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Classification of MRI brain images using ANN

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***Abstract*— when abnormal cells form within the brain, causes Brain tumor. Brain tumors can be cancerous (malignant) or non-cancerous (benign).Person may suffer from vomiting, blurred vision or double vision, confusion, seizures , weakness of a limb or part of the face, a change in mental functioning. Brain tumors account for 85% to 90% of all primary central nervous system (CNS) tumors. The worldwide incidence is close to 3,00,000 cases, out of which 10% are from India. To generate images of the inside of the body MRI scanners is used, It uses strong magnetic fields, radio waves, and field gradients for this. In this research work, We classify brain tumor into four classes and feature of each class extracted by GLCM and applied back propagation algorithm, which give 99%classification rate.**

***Index Terms*— SVM (Support Vector Machine), GLCM (Gray Level Co-Occurrence Matrix), MRI (Magnetic resonance imaging), KSVM (Kernel Support Vector Machine),CNS (central nervous system)**

I. INTRODUCTION

The cluster of abnormal cells growing in the brain is called Brain Tumor. If the tumor is detected and classified correctly at its early stage it is possible that the chances of survival can be increased. Detection of these tumors from brain is very difficult at the regions where a tumor is overlapped with dense brain tissues. Nowadays, automatic brain tumor detection in MRI images is very important in medical applications[8]. Magnetic resonance imaging is an imaging technique which produces high quality images of the anatomical structures of the human body, especially in the brain. When dealing with a human life, automated classification and detection of tumors in different medical images is motivated by the necessity of high accuracy. In this paper the designed system is developed for Detection and Classification of Brain tumor from a given MRI image of tumor affected patients.

Brain tumors are classified into two categories - primary brain tumor and secondary brain tumor[5]. The primary tumors are tumors that originate in the brain itself and the secondary brain tumors are the cancer cells that originate from another part of the body and have spread to the brain. In this research paper, we used the GLCM textural features for tumor classification using the back propagation algorithm.

II. METHODOLOGY

The method involves processing of MRI images which are affected by brain tumor for detection and classification of brain tumors. The image processing techniques like preprocessing is used to the detection of tumor then texture feature extraction method is used for extracting features from the MRI image. Features are extracted by using Gray Level Co occurrence Matrix. After feature extraction BPNN is used for the classification of brain tumor from abnormal images.

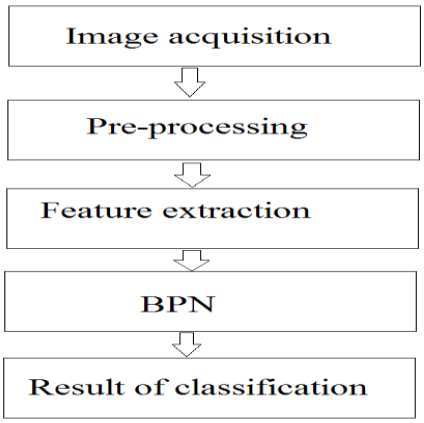

Figure 2.1 Work Process of our work

2.1 **Magnetic Resonance Imaging**

For extremely accurate method of disease detection throughout the body an MRI scan can be used and is most often used after the other testing fails to provide sufficient information to confirm a patient's diagnosis. The head can be seen as bleeding or swelling.[9] The abnormalities often found include brain aneurysms, stroke, tumors of the brain, as well as tumors or inflammation of the spine.

Class I (Astrocytoma)

The patient was a young man; the mixed signal intensity on proton density (PD) and T2-weighted (T2) images is demonstrated by MR [8] .Contrast enhancement can be show the lesion to contain cystic elements. an anterior border of high uptake can be shown by thallium images , consistent with a small region of tumor recurrence[5].

Class II (Meningioma)

The patient was an old man who had several month history of progressive difficulty walking. He had noted that his left lower extremity weak and feel some difficulty with memory and concentration [8]. He was alert and oriented, but had slow and hesitating speech. He could remember only 1 of 3 objects in few minutes.

