International Journal Of Advanced Research In Engineering Technology & Sciences ISSN: 2394-2819

Email: editor@ijarets.org June- 2015 Volume 2, Issue-6 www.ijarets.org

A Review Paper on Machine Learing Techniques And Anlaysis of MR Images

Megha Tyagi
Department of Computer Science and engineering
Roorkee College of Engineering
Roorkee

Himanshu Tyagi
Department of computer science and Engineering
Uttarakhand Technical University
Dehradun

ABSTRACT:
The field of medical imaging is greatly influenced due to the advancement of computer technology and evolution of the new and updated techniques of data acquisition, visualization, processing, and analysis. Classification of medical images is an important and inspiring issue in image analysis and pattern recognition. Brain neoplasm identification and classification is a challenging task for medical analysts and radiologists. In this research brain tumor MR image classification is performed using machine learning techniques.
In past various machine learning based classification algorithms have been discussed and compared with other algorithms in terms of performance and accuracy. Feature extraction, as a crucial part of image classification, has been extensively studied over the previous few years, and a number of feature extraction algorithms have been suggested. However, there is no comprehensive study concerning the connections between different coding methods, especially how they have evolved. In this research, a survey has been done on past feature extraction methods, including their motivations and scientific illustrations.

KEYWORDS: Keywords –Machine Learning, Brain Tumor, MR Images, Image Classification, Feature Extraction.

INTRODUCTION :

Machine learning is a systematic discipline that allows the computers to automatically learn and predict the behaviour of the systems on the basis of experiences. Machine Learning (ML) [1] is approaching into its own, with a rising recognition that ML can play a crucial role in extensive variety of critical applications, such as data mining, effective web search, speech recognition, natural language processing, image recognition, and expert systems. ML offers potential solutions in all these domains and more, and is set to be a pillar of our future civilization. Several procedures and algorithms form the foundation of machine learning. Everyday new algorithms are added to these algorithms to improve the functionality of the previous methods. One of the objective of these algorithm is to identify the class of unknown data when the information about the classes of previous data is known. This process is called classification (Amasyali, 2006**)** Classification of images or data is a field of machine learning which classify the data set into a set of categories. In machine learning classification is the problem of verifying or investigating to which of category the unknown pattern belongs on the basis of instances whose category relationship is given. Text categorization, bioinformatics, machine vision, market segmentation are the examples of classification problems**.**

OBJECTIVE:

The main goal is to use machine learning algorithms and approaches which can further helpful in analysis of medical imaging. The objective is to implement an algorithms for feature extraction to extract features from Brain MR Images. The extracted features should be precise and accurate and should be able to correctly classify the type of malignant brain tumor.

DATA SET:

For the research work, brain tumor MR images were collected from the Department of Radiology, Sawai

Man Singh (SMS) medical College Jaipur, Rajasthan, India. In proposed work the operations associated to the CLOM methodologies are applied on the five categories of high grade malignant tumor MR images.

In this research brain tumor is classified into five classes (Central Neuro Cytoma, Glioblastoma Multiforme, Glioblastoma Multiforme, Gliomas, and Intraventricular Malignant Mass**).** All the data source images are having a no. of modalities T1-weighted, eT1-weighted, T2- weighted, eT2- FLAIR and e T2-Weighted.The five classes of brain tumor is discussed below:

CENTRAL NEURO CYTOMA are abbreviated as CNC, is a very uncommon benign intraventricular tumor. According to WHO Central neuro cytoma's are grade II tumors. These tumors are commonly seen in young patients (20-40 years) and the tumors appear as dissimilar size of masses and develop inside lateral ventricle. Generally it appears with symptoms as headache, enlarged intracranial pressure [2].

GLIOBLASTOMA MULTIFORME are abbreviated as GBM are grade IV astrocytoma tumors. GBM are high grade form of astrocytomas which is very common kind of brain neoplasm in adults. These are more aggressive kind of glial (oligodendrocytes and astrocytes) tumors which grows very fast and develops in star shapes (glial cells). More generally GBM occurs in temporal and frontal lobes of the brain. GBM is a life devastating cancerous tumour causes death within 15months after investigation.

