A Literature Review on Classification methods of MR brain images

[1]Maske Hema Shivajirao, [2]Sanjeev Dadarao Bhosale,

[1]PG Student at Electronics & Telecommunication department,
[2]Asst. Professor at Electronics & Telecommunication department,
[1]Shri Tuljabhavani college of engineering, Tuljapur,India.

Abstract : An automated and accurate classification of MR brain images is extremely important for medical analysis and evaluation. Many such methods have already been proposed. In this paper, we have given review on classification on a given MR brain images with different methods. The methods which are first employed segmentation by thresholding and morphological operations. In this article, a comprehensive overview of recent automatic brain tumor segmentation techniques of MRI, PET, CT, and multimodal imaging techniques has been provided. Such different methods, techniques, their working principle, advantages, their limitations, and their future challenges are discussed in this article.

I. INTRODUCTION

Automated and accurate classification of MR brain images is extremely important for medical analysis and interpretation. Over the last decade, numerous methods have already been proposed. Clinical decisions regarding the treatment of brain neoplasms rely on, in part, on MRI at various stages of the treatment process. Radiological diagnosis is predicated on the multi- parametric imaging profile (CT, conventional MRI, advanced MRI). Tumor characterization is difficult, because neoplastic tissue is usually heterogeneous in spatial and imaging profiles [1], and for a few imaging techniques often overlaps with normal tissue (especially the infiltrating part) [2][3]. Gliomas might show mixed characteristics, for instance demonstrating both low and high grade features. The reference standard for characterizing brain neoplasms is currently supported histopathology analysis following surgical biopsy or resection, but this also has limitations including sampling error and variability in interpretation [1][4]. Magnetic resonance imaging (MRI) is an imaging technique that produces prime quality images of the anatomical structures of the build, especially within the brain, and provides rich information for clinical diagnosis and biomedical research [1-5]. The diagnostic values of MRI are greatly magnified by the automated and accurate classification of the MRI images [6-8]. Wavelet transform is a good tool for feature extraction from MR brain images, because they permit analysis of images at various levels of resolution because of its multiresolution analytic property. However, this method requires large storage and is computationally expensive [1]. To scale back the feature vector dimensions and increase the discriminative power, principal component analysis (PCA) has been used. PCA is reduces the computational cost of analyzing new data because it effectively reduces the dimensionality of the data. Then, the problem of how to classify the input data comes. The brain is a made up of a large number of cells, and each cell has a specific function, so it's complex organ that contains 50–100 billion neurons. It is Most of the cells that are generated in the body partition to form new cells for appropriate functioning of the human body. When new natural cells grow, aged or damaged cells die. Then, new cells take their place. Sometimes, new cells are generated when the body does not need them. Moreover, aged or damaged cells do not die as they should. The body produces extra cells that construct a lump of tissue called a tumor. A tumor inlaid in the brain region causes the sensitive functioning of the body to be malformed. It is very difficult and perilous to treat due to its location and spreading capability [3–5]. Brain tumors are primarily categorized into two types: benign and malignant. Benign tumors are those tumors that are non-cancerous, and malignant ones are those which contain cancerous cells [6]. The early detection and recognition of brain tumors are very crucial. Now a days, computer-aided diagnosis (CAD) systems are mostly used for systematic and specific detection of brain abnormalities [7]. A brain tumor is the unnatural growth of tissue or central spine that can interrupt the proper function of the brain. Currently, researchers have proposed a lot of approaches for this goal, which fall into two categories. One category is supervised classification, including support vector machine (SVM) [3] and k-nearest neighbors (k- NN) The other category is unsupervised classification, including self-organization feature map (SOFM) [3] and fuzzy c-means [5]. While all these methods achieved good results, yet the supervised classifier performs better than the unsupervised classifier in terms of classification accuracy (success classification rate) [6]. Among supervised classification methods, the SVMs are state-of-the-art classification methods based on machine learning theory [7]. Compared with other methods such as artificial neural networks, decision trees, and Bayesian networks, SVMs have significant advantages of high accuracy, elegant mathematical tractability, and direct geometric interpretation. Besides, it does not need a large number of training samples to avoid over fitting [8]. dimensional feature space, it may be nonlinear in the original input space. The structure of the rest of this paper is organized as follows. Next gives the detailed procedures of pre-processing, including the discrete wavelet transform (DWT) and principle component analysis (PCA). It introduces the motivation and SVM, and then turns to the kernel SVM. And also introduces protecting the classifier from over fitting. Experiments used totally 160 images because the dataset, showing the results of feature extraction and reduction. Afterwards, we compare our method with different kernels to the newest methods within the decade. The clearest appearance of the changes between the various textures represented by the sub-band whose histogram has the utmost variance. J. Huang, J. Lu, C., X. Ling at al explained the method of the wavelet transforms. One of the most powerful methods for extraction is Wavelet transform. This is an efficient tool for 2D image feature extraction because it allows for the analysis of images at various levels of resolution. The main advantage of the wavelet is that it affords localized frequency information about the function of a signal, which is particularly beneficial for classification.