Class III (Metastatic Bronchogenic Carcinoma)

This 42 year old woman at began having headaches and she uses tobacco, few month before these images were obtained. a large mass with surrounding edema shown in Brain images [8], and compression of adjacent midbrain structures. The high signal intensity on proton density (PD) and T2-weighted (T2) images is demonstrated by MR which is at large left temporal region

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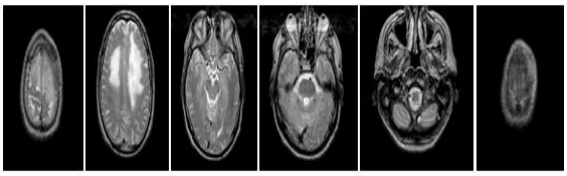
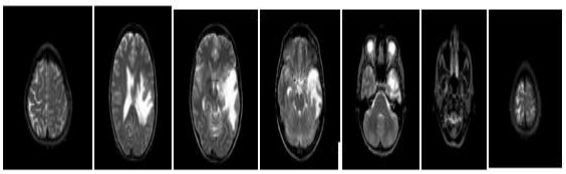
Class IV (Sarcoma)
The patient was a younger man who was admitted for resection of Ewing's sarcoma (peripheral/primitive neuroepithelial tumor- PNET[8]). He was noted Vaguely described visual difficulty and retrospectively to have begun approximately one month prior to admission.

2.2 **MRI Image database**
For this experimental work Four different classes of Brain tumor MR images are used, in which samples are collected from the Whole Brain Atlas (WBA). Every image is having the exact size of 256x256 in axial view.

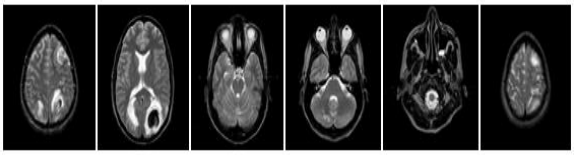
1 Class (Menengioma)



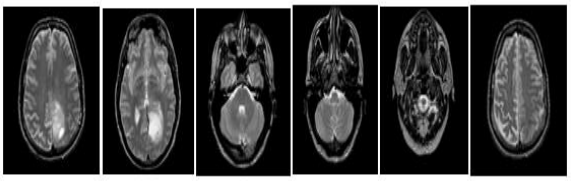
2 Class (Meta)



3 Class (Sarcoma)



4Class(Spect)



2.3 Feature Extraction
The Gray Level Co ocurrence Matrix (GLCM) method is used to extract second order statistical texture features. This approach has been used in a number of applications, Third and higher order textures consider the relationships among three or more pixels[2]. A GLCM is a matrix where the number of rows and columns is equal to the number of gray levels. Gray Level Co-Occurrence Matrix (GLCM) is popular statistical method of extracting textural feature from images.
In this work we use twenty two features from GLCM-

1. Uniformity / Energy / Angular Second Moment
2. Entropy
3. Dissimilarity
4. Inverse difference
5. Contrast / Inertia .
6. Correlation
7. Homogeneity / Inverse difference moment
8. Autocorrelation
9. Cluster Shade
10. Cluster Prominence
11. Sum Variance
12. Maximum probability
13. Sum of Squares
14. Sum Average
15. Difference entropy
16. Sum Entropy
17. Difference variance
18. Information measures of correlation (1)
19. Information measures of correlation (2)
20. Inverse difference moment normalized (IDN
21. Maximal correlation coefficient
22. Inverse difference normalized (INN)

2.4 **Classification**
An artificial neuron network (ANN) is a computational model that is based on the structure and functions of biological neural networks. This network[6] is of highly interconnecting processing elements (neurons) operating in parallel. These elements are inspired by biological nervous systems. The connections between elements largely determine the network function. A subgroup of processing element is known as a layer of the network.
Back propagation network is the primarily used in supervised artificial neural network. Prior to training, the selection of architecture plays a vital role in determining the classification accuracy. The backward propagation of errors or back propagation is a common method of training artificial neural networks. In this work, a three layer network is developed i.e. input layer ,output layer and Hidden layer. Input layer contain 44 neurons, hidden layer contain **210** neurons and Output layer has 4 neurons.

