Survey of Brain Tumor Image Quarrying Techniques

[1]PrashantAher, [2]Prof. Umesh Lilhore

[1]M Tech.(CSE), Research Scholar, [2]PG In charge
NIIST Bhopal (MP)

***Abstract*—Image quarrying is a sub field of Data mining technique. Image quarrying techniques are widely used to analyze and retrieve meaningful information from image data set. In medical field MRI images are widely generating day by day, for various brain tumor patients. Analysis of MRI images more efficiently and correctly is a growing field of research. Various researchers have been suggested different image quarrying rules and techniques for tumor detection from MRI images. In this research paper we are presenting a comparative study of various image quarrying methods for brain tumor detection. This paper also presents challenges or limitations of existing methods.**

***IndexTerms*— Data mining, Image quarrying, Brain tumor and MRI, ANN Classifier.**

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. In Medical diagnosis, through Magnetic Resonance Images, Robustness and accuracy of the Prediction algorithms are very important, because the result is crucial for treatment of Patients. There are many popular classification and clustering algorithms used for predicting the diseases from Images figure1,2. The goal of clustering a medical image is to simplify the representation of an image into a meaningful image and make it easier to analyze. Several Clustering and Taxonomy algorithms are aimed at enhancing the Prediction accuracy of diagnosis Process in detecting abnormalities such as Cancer and white matter lesions from MR Images.

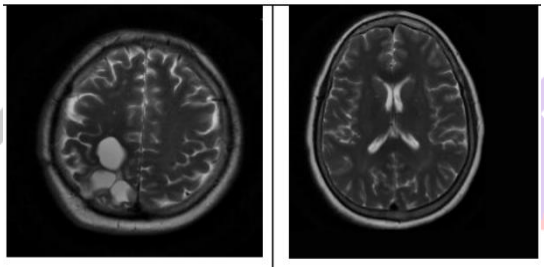

Figure 1,2 MRI Brain Tumor Images

This study assesses many techniques that play a vital role within the taxonomy 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 valuation of the techniques discussed in the related work section. Finally, we conclude in the last section.

2. EXISTING WORK

B.Jyothi and Y.MadhaveeLatha[1] presented Integrated Multiple Features for Tumor Image Retrieval Using Classifier and Feedback Methods. This paper presents an effective approach in which the region of the object is extracted with the help of multiple features ignoring the background of the object by employing edge following segmentation method followed by extracting texture and shape characteristics of the images. The former is extracted with the help of Steerable filter at different orientations and radial Chebyshev moments are used for extracting the later. Initially the images similar to the query image are extracted from a large group of medical images. Then the search is by accelerating the retrieval process with the help of Support Vector Machine (SVM) classifier. The performance of the retrieval system is enhanced by adapting the subjective feedback method of Support Vector Machine (SVM) classifier. The performance of the retrieval system is enhanced by adapting the subjective feedback method.

K.P Shanmugapriya et al [2], 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.

L.S. Kumar and A. padampriya [3] 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.

W.H. Ibrahim, A.A.A Osman and Y.I. Mohamed [4] 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.

R. Isola et al. [5] 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.

M.N. Ahmed et al. [6] 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 no uniformity. Therefore, further work is needed for localized measurement like impact on tumor boundary or volume determinations

3. IMAGE MINING & MRI IMAGES

Image mining is the process of searching and discovering valuable information and knowledge in large volumes of data. Image mining draws basic principles from concepts in databases, machine learning, statistics, pattern recognition and 'soft' computing.