II. LITERATURE SURVEY

[1] MRI Fuzzy Segmentation of Brain Tissue Using Neighborhood Attraction With Neural- Network Optimization. Shan Shen, William Sandham, Member, IEEE, Malcolm Granat, and Annette Sterr. Image segmentation is an important process within the visualization of human tissues, particularly during clinical analysis of resonance (MR) images. Unfortunately, MR images always contain a big amount of noise caused by operator performance, equipment, and therefore the environment, which may cause serious inaccuracies with segmentation. A robust segmentation technique supported an extension to the normal fuzzy c-means (FCM) clustering algorithm is proposed during this paper. A neighborhood attraction, which depends on the relative location and features of neighboring pixels, is shown to enhance the segmentation performance dramatically. The degree of attraction is optimized by a neural- network model. Simulated and real brain MR images with different noise levels are segmented to demonstrate the superiority of the proposed technique compared to other FCM- based methods. This segmentation method may be a key component of an MR image-based arrangement for brain tumors, currently being developed.

[2] Classification of brain MRI using the LH and HL wavelet transform sub-bands Lahmiri, S. Boukadoum, M. Circuits and Systems (ISCAS), 2011 IEEE International Symposium The problem of automatic classification of brain images obtained by magnetic resonance imaging (MRI) is considered. In order to design the classification system, a three- stage approach is used. It consists of wavelet decomposition of the image under study, feature extraction from the LH and HL sub- bands using first order statistics, and final classification by support vector machines (SVM). The proposed approach shows higher performance than when using features extracted from the LL sub-band. It is concluded that the horizontal and vertical sub- bands of the wavelet transform can effectively encode the discriminating features of normal and pathological images.

[3] Brain MRI classification using an ensemble system and LH and HL wavelet sub-bands features Lahmiri, S. Boukadoum, M. Computational Intelligence In Medical Imaging (CIMI), 2011 IEEE Third International Workshop. A new arrangement for brain images obtained by resonance imaging (MRI) is presented. A three-stage approach is employed for its design. It consists of second-level discrete wavelet transform decomposition of the image under study, feature extraction from the LH and HL sub-bands using first order statistics, and subsequent classification with the k-nearest neighbor (k-NN), learning vector quantization (LVQ), and probabilistic neural networks (PNN) algorithms. Then, an ensemble classifier system is developed where the previous machines form the bottom classifiers and support vector machines (SVM) are employed to aggregate decisions. The proposed approach was tested on a bank of normal and pathological MRIs and the obtained results show a higher performance overall than when using features extracted from the LL sub-band, as usually done, resulting in the conclusion that the horizontal and vertical sub-bands of the wavelet transform can effectively and efficiently encode the discriminating features of normal and pathological images. The experimental results also show that using an ensemble classifier improves the right classification rates.

