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Artificial Neural Network Based Brain MRI Using DCT

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Abstract: The classification in recovery systems Brain is to differentiate among normal and abnormal brain tissue. In this paper use feature extraction from MRI is carried out by Wavelet transform and ANN techniques. Wavelet transform tool for feature extraction because it gives better contrast to an image. Due to better contrast it improves easily hanging signals of an image and reduces the overhead. GLCM is used to select the best features for classification..

Keywords: Wavelets transform, Neural Network, GLCM, MRI, Brain tumor, ANN, etc.

I Introduction

The brain is the most fascinating and least understood, organ in the human body. For centuries, scientists and philosophers have pondered the relationship between behavior, emotion, memory, thought, consciousness, and the physical body. In the Middle Ages there was much controversy as to whether the soul was located in the brain or in the heart. As ideas developed however, it was suggested that mental processes were located in the ventricles of the brain. According to this theory 'common sense' was located in the lateral ventricles, along with imagination accommodated in the posterior part. The third ventricle was the seat of reasoning, judgment and thought, whilst memory was contained in the fourth ventricle.

Medical Image analysis and processing has great significance in the field of medicine, especially in Noninvasive treatment and clinical study. This is medical imaging techniques analysis tools enable both doctors and radiologists to arrive at a specific diagnosis process. Medical Image Processing has emerged as one of the most important tools to identify as well as diagnose various disorders. Imaging helps of the doctors to visualize and analyze the image for understanding of abnormalities in internal structures. In brain images data obtained from Bio-medical Devices which use imaging techniques like Magnetic Resonance Imaging (MRI), Computed Tomography (CT) and mammogram function, which indicates the presence or absence of the lesion along with the patient history, of important factor in the diagnosis process.

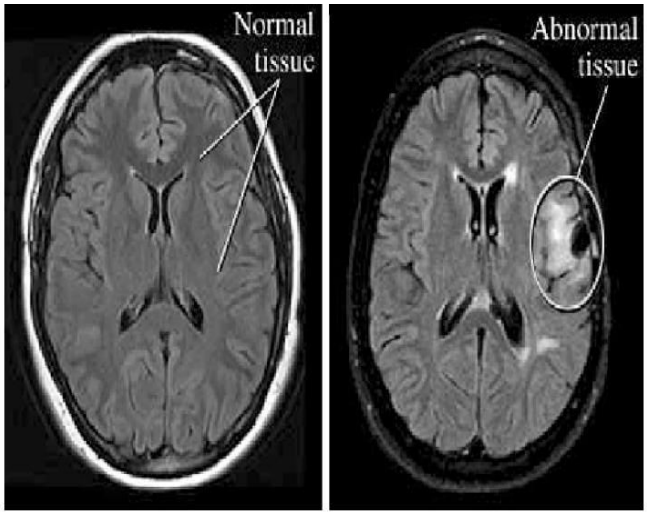


Fig. 1 Normal and Abnormal Brain MRI Image

A method for semiautomatic segmentation of brain structures such as thalamus from MRI images based on the concept of geometric surface flow has been done. The model evolves by incorporating both boundary and region information following the principle of variational analysis.

In this work classification method based on wavelet and ANN. Extraction of texture features from images represents the information about the texture characteristics of the image and the variations in the intensity or gray level .

II .Related Work

In 2010, Ahmed Kharrat , Karim Gasmi, Mohamed Ben Messaoud , Nacera Benamrane and Mohamed Abid introduced a hybrid approach for classification of brain MRI tissues based on genetic algorithm(GA) and support vector machine (SVM).The optimal texture features are extracted from brain MRI images by using GLCM . These features are given as input to the SVM classifier. The choice of features are solved by using GA.

In 2011, V.Sivakrithika and B.Shanthi are proposed comparative study on cancer image diagnosis using GLCM to extract features from images and neuro-fuzzy as tool for classification stage.

In January , 2012 Sahar Jafarpour , Zahra Sedghi and Mehdi Chehel Amirani proposed method for classification brain MRI images they used GLCM to extract features from brain MRI and for selecting the best features ,PCA+LDA is implemented. The classification stage is based on artificial neural network(ANN) and k-nearest neighbor(K-NN) .

III . NEURAL NETWORK

The power and usefulness of artificial neural networks have been demonstrated in several applications including speech synthesis, diagnostic problems, medicine, business and finance, robotic control, signal processing, computer vision and many other problems that fall under the category of pattern recognition. For some application areas, neural models show promise in achieving human-like performance over more traditional artificial intelligence techniques.

Neural networks are composed of simple elements operating in parallel. The neuron model shown in Figure 1 is the one that widely used in artificial neural networks with some minor modifications on it.