GLIOMAS is a category of brain tumor that arises at spinal or brain. It originates from glial cells. Gilomas can be high grade or low grade depending upon the growth of the tumor. Brain gilomas may cause vomiting, headache, nausea, seizures, enlarged intracranial pressure.

INTRAVENTRICULAR MALIGNANT MASS are benign tumors arise at the ventricles of the brain. These are often called as ventricular tumors. These tumors may start from range of cells and usually block the flow of cerebrospinal fluid.

Intraventricular tumors (also known as ventricular tumors) are generally benign tumors or lesions found within the ventricles of the brain. These tumors may arise from a variety of cells in the region and often obstruct the flow of Watery (cerebrospinal) fluid and originates a pressure or heaviness in the skull.

METASTASIS means "the removal from one location to another location". Metastasis brain tumors are the primary brain tumors that spread at anywhere in body or brain. These tumors are cancerous. According to the pathologists metastasis tumors cells seems same as cancer cells. Even metastatic tumor cells and cancer cells have same molecular features. The following figure shows the MR images of above five classes of tumor.

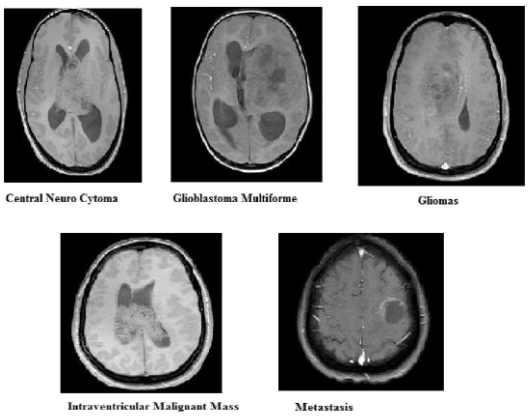

Fig 1.2: MR Images of five different classes of brain tumor

TECHNIQUES OF MR IMAGES CLASSIFICATION:

A. GREY LEVEL CO-OCCURRENCE MATRIX:

A **GLCM** is a histogram of co-occurring grayscale values at a given offset over an image **.**In [3] author suggested a feature extraction method called GLCM (Grey level Co-occurrence matrix), GLCM is most

frequently used technique in pattern recognition to extract features which uniquely distinguish each pattern. GLCM is used in variety of applications [3, 4, 5, 6, 7, 8] by many research analysts.

B. LINKED LIST APPROACH OF GLCM:

A linked list approach has been developed to effciently calculate texture features based on cooccurrence probabilities. David A. Clausi and M. Ed Jernigan [4] recommended linked list approach of GLCM. The speed of GLCM is fully dependent on the pixel or intensity values of the grey label values. While in linked list approach operations on pixels are performed more feasibly because in linked list representation of the image pixels the dynamic range of the image can be employed. In [10] multiple class brain tumor classification is done by capturing 100 features from GLCM, shape, Gabor, statistical and intensity feature extraction techniques.

C. RUN LENGTH CODE METHOD:

Padma in [7] proposed run length method of extracting features for segmentation and classification of brain MR images using SVM and Genetic algorithm. The technique is based on the fact that the brain MR tissue (GM, CSF, Abnormal tumor region, WM) having distinct textural features. The experiments are performed on 120 images out of which 60 are abnormal and 60 images are normal. The proposed run length method is compared with co-occurrence method and Wavelet co-occurrence method. For the co-occurrence method out of features 52 features are 16 are selected using genetic algorithms and it gives the accuracy of 93.3 %. For wavelet Co-occurrence technique out of 27 features 12 features are selected and the classification accuracy of wavelets method is 95.8%. In proposed run length method out of 16 features 8 features are selected and the classification accuracy of run length method is 98. 3%. The comparative analysis shows that run length method gives better classification and segmentation results when compared to Wavelets and co-occurrence method using SVM classifier.

D. MULTIPLE BRAIN NEOPLASM CLASSIFICATION:

In [8] multiple class Brain neoplasm classification is accomplished on 428 T1-weighted, post contrasted images of 55 patients. The MR images includes five different categories of brain tumor namely glioblastoma multiforme (GBM), secondary tumor-metastatic (MET) meningioma (MEN), astrocytoma (AS), medulloblastoma (MED), and normal regions (NR). By applying Content based contour model 856 regions of interests (SROI's). From SROI 218 textural and intensity features are extracted. For dimensionality reduction PCA is used. Further classification is performed using Artificial Neural Networks (ANN). Two kind of experiments are accomplished. In first accuracy is verified using ANN and in second the accuracy is determined by PCA-ANN. The classification accuracy using the PCA-ANN increased from 77 to 91%.