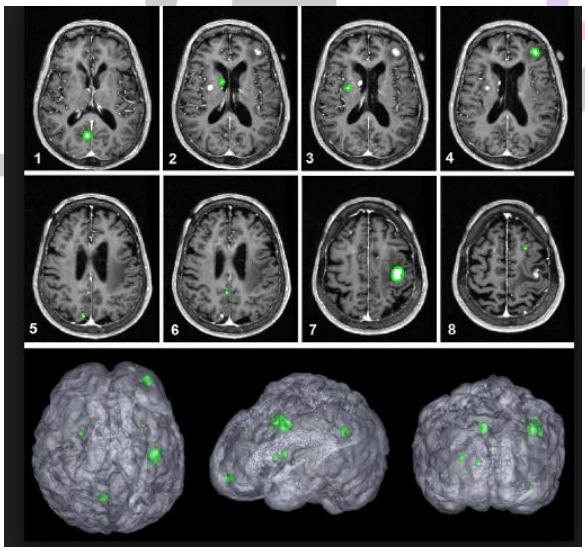

Figure 3 MRI Images for tumor detection

Medical imaging research faces the challenge of detecting brain tumor through Magnetic Resonance Images (MRI).In 1969 Raymond V. Damadian invented MRI and was the first person to use MRI to investigate the human body [1]. Magnetic resonance imaging [2] is a powerful tool for investing the body's internal structure. MRI provides better quality images for the brain, the muscles, the heart and cancerous tissues compared with other medical imaging techniques such as computed tomography (CT) or X-rays.
In tumorous brain MR images intensity level of timorous tissues exhibit different intensity level on T1-w and T2-w images based on the type of tumor. On T1-w most tumors have low or intermediate signal intensity. On T2-w most tumors have bright intensity. The anatomy of the Brain can normally be viewed by the MRI scan. So this technique is a special one for the brain tumor detection and cancer imaging.

Methods use for Brain tumor detection-

3.1 Image Preprocessing-Pre-processing of MRI images is the primary step in image Analysis which performs image enhancement and noise reduction techniques which are used to enhance the image quality [6]. Image is enhanced in the way that finer details are improved and noise is removed from the image. Enhancement and noise reduction techniques are implemented in brain tumor detection that can give best possible results. Enhancement will result in more prominent edges and a sharpened image like tumor is obtained noise will be reduced thus reducing the blurring effect from the image Figure 3 shows tumor data sets. Following Methods are used for MRI Image pre processing-

3.1.1 Median Filter technique- In a median filter, a window slides along the image and the median intensity value of the pixels within the window becomes the output intensity value of the pixel being processed. Median filter preserves edges in an image while reducing random noise. Each pixel is set to median of the pixel values in the neighborhood of the corresponding input pixels. This filter is used to remove these noises and bounding box method is implemented to identify the location of the tumor [6].

3.1.2 Order statistics filters Method- Present a simple and efficient technique to remove noise from the medical images which combines both median filtering and mean filtering to determine the pixel value in the noise less image. This method is used to remove the Rician noise which affects the MRI images [4].

3.1.3Anisotropic filter Method- This technique applies a concurrent filtering and contrast stitching. Diffusion constant related to the noise gradient and smoothing the background noise by filtering a proper threshold value is chosen [7].

3.1.4 Weighted median filter- It is applied to remove high frequency components and it can remove salt and pepper noise from MRI without disturbing of the edges. It is applied for each pixel of a 3*3,5*5,7*7,9*9.11*11,windowof neighborhood pixels are extracted and analyzed the mean gray value of foreground mean value of background and contrast value [9].

3.2 Image segmentation- The purpose of image segmentation is to partition an image into regions (spatially connected groups of pixels called classes. or subsets) and objects with respect to one or more characteristics or features. Image segmentation plays a significant role in image processing as it helps in the extraction of suspicious regions from the medical images. The idea behind segmentation is to segment an image into several clusters. The results will be such that, it is possible to identify regions of interest and objects in the original image [11].

3.2.1 Watershed segmentation algorithm- Maker based watershed segmentation solves image segmentation problems. In this internal markers are produced from gray scale image and external markers are used to find the pixels between the internal markers. This is done by watershed transform. Computation of this transform along with modified gradient image produces watershed ridge lines and these lines are superimposed on the original image and produce the segmentation of tumor region from MRI. Tumor cells are clustered using hierarchical clustering algorithm 10].

3.2.2 Color based segmentation using k-means clustering- It identifies the tumor region significantly form the pre-processed MR image as a clustering feature. Here the pre-processed gray-level brain MR image is converted into RGB color image. Histogram equalization technique is performed and it takes advantages of the neglected pixel values. The RGB color image is then been coarsely represented using 25 bins. Coarse representation uses the spatial information from a histogram based windowing process. K-means is been used to cluster the coarse image data[4].