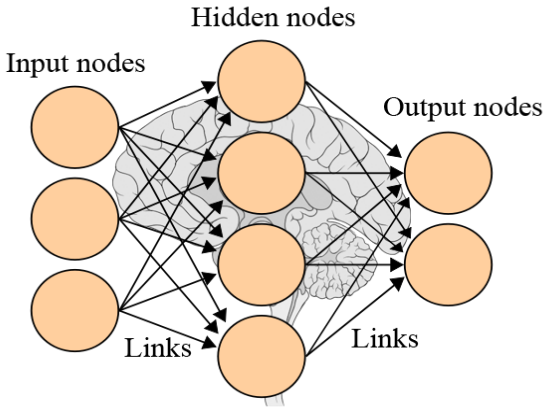


Figure 2.4.Neural network

III. RESULT

This show all the statistical characteristics of **Levenberg-Marquardt**'s features for abnormal MRI images data processed from fig.3.1 to fig.3.3 to know the correct selection from the parameters and gives the true result of tumor
detection, So it plotted in the curve and calculated the correlation between them.

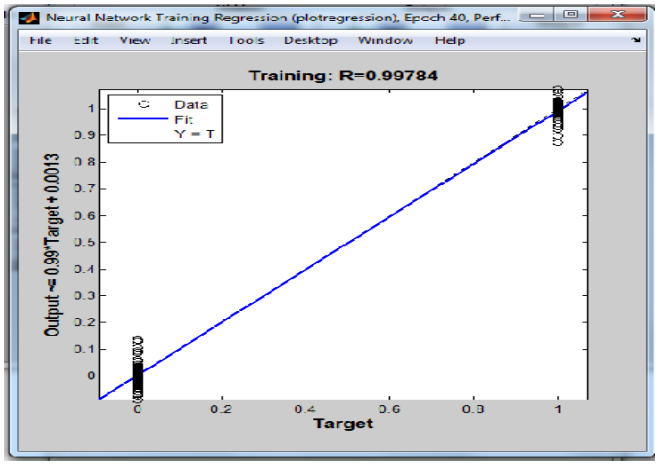


Figure 3.1 Regression

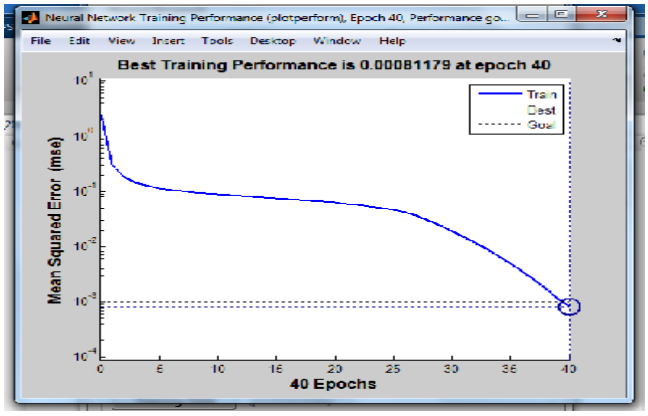


Figure 3.2 Performance

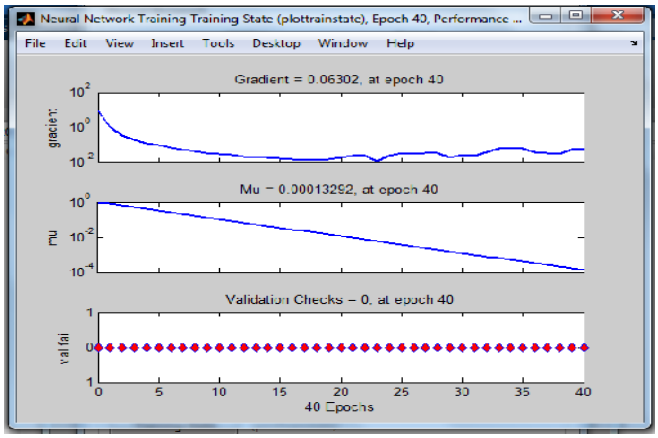


Figure 3.3 Training State

IV. Results of Artificial Neural Networks Training:

This is result of Back propagation artificial neural networks training and performance of training for best twenty two parameter and random choose different parameter.