[4] MRI brain cancer classification using Support Vector Machine Nandpuru, H.B. Salankar, S.S. ; Bora, V.R. Electrical, Electronics and computing (SCEECS), 2014 IEEE Students' Conference. This research paper proposes an intelligent classification technique to acknowledge normal and abnormal MRI brain image. Medical image like ECG, MRI and CT-scan images are important thanks to diagnose disease of person efficiently. The manual analysis of tumor supported visual inspection by radiologist/physician is that the conventional method, which can cause wrong classification when an outsized number of MRIs are to be analyzed. To avoid the human error, an automatic intelligent arrangement is proposed which caters the necessity for classification of image. One of the main causes of death among people is brain tumour . The chances of survival are often increased if the tumor is detected correctly at its early stage. Magnetic resonance imaging (MRI) technique is used for the study of the human brain. In this research work, classification techniques supported Support Vector Machines (SVM) are proposed and applied to brain image classification. In this paper feature extraction from MRI Images will be carried out by gray scale, symmetrical and texture features. The main objective of this paper is to offer a superb outcome (i.e. higher accuracy rate and lower error rate) of MRI brain cancer classification using SVM..

[5] MRI brain image classification using neural networks Ibrahim, W.H. Osman, A.A.A. ; Mohamed, Y.I. Computing, Electrical and Electronics Engineering (ICCEEE), 2013 International Conference. Classification of brain tumor using. Magnetic resonance Imaging (MRI) may be a difficult task thanks to the variance and complexity of tumors. This paper presents Neural Network techniques for the classification of the resonance human brain images. The proposed Neural Network technique consists of three stages, preprocessing, dimensionality reduction, and classification. In the first stage, we The MR image will obtain and convert it to data form (encoded information which will be stored, manipulated and transmitted by digital devices), in the second stage have obtained the dimensionally reduction using principles component analysis (PCA), then within the classification stage the Back-Propagation Neural Network has been used as a classifier to classify subjects as normal or abnormal MRI brain images. In the experiment 3×58 datasets of MRI Brain sagittal images.

[6] Hasan, S. K and Ahmad, M. et al., 2018 [6] proposed research on two-stage authenticated technique for detection of brain tumor. In this research, the proposed technique is authenticated scheme for detection of brain tumor, called a watershed matched approach. The segmentation of brain tumor area was done through classification approach of the watershed algorithm. In addition, scale invariant feature transform technique was also used to extract feature regions and matching divided area of brain tumor with an actual picture. Along with that, compute dimensions of the tumor using various approaches. They implemented an approach through free surfer system software to look the width of cortical and therefore the compute variance among benign and malignant.

.

Sr. No.	Method proposed by	Method used	Year of publication
1	Shan Shen, William Sandham, Member, IEEE, Malcolm Granat, and Annette Sterr	MRI Fuzzy Segmentation of Brain Tissue Using Neighborhood Attraction With Neural- Network Optimization.	2013
2	Lahmiri, S.; Boukadoum, M. Circuits and Systems (ISCAS), IEEE International Symposium	Classification of brain MRI using the LH and HL wavelet transform sub-bands	2011
3	Lahmiri, S. ; Boukadoum, M. Computational Intelligence In Medical Imaging (CIMI), IEEE Third International Workshop	Brain MRI classification using an ensemble system and LH and HL wavelet sub-bands features	2011
4	Machine Nandpuru, H.B. ; Salankar, S.S. ; Bora, V.R. Electrical, Electronics and Computer Science (SCEECS), IEEE Students' Conference	MRI brain cancer classification using Support Vector	2014
5	Ibrahim, W.H. ; Osman, A.A.A. ; Mohamed, Y.I. Computing, Electrical and Electronics Engineering (ICCEEE), International Conference.	MRI brain image classification using neural networks	2013
6	Hasan, S. K and Ahmad, M. et al.,	Two-stage authenticated technique for detection of brain tumor	2018