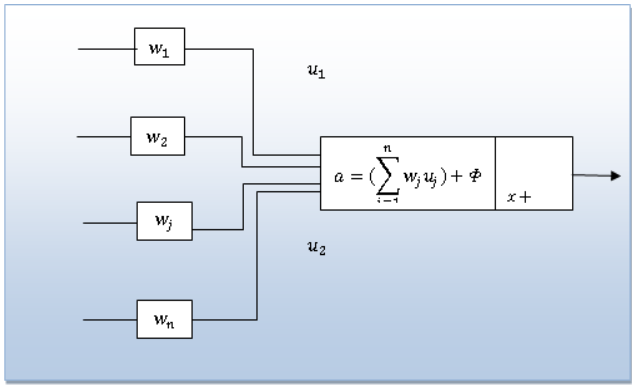


Fig. 2 Artificial Neuron

The artificial neuron given in this figure has N input, denoted as u1, u2,…uN. Each line connecting these inputs to the neuron is assigned a weight, which is denoted as w1,w2,….,wN respectively. The threshold in artificial neuron is usually represented by Φ and the activation is given by the formula

$$a = \left(\sum_{j=1}^{n} w_j u_j\right) + \Phi$$

IV . PROPOSED WORK

The proposed method as described the flowchart is based on following discussed MRI techniques: Grey-Level Co-occurrence matrix (GLCM) and wavelet transform. This method consists of two stages: in a Feature Extraction and Feature Classification. For medical images and film it is classifies between normal and abnormal brain images along with type of abnormality exist.

- Image processing
- Feature extraction.
- Classification using ANN

The proposed system are implemented on a real human brain dataset. The input dataset consist in 19 images: 10 images are normal, 9 abnormal images. These normal and abnormal images used for classification, are 256×256 sizes and acquired at several positions of the transsexual planes.

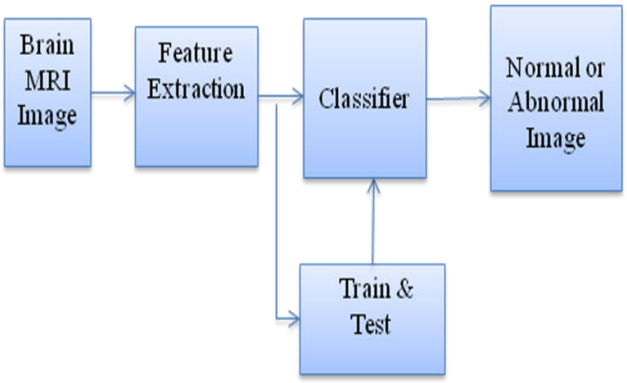


Fig. 3 System Block diagram

IV.1 FEATURE EXTRACTION

Feature extraction means identifying the characteristics found within the image , these characteristics are used to describe the object . Image features are useful extractable attributes of images or regions within an image.

Feature extraction methodologies analyze objects and images to extract the features that are representative of the various classes of objects . Features are used as inputs to classifiers that assign them to the class that they represent . In this work grey-level co-occurrence matrix (GLCM) features are extracted.

IV.2 DISCRETE WAVELET TRANSFORM

Image Reconstruction with wavelet transform used 2D version of the analysis and synthesis filter banks. In the 2D (image) case, the 1D analysis filter bank is first applied to the columns of the image and then applied to the rows. If the image has N1 rows and N2 columns, then after applying the 1D analysis filter bank to each column, two sub band images are created, each having N1/2 rows and N2 columns; after applying the 1D analysis filter bank to each row of both of the two sub band images, four sub band images are generated, each having N1/2 rows and N2/2 columns.

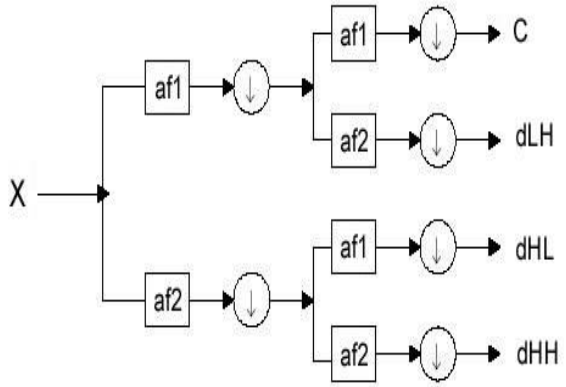


Fig. 4 Stage in multi-resolution wavelet decomposition of an image

IV.3 GREY-LEVEL CO-OCCURRENCE MATRIX (GLCM)

A well-known statistical tool for extracting second-order texture information from images is the grey-level co-occurrence . The Grey-level co-occurrence matrix is one of the most popular and effective sources of features in texture analysis system. For a region, defined by a user specified window , Grey-level co-occurrence matrix (GLCM) is the matrix of those measurements over all grey level pairs.

The GLCM matrix of an a image f(i,j) , containing pixels of image with gray levels {0,1,. . . , G-1 }, is a two-dimensional matrix C(i,j) where each element of the matrix represents of the probability of joint occurrence of intensity levels i and j at a certain distance d and an angle θ . If there are L brightness values possible then the Grey-level co-occurrence matrix (GLCM) matrix will be an L × L matrix of numbers relating the measured statistical dependency of pixel pairs . In generally, four directions corresponding to angles of θ = 0, 90, 45, 135 are used. There will be one Grey-level co-occurrence matrix matrix for each of the chosen values of d and θ. Figure (5) shows the four directions of this texture analysis technique.

