Rameez Ahmad Kuchay, 2021, 9:2
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

A Review on Brain Tumor Detection a Classification Using Machine Learning Technique

M. Tech. Scholar Rameez Ahmad Kuchay, Asst. Prof. Zuber Farooqui
Department of Computer Science,
ASCT, Bhopal

Abstract- Detection and classification of brain tumors from modem imaging methods is a major problem. But this is a time-consuming or deadly job done by a radiologist or clinical supervisor. The precision of radiologist detection o of tumor phases depends only on their experience. Therefore, use of computer-aided technology is very significant in helping diagnostic accuracy. Imaging techniques such as separation, enhancement and edge detection etc. Have been widely used for more than a decade. Image analysis related to this field such as panchromatic sharpening medical image analysis biomedical analysis is extremely important. Image processing plays a significant role for analysing MR images. Advanced techniques or algorithms need to be developed for automatic detection of brain tumor from MR images so that the doctor can take informed decision during drug administration In this thesis, we investigate the problem of automatic detection of brain tumor with the help of image processing techniques by comparing segmentation score, accuracy of the classification and dice similarity index. We have studied and extract different features for classification of tumor type. 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. This study presents a comprehensive review of traditional machine learning techniques.

Keywords: - Machine Learning, SVM, BWT, Feature Extraction, MRI image.

I. INTRODUCTION

Cancer is a life-threatening sickness and it is also evident that if the early treatment is offer to the patient with the right combination of the therapy, then the chances of the survival of the patient is increase.

During the last one decade lots of research has been produced and investigated, number of researchers have developed new techniques to segment, detect and classify tumor types using the modems techniques based on support vector machine (SVM), self-organizing map (SOM), fuzzy clustering means (FCM), genetic algorithm (GA), principal component analysis (PCA) etc. In spite of many researches has developed to detect tumor from the magnetic resonance imaging (MRI) or from other modern imaging modalities, no researches are fully automatic and adoptable.

In addition, no research has been conducted to generate automatic reports. This may be the first attempt to study an automatic report generation scheme integrated to promotion radiologists or clinical supervisors in conducting rapid diagnostic analysis.

The resolution of this research work is to extract relevant information from segmented tumour regions or categories healthy or infected tumour tissues to build a large medical imaging folder. The

results of this study help to quickly and accurately classify benign and malignant tumors, thereby improving the diagnosis of tumour sections. From the literature discovery, we are motivated to solve the following problems.

Presents the segmentation method for the brain tumor segmentation from MR images and results of the current study. It starts with an overview of segmentation method, their areas of applications in the different fields of interest and continues with the discussion of different methods or techniques of segmentation.

Finally focus on our proposed segmentation technique which is based on BWT with their complete mathematical notions, and the segmentation results and also discusses the merits and weaknesses of each segmentation method by means of segmentation score. This chapter presents the method developed in this study for feature extraction and their optimization by means of retaining only relevant features; it starts with an overview of different feature extraction methods with their complete mathematical notions and continues on the impact of some of the features on Brain Tumor Detection (BTD).

It discusses how the area of the tumor is calculated and its impact on the decision of the tumor type.

In this research work, we used double classification technique to classify the tumor type; one decision is influenced by the features and second is influenced by the area of the tumor. Feature selection and available methods used for feature selection with their detailed algorithm are also discussed. This chapter presents the classification technique for the classification of type of brain tumor from the MR images.

This chapter discusses performance evaluation metrics which is one of the important criteria to judge the superiority of the algorithm. It gives detailed comparison of the proposed classifier with the other state of the art techniques and also discusses their accuracies with and without feature extraction. This chapter also presents the proposed methodology. It discusses the algorithm developed for the brain tumor detection from the MR images and also focuses on their design layout using graphical user interface.

It also presented experimental results and the impact of compression on the proposed algorithm with their detailed performance analysis parameters for segmented tissues. Gives an overall summary, conclusion on the proposed work, its limitations and offering suggestions for future research.

II. RELATED WORK

Tumor is a dangerous disease for humans, so early diagnosis that provides better treatment than the most recent diagnosis is the first consideration. In the past decade, many techniques for the detection and evaluation of brain abscesses have been developed for a variety of motion exercises.

However, getting sleep and screening is a daunting task. As a result, many researchers have contributed to the exploration of more advanced and more comprehensive diagnostic systems. Many researchers have proposed several techniques for mapping the brain muscles to MR images, most notably FCM, SVM, artificial neural network (ANN), GA, self-mapping (SOM), techniques and expectations based by knowledge. Maximization (EM) technology algorithm. The following is a summary of recent studies that confirm the findings in this field.

III. 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.

Laxmi Narayana Pondhu 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, and 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 person's mobility. Tremors, rigidity of the muscles and imprecise gait movements are characteristics of this disease. Past attempts have been made to classify Parkinson disease from healthy subjects but in this work, effort was made to focus on the specific gait characteristics which would help differentiate Parkinson Disease from other neurological diseases (Amyotrophic lateral sclerosis (ALS) and Huntington's 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 Parkinson 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.

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.

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.

V. Zeljkovic et.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.

Hayder Saad Abdulbaqi et.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.

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 multiscale, multiphysics 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.

Haocheng Shen et.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 neighborhood 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 pair wise 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.

Haocheng Shen [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.

IV. CONCLUSION

In this paper, we have proposed different techniques to detect and segment Brain tumor from MRI images. To extract and segment the tumor we used different techniques such as SOM Clustering, k-mean clustering, Fuzzy C-mean technique, curve let transform.