E. SUB – BAND DOMAIN CO-OCCURRENCE MATRIX:

N. Dhivya in [9] apply machine learning approaches to classify the faulty fabric. Classification of faulty fabric is a stimulating field in textile industry. In this research author apply DWT on the fabric images which decomposes the images into sub-band coefficients, textural features are extracted from these sub band coefficients. The proposed method named as SBCM (sub – band domain co-occurrence matrix) and the performance of the proposed method is compared with spatial domain co-occurrence matrix using classification rate. The experiment is applied on 37 fabric images out of which 20 images used for training and 17 images used for testing. Texture features as entropy, inverse different moment, contrast, angular sum moment are extracted. The classification rate of the proposed method SBCM is 94%.

STANDARD METHODOLOGY FOR IMAGE ANALYSIS:

In every domain of image analysis, Image Classification is an important technology. There are various applications such as bio-medical (medical imaging), space application, image and video production, pattern recognition, remote sensing and computer graphic images require image classification. The purpose of classification is execution of a process in which an image is assigned to a pre-determined class among several classes. The main stages of the brain tumor MR image classification is pre-processing, feature extraction, feature selection and classification. The input image is initially pre-processed, pre-processed image is used for feature extraction. The extracted hybrid feature set uses feature selection method for selecting relevant subset of image features, which is used by the classifier for training and testing of images.

PRE-PROCESSING:

The distinct characteristics of medical MR images make the classification task challenging. So classifying the large database of these MR images is very difficult and complicated [10]. MR images acquired from radiologists may consist of noise or unwanted signals that may cause error for further phase of classification. MR images are organized in such a way that the objects in x-rays with higher density appear brighter and objects with lower density appear less bright. As a consequence Bones in x-ray images possess very high level of brightness as comparison the soft tissues. Further medical images possess low level of contrast. To enhance the image quality contrast of images should be improved and noise should be removed. Pre-processing stage is required to remove unwanted noise and for better contrast.

NOISE REMOVAL:

Medical images may include a variety of noise. At the time of image acquisition noise [11] can be added, many times the Imaging devise such as MRI devise or CT scan may be a source of noise. It can also be added due to the destruction or damage of scanner, while transmitting the images electronically may incorporate noise. Due to noise intensity values do not appear the true pixel values of real image.

CONTRAST IMPROVEMENT:

By using Median filter noise in the medical images will be removed. Additionally The intensity distribution and contrast can be improved by determining each pixel value in image. Each pixel value can be determined using the pixel label values in the adjacency of particular pixel. Subsequently the pixel value of each pixel will reconfigured by using histogram equalization. The process initiates by determining a square window (3*3) and sliding the window on image array. In the next step histogram beneath the square window and the intensity values of pixels will be replaced by new pixel values. Histogram equalization can be performed by exponential distribution, Rayleigh distribution or uniform distribution. By employing the histograms improve the contrast but increase the noise in the image. Noise can be removed by applying median filters.

GREY LEVEL CONVERSION

The pre- processing phase include the removal of noise and contrast improvement to improve the image quality for further operations. After these enhancement operations the colour image is converted into its gray level representation. All the operations in the images are always applied on its gray level representation.

FEATURE EXTRACTION

In study of pattern recognition the precise classification rate is always required in order to improve the classification accuracy. As the progress of technology data sets grow and update faster, the size of data dimensions grows unstructured and higher. In the field of classification large dimension of data is used which is very difficult to manage all data efficiently. To use the large database efficiently and extract significant knowledge from this database is a crucial and challenging task. Extraction of important and useful information to reduce the data dimension and to use the data set more efficiently is the process of feature extraction.

FEATURE SELECTION

For classification of tumor a large no of features are extracted using feature extraction mechanism. Feature selection is used to reduce the data dimensionality to acquire most favourable and suitable features from a large dataset. Feature selection is a process used in machine learning also known as subset selection or dimensionality reduction. It is the process of selecting a subset of appropriate features in order to reduce the error. Feature selection mechanism provides methods to select best suitable least no of features from a large feature set and discards the unimportant and redundant features. The feature selection method is applied on each training set to achieve the classification criteria.

