wavelet based dominant gray level run length texture features", middle-east journal of scientific research 13(7): 883-888.

[19] Abdullah, N., Ngah, U.K., and Aziz, S.A. 2011. "Image Classification of Brain MRI using support vector machine", IEEE.

[20] Ubaidillah, S.H.S.A., Sallehuddin, R. and Ali, N.A. 2013. "Cancer detection using artificial neural network and support vector machine:A Comparative study", jurnal teknologi(science & engineering) 65:1.

[21] Rajendran, P. and Madheswaran, M. 2010. "Hybrid medical image classification using association rule mining with decision tree algorithm", journal of computing, volume 2, issue 1.

[22] Subhashini, M.M. and Shood, S.K. 2012. Brain tumor detection using pulse couple neural network (PCNN) and back propagation network. Third International Conference on Sustainable Energy and Intelligent System, VCTW, Tiruchengode, Tamilnadu, India on 27-29.

[23] Gupta, V. and Sagale, K.S. 2012. Implementation a classification system. Nirma University International Conference On Engineering, 06 08

[24] Badarnel, A.A., Nafadat, H. and Alraziqi A.M. 2012. A classifier to detect tumor disease in brain MRI brain images. ACM international conference on advances in social networks analysis and mining, IEEE.

[25] S.N. Deepa and B.A. Devi 2012. Artificial neural networks design for classification of brain tumour. International Conference on Computer Communication and Informatics (ICCCI -2012), Jan. 10 – 12, Coimbatore, INDIA.

[26] Kovacevic, D. and Loncaric, S. 1997. "Radial basis function-based image segmentation using a receptive field",? Processing of 10th IEEE Symposium on Computer-Based Medical Systems.

[27] Ahmed, M.N., Yamany, S.M., Mohamed N.and Moriarty, T. 2002 "A modified fuzzy c-means algorithm for bias field estimation and segmentation of MRI data",? Proceedings of the IEEE transaction on Medical Images, KY, USA.