It can be seen that detection of Brain tumor from MRI images is done by various methods, also in future work different automatic methods achieve more accuracy and more efficient.

REFERENCES

[1] Laxmi Narayana Pondhu, Govardhani Kummari Performance Analysis of Machine Learning Algorithms for Gender Classification 2018 Second International Conference on Inventive Communication and Computational Technologies (ICICCT) Year: 2018 ISBN: 978-1-5386-1974-2 DOI: 10.1109/ IEEE: Coimbatore, India.

[2] Halil Ibrahim Bulbul Nese Usta Musa Yildiz Classification of ECG Arrhythmia with Machine Learning Techniques 2017 16th IEEE International Conference on Machine Learning and Applications (ICMLA) Year: 2017 ISBN: 978-1-5386-1418-1 DOI: 10.1109/ IEEE Cancun, Mexico.

[3] Mittal Bhatt; Vishal Dahiya; Arvind Singh; Supervised Learning Algorithm: SVM with Advanced Kernel to classify Lower Back Pain 2019 International Conference on Machine Learning, Big Data, Cloud and Parallel Computing (COMITCon) Year: 2019 ISBN: 978-1-7281-0211-5 DOI: 10.1109 IEEE Faridabad, India, India.

[4] Ma. Madecheen; S. Pangaliman; Febus Reidj; G. Cruz; Timothy M. Amado; Machine Learning Predictive Models for Improved Acoustic Disdro meter2018 IEEE 10th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment and Management (HNICEM) Year: 2018 ISBN: 978-1-5386-7767-4 DOI: 10.1109/ IEEE Baguio City, Philippines, Philippines.

[5] Sachin Shetty Y. S. Rao SVM based machine learning approach to identify Parkinson's disease using gait analysis 2016 International Conference on Inventive Computation Technologies (ICICT) Year: 2016 ISBN: 978-1-5090-1285-5 DOI: 10.1109/IEEE Coimbatore, India.

[6] Annisa Wulandari; Riyanto Sigit; Mochamad Mobed Bachtiar Brain Tumor Segmentation to Calculate Percentage Tumor Using MRI 2018 International Electronics Symposium on Knowledge Creation and Intelligent Computing (IES-KCIC) Year: 2018 ISBN: 978-1-5386-8079-7 DOI: 10.1109/IEEE Bali, Indonesia, Indonesia.

[7] Mircea Gurbină Mihaela Lascu Dan Lascu Tumor Detection and Classification of MRI Brain Image using Different Wavelet Transforms and Support Vector Machines 2019 42nd International Conference on Telecommunications and Signal Processing (TSP)Year: 2019 ISBN: 978-1-7281-1864-2 DOI: 10.1109/ IEEE Budapest, Hungary, Hungar.

[8] A. Jemimma; Y. Jacob Vetharaj Water shed Algorithm based DAPP features for Brain Tumor Segmentation and Classification 2018 International Conference on Smart Systems and Inventive Technology (ICSSIT) Year: 2018.

[9] Manu Gupta; K.S. Gayatri; K. Harika; B.V.V.S.N. Prabhakar Rao; Venkateswaran Rajagopalan; Abhijit Das; C. Kesavadas Brain tumor segmentation by integrating symmetric property with region growing approach 2015 Annual IEEE India Conference (INDICON) Year: 2015 ISBN: 978-1-4673-7399-9 DOI: 10.1109/IEEE New Delhi, India.

[10] V. Zeljkovic; C. Druzgalski; Y. Zhang; Z. Zhu; Z. Xu; D. Zhang; P. Mayorga Automatic brain tumor detection and segmentation in MR images 2014 Pan American Health Care Exchanges (PAHCE) Year: 2014 ISBN: 978-1-4799-3555-0 DOI: 10.1109/ IEEE Brasilia, Brazil.

[11] Hayder Saad Abdulbaqi; Mohd. Zubir Mat; Ahmad Fairuz Omar; Iskandar Shahrim Bin Mustafa; Loay Kadom Abood Detecting brain tumor in Magnetic Resonance Images using Hidden Markov Random Fields and Threshold techniques 2014 IEEE Student Conference on Research and Development Year: 2014.

[12] Stefan Bauer; Christian May; Dimitra Dionysiou; Georgios Stamatakos; Philip Buchler; Mauricio Reyes Multi scale Modeling for Image Analysis of Brain Tumor Studies IEEE Transactions on Biomedical Engineering Year:2012DOI: 10.1109/IEEE.

[13] Haocheng Shen ; Jianguo Zhang Fully connected CRF with data-driven prior for multi-class brain tumor segmentation 2017 IEEE International Conference on Image Processing (ICIP) Year: 2017 ISBN: 978-1-5090-2175-8 DOI: 10.1109/ IEEE Beijing, China.

[14] T. M. Shahriar Sazzad Dept K. M. Tanzibul Ahmmed Misbah Ul Hoque Mahmuda Rahman Development of Automated Brain Tumor Identification Using MRI Images 2019 International Conference on Electrical, Computer and Communication Engineering(ECCE), 7-9 February, 2019 978-1-5386-9111-3/19/$31.00 ©2019 IEEE pp.

[15] Divyamary. D, Gopika. S, Pradeeba. S Brain Tumor Detection from MRI Images using Naive Classifier 2020 6th International Conference on Advanced Computing & Communication Systems (ICACCS) 978-1-7281-5197-7/20/$31.00 ©2020 IEEE pp-620-622.