CLASSIFICATION:

The efficiency of feature vector is dependent on how well distinct classes can be separated in whole feature space. The procedure of classification [12,13,14] categorize the image features into distinct

classes. It categorize all pixels in the digital images into distinct classes based on their attributes. The task of classification is influenced by the training and testing samples. The classification can be performed into two categories. In supervised classification require training data set for which the label of class is known. The supervised classifier used a set of objects whose classes are known. The classifier uses these objects to determine the type of unknown objects. These known objects are called training set because these are used by the classifier to train or learn the unknown objects. In unsupervised classification training set is not provided. In terms of accuracy and precision supervised classification performs better than unsupervised classification

RESULT:

The last step of the methodology is the result after performing the above steps the final output comes according to the approach used different approach gives different results for the same image input.

LIST OF ABBREVIATIONS:

AI	Artificial Intelligence
ML	Machine Learning
GLCM	Grey Level Co-occurrence Matrix
DGLRLM	Dominant Grey Level Run Length Matrix method
WHO	World Health Organization

REFERENCES:

1. Taiwo Oladipupo Ayodele (2010). Types of Machine Learning Algorithms, New Advances in Machine Learning, Yagang Zhang (Ed.), ISBN: 978-953-307-034-6, InTech, DOI: 10.5772/9385.
2. V.B. Sebastian, A. Unnikrishnan, K. Balakrishnan, "Grey Level Co Occurrence Matrices: Generalisation and Some New Features", International Journal of Computer Science, Engineering and Information Technology (IJCSEIT), vol.2, no.2, 2012.
3. D. A. Clausi, M. Ed Jernigan, "Fast Method to Determine Co-occurrence Texture Features", IEEE Transactions on Geosciences and Remote Sensing, vol.36, no. 1, 1998.
4. R.M. Haralick, K. Shanmugam, I. Dinstein, "Textural Features for Image Classification", IEEE Transactions on Systems, Man and Cybernetics,vol.3, no. 6, pp. 610-621, 1973.
5. R. M. Haralick, "Statistical and structural approaches to texture", Proceedings of IEEE, vol. 67, no.5, pp. 786- 804, 1979.
6. A.Padma and R.Sukanesh. "Automatic Classification and Segmentation of Brain Tumor in CT Images using Optimal Dominant Gray level Run length Texture Features", International Journal of Advanced Computer Science and Applications (IJACSA), vol. 2, no. 10, 2011.
7. J.Sachdeva, V. Kumar, I. Gupta, N. Khandelwal, C.K. Ahuja. "Segmentation, Feature Extraction, and Multiclass Tumor Classification" International Journal of Digital Imaging, vol. 26, pp. 1141-1150, 2013
8. N. Dguvya, R. A. Lakshmi, D. Ramalakshmi. "A Hybrid Approach for detection and classification of Fabric Faults in Textile Industries Using Wavelet Transform And GLCM Technique", ISSN(Print): 2278-8948 Vol-2,2013.
9. N. J. Fesharaki, H. Pourghassem, "Medical X-ray Images Classification Based on Shape Features and Bayesian Rule" 2012 Fourth International Conference on Computational Intelligence and Communication Networks, pp. 369-373, 2012.
10. Image Processing Fundamentals – Statistics, "Signal to Noise Ratio" (2001).
11. E. I. Zacharaki, S. Wang, S. Chawla, D. S. Yoo, R. Wolf, E. R. Melhem, C. Davatzikos, "Mri-Based Classification Of Brain Tumor Type And Grade Using Svm-Rfe" IEEE International Symposium on Biomedical Imaging, pp. 1035-1038, 2009.
12. E.S.Ahmed, E.Dahshan, T. Hosny,A.Badeeh, M. Salem "Hybrid intelligent techniques for MRI brain images classification" , Digital Signal Processing, vol. 20, issue 2, pp. 433-441, 2010.
13. A.vidyarthi, N. Mittal "A Hybrid Model for Extraction of Brain Tumor in MR Images" , 2013 International Conference on Signal Processing and Communication (ICSC) , pp. 202 – 206 ,2013