3.2.3 Histogram Thresholding- Hassan proposed Histogram Thresholding segmentation method for detecting the brain tumor in MRI image. This is based on thresholding of histogram features and gray level thresholding. It is suitable for an image with region or object of uniform brightness placed against a background of different gray level. A threshold must be applied to segment the object and background. Histogram presents the intensity values of an image and the thresholding is a technique for converting the grayscale or color image in to a binary image based on threshold values. MRI image of the brain is divided and the histogram of each part is drawn. Threshold point of the histogram is calculated and the segmentation is done using the threshold point for both the halves. Plot the histogram and it is between number of pixel and pixel intensity .Bar graph can be used to plot the histogram. Difference of the two histogram is calculated and the resultant difference is plotted using bar graph to select the threshold point. This result gives the great importance in detecting the brain tumor in MRI image [10].

3.2.3 Seeded Region- Growing method is an approach to segmentation where it examines neighboring pixels of initial 'seed points' and determines pixel neighbors should be added to the region. It is a technique for determining the regions directly. Formulation of the region based segmentation is, it must be complete and every pixel in the region must be disjoint so that clear separation from each other can be identified. It satisfies the condition that the gray level of pixel is in the range of region. This segmentation is used to find the abnormality is present in the image or not. Fast and fully automatic algorithm, both the homogenous texture features and spatial features of the MRI are used to find the seed points and segmentation results obtained are accurate [2].

3.3 Feature extraction- Feature extraction is the technique of extracting specific features from the pre-processed images of different abnormal categories. This technique extracts high-level features needed in order to perform classification of targets. Features are those items which uniquely describe such as size, shape, composition, location etc. Feature Extraction is an important step in the construction of any pattern classification and aims at the extraction of the relevant information that characterizes each class. Gaurav Kumar and Pradeep Kumar Bhatia reviewed various types of features, feature extraction techniques and importance of Using this techniques in image processing systems [1].

3.3.1 Gray Level Co-occurrence Matrix- GLCM and Gabor feature extraction algorithm with the help of k-means clustering segmentation. Some features are extracted using GLCM techniques and the Gabor features extractions are Contrast, Correlation, Homogeneity, Entropy, and Energy. Thus the feature was extracted and compared with other metric and gives efficient result[9].

3.3.2 Connected Component Analysis-Ladhake developed CCA (Connected Component Analysis) technique in Digital MRI images to extracts the region which are not supported by boundary after region boundaries have been detected. CCA is to detect the large sized connected foreground region or object. In image analysis, the object is extracted using the connected component labeling operation which consists of assigning a unique label to each maximally connected foreground region of pixel. Any set of pixels which is not separated by the boundary is called connected component. The set of connected components partition an image into segments and thus the area of detected tumor are calculated in pixels using connected component analysis [10].

3.4 Image classification- Classification is the labeling of a pixel or a group of pixels. Multiple features are used for a set of pixels i.e. many images of a particular object are needed. Image classification refers to the labeling of images into one of a number of predefined categories. Image classification is more important as it is a critical step for high-level processing such as brain tumor classification. Classification is the last step in the process of brain tumor detection used to classify the image into normal or abnormal and classify the abnormality type whether it is benign or malignant. This study evaluates various techniques which are used in tumor detection from brain MRI[13].

3.4.1 FF-ANN and BP-ANN- The networks were categorized into feed-forward neural networks and Back propagation neural Network. First classifier based on feed forward artificial neural network (FF-ANN) and second classifier based on Back propagation Neural Network (BP-ANN).FF-ANN classifier was created with 500 nodes in the first (input) layer. 1 to 50 nodes in the hidden layer and 1 node as the output layer and varied the nodes in order to determine the optimal number of hidden nodes[4].