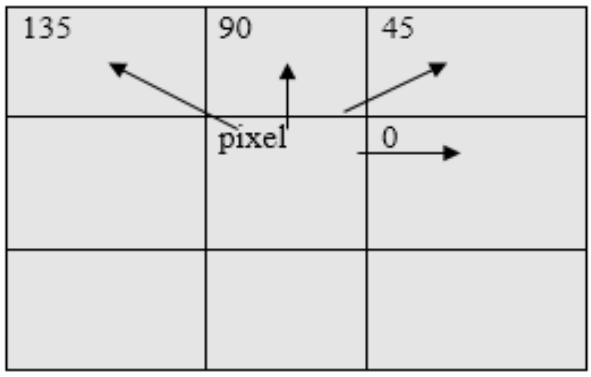


Fig. 5 Four directions of GLCM matrix.

This approach computes an intermediate matrix of the statistical measures from an image. These features relate to contrast, texture directionality, and homogeneity on a perceptual level. The values of a Grey-level co-occurrence matrix contains frequency Information about the local spatial distribution of gray level pairs process. Various statistics derived from gray level spatial dependence matrices for use in classifying image textures. Figure (5) shows an example of a 5 × 5 image matrix and its GLCM matrix for right neighbors (θ = 0 and d= 1).

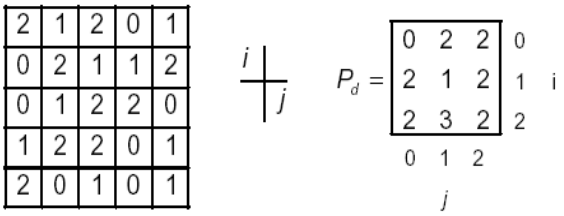


Fig. 6 GLCM Matrix [3]

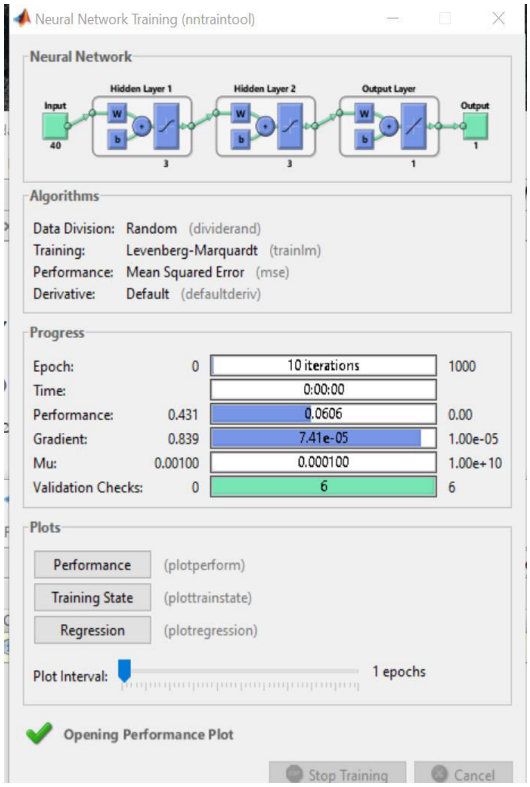
In this matrix Count all pairs of pixels in which the first pixel has a value i, and its matching pair displaced from the first pixel by d has a value of j. This count is entered in the ith row and jth column of the matrix Pd[i,j] Note that Pd[i,j] is not symmetric, since the number of pairs of pixels having gray levels [i,j] does not necessarily equal the number of pixel pairs having gray levels [j,i]. Afterwards various parameters like energy, entropy, mean and contrast has been calculated.

IV.4 ANN

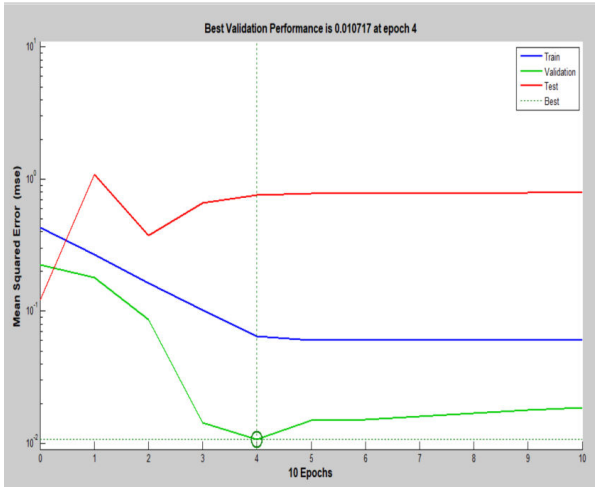
An ANN is information processing paradigm that is inspired by the way biological nervous system such as the brain process information. The key element of the paradigm is the novel structure of the information processing system. It is composed of large number of highly interconnected processing element working is unison to solve specific problem.

V. Simulation and Results