TABLE -1: SUMMARY OF LITERATURE REVIEW

III. CONCLUSIONS

In this article, various automated brain tumor segmentation techniques of MRI, CT, PET, and multimodal images have been reviewed. The methods, advantages, their limitations, and future challenges are discussed to supply insight into various techniques. MRI-based brain tumour segmentation methods are employed more for brain tumor segmentation due to the good soft tissue contrast and noninvasive of MRI. However, percentages of clinical application of automated brain tumour segmentation methods are significantly very low thanks to lack of interaction between developers and physicians. Technically sound algorithms are difficult to use in real time applications. In spite of the existence of the many tools for tumor segmentation, manual segmentation is preferred within the day today life. Automatic segmentation performed in jiffy isn't accepted clinically thanks to the shortage of interpretability and straightforward handling of the tools. Hence more user-friendly tools should be embedded within the clinical environment in future. The failure of the system even for fewer number of times also affects clinical applicability. Hence, robustness and accuracy of the system also are another important factor to enhance the arrogance within the automated system.

The improvement in advanced tumour assessment, like tumour volume estimation, tumour progression estimation in future, and multiclass tumour classification, will improve achievements in current techniques. The brain tumour segmentation techniques will undoubtedly show great potential in future, along with all specified remarkable advancement in this area.

REFERENCES

[1] MRI Fuzzy Segmentation of Brain Tissue Using Neighborhood Attraction With Neural- Network Optimization. Shan Shen, William Sandham, Member, IEEE, 2013 Malcolm Granat, and Annette Sterr.
[2] Classification of brain MRI using the LH and HL wavelet transform sub-bands Lahmiri, S.; Boukadoum, M. Circuits and Systems (ISCAS), 2011 IEEE International Symposium.
[3] Brain MRI classification using an ensemble system and LH and HL wavelet sub-bands features Lahmiri, S. ; Boukadoum, M. Computational Intelligence In Medical Imaging (CIMI), 2011 IEEE Third International Workshop.
[4] MRI brain cancer classification using Support Vector Machine Nandpuru, H.B. ; Salankar, S.S. ; Bora, V.R. Electrical, Electronics and Computer Science (SCEECS), 2014 IEEE Students' Conference.
[5] MRI brain image classification using neural networks Ibrahim, W.H. ; Osman, A.A.A. ; Mohamed, Y.I. Computing, Electrical and Electronics Engineering (ICCEEE), 2013 International Conference.
[6] Hasan, S. K., & Ahmad, M. (2018). Two-step verification of brain tumor segmentation using watershed-matching algorithm. Brain informatics,vol. 5(2), 8.
[7] Angulakshmi, M., & Lakshmi Priya, G. G. (2017). Automated brain tumour segmentation techniques—A review. International Journal of Imaging Systems and Technology, vol. 27(1), pp. 66-77.
[8] Kilic, H., Yuzgec, U., & Karakuzu, C. (2018). A novel improved antlion optimizer algorithm and its comparative performance. Neural C.
[9] Kurnar, M., Sinha, A., and Bansode, N. V. (2018). Detection of Brain Tumor in MRI Images by Applying Segmentation and Area Calculation Method Using SCILAB. In 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA) (pp. 1-5). IEEE.
[10] Akter, L. A., and Kwon, G. R. (2018). Integration of Contourlet Transform and Canny Edge Detector for Brain Image Segmentation. In 2018 Tenth International Conference on Ubiquitous and Future Networks (ICUFN) (pp. 798-800). IEEE.
[11] Bai, X., Chen, Z., Liu, M., and Zhang, Y. (2015). Center-free PFCM for MRI brain image segmentation. In 2015 IEEE International Conference on Image Processing (ICIP)(pp. 656-660). IEEE.