3.4.2 Multi class Support Vector Machine classifier - The MR images are classified by wrapper approach with Multi class Support Vector Machine classifier (MC-SVM) using color, texture and shape features. To reduce the large numbers of features to a smaller set of features wrapper algorithm with multi-class SVM is used. Performance of the MC-SVM classifier is compared with different kernel functions. From the analysis and performance measures like classification accuracy, it is inferred that the brain MRI classification is best done using MC- SVM with Gaussian RBF kernel function than linear and polynomial kernel Functions, the wrapper approach MC-SVM with Gaussian RBF kernel function enhance the classification of MR brain image with normal and benign or malignant classes [5].

3.4.3 Linear vector quantization- LVQ is a supervised version of Kohonen learning rule. In LVQ each output unit represents a class.LVQ was used for classification of the tumor show that texture and shape features can give satisfactory result in analysis and classification of brain tumors [12].

4. PROBLEM IDENTIFICATION

Based on above literature survey following challenges are identified-

1. Slow Identification rate
2. Incorrect region detection from MIR tumor images
3. Poor classification for large data sets

5. 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.

REFERENCES

[1] B.Jyothia, Y.MadhaveeLathab, P.G.KrishnaMohanc ,V.S.K.Reddy," Integrated Multiple Features for Tumor Image Retrieval Using Classifier and Feedback Methods", International Conference on Computational Modeling and Security (CMS 2016), Science direct, 2016, PP 141-148.

[2] Müller H, Michoux N, Bandon D, and Geissbuhler A. A review of content-based image Retrieval systems in medical applications-clinical benefits and future directions. Medical Informatics. 1,73 (2004).

[3] L.A. Khoo, P. Taylor, and R.M. Given-Wilson, "Computer-Aided Detection in the United Kingdom National Breast Screening Programme: Prospective Study," Radiology, vol. 237, pp. 444-449, 2005.

[4] B.Jyothi, Y.MadhaveeLatha, P.G.Krishna Mohan," Multidimentional Feature Vector Space for an Effective Content Based Medical Image Retrieval 5th IEEE International Advance Conputing Conference (IACC-2015),BMS College of engineering Bangalore,June 12 to 13 ,2015.

[5] Ashwani Kr. Yadav, R. Roy, Vaishali and Archek Praveen Kum," Survey on Content-based Image Retrieval and Texture Analysis with Applications" International Journal of Signal Processing, Image Processing and Pattern Recognition Vol. 7, No. "6 (2014), pp. 41-50.

[6] Nitin Jain & Dr. S. S. Salankar," Color & Texture Feature Extraction for Content Based Image Retrieval", IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE) e-ISSN: 2278-1676, p-ISSN: 2320-3331 PP 53-58.

[7] Cs Pillai, "A Survey of Shape Descriptors for Digital Image Processing", IRACST - International Journal of Computer Science and Information Technology & Security (IJCSITS), ISSN: 2249-9555 Vol. 3, No.1, February 2013.

[8] Ch.SrinivasaRao ,S.Srinivas Kumar , B.ChandraMohan,"Content based image retrieval using exact legend moments ad support vector machine",theinternational journal of multimedia and its applivations(IJMA),vol 2,no 2,may 2010.

[9] Darshana Mistry," Survey of Relevance Feedback methods in Content Based Image Retrieval", Darshana Mistry / International Journal of Computer Science & Engineering Technology (IJCSET), Vol. 1 No. 2,pp 32-40, ISSN : 2229-3345.

[10] Ramakrishna Reddy, Eamani and G.V Hari Prasad," Content-Based Image Retrieval Using Support Vector Machine in digital image

[11] processing techniques", International Journal of Engineering and Technology (IJEST),IIN:0977-5462 vol.04 No04 April 2012

[12] KritSomkantha, NiponTheera-Umpon, "Boundary Detection in Medical Images Using Edge Following Algorithm Based on Intensity Gradient and Texture Gradient Features," in Proc. IEEE transactions on biomedical engineering, vol. 58, no. 3, march 2011,pp. 567–573.

[13] Xiang-yang wang a, yong-jian Yu a, Hong-Ying Yang," An effective image retrieval scheme using color, texture and shape features", Computer Standards & InterfacesCSI-02706; No of Pages 10.