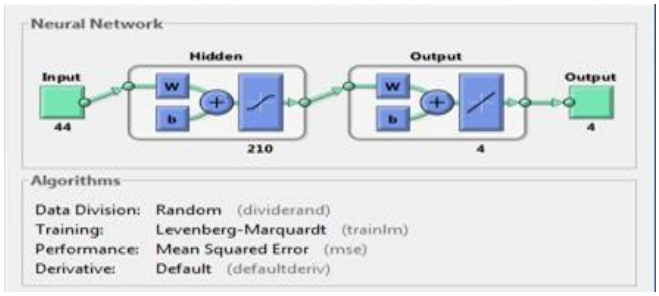


Figure 4.1 Training of Neural Network

V. Result Table

Type	Training Data	Training Data %	Testing Data	Testing Data %
Meningioma	19/19	100%	6/6	100%
Metastatic	17/17	100%	3/6	50%
Sarcoma	18/18	100%	4/6	66.66%
Astrocytoma	22/22	100%	4/6	66.66%

VI. Conclusion

This paper aimed to design automatic algorithm to detect the brain tumor from MRI images by artificial neural networks. This algorithm has been successfully designed. The data collected from Whole Brain Atlas website. For feature extraction we use GLCM, it gives twenty two features. The ANN is used to train our system, which gives batter performance for classification. The back propagation network has been successfully tested and achieved the best results with accuracy 99% .The system is designed to be user friendly by creating Graphical User Interface (GUI).The proposed system efficiently classifies the MRI brain tumor images.

REFERENCES

[1] Chang R.F., Wu W.J., Moon W.K., Chou Y.H., Chen D.R., "Support vector machines for diagnosis of breast tumors on US images", Academic Radiology, 2003, 10(2), p. 189-197.

[2] W. Chu, C. J. Ong, and S. S. Keerthi "An improved conjugate gradient scheme to the solution of least squares SVM", IEEE Transactions on Neural Networks 16(2): pp. 498-501, 2005.

[3] Kaus *et.al.*, " Automated segmentation of MR images of brain tumors", Journal of radiology, vol.218, no.2, pp: 586-591, 2001.

[4] Haralick R. M., Shanmugam K., Dinstein I., "Textural Features for Image Classification", IEEE Trans. On Systems Man and Cybernetics, 1973, 3(6), p. 610-621.

[5] Ricci P.E., Dungan D. H., "Imaging of low- and intermediate-grade gliomas", Seminars in Radiation Oncology, 2001, 11(2), p. 103-112.

[6] Martin T. Hagan and Mohammad B. Menhaj, "Training Feed forward Networks with the Marquardt Algorithm", IEEE Trans. on Neural Networks, Vol. *5*, No. *6*, November 1994

[7] J.Vijay, J.Subhashini, "An Efficient Brain Tumor Detection Methodology Using K-Means Clustering Algorithm", in Int Conf on Communication and Signal Processing, 2013, IEEE.

[8]Ananda Resmi S, Tessamma Thomas, "Automatic Segmentation Framework for Primary Tumors from Brain MRIs Using Morphological Filtering Techniques", in 5th Int Conf on Biomedical Engineering and Informatics,2012,IEEE

[9] Chang Wen Chen, Jiebo Luo, Kevi J. Parker,"Image Segmentation via Adaptive K-Mean Clustering and Knowledge-Based Morphological Operations with Biomedical Applications", *IEEE Trans. Image Process.*,vol.7,no.12, pp1673-1683, 1998.

[10] Pratibha Sharma, Manoj Diwakar, Sangam Choudhary,"Application of Edge Detection for Brain Tumor Detection", *International Journal of Computer Applications*, vol.58, no.16, pp 21-25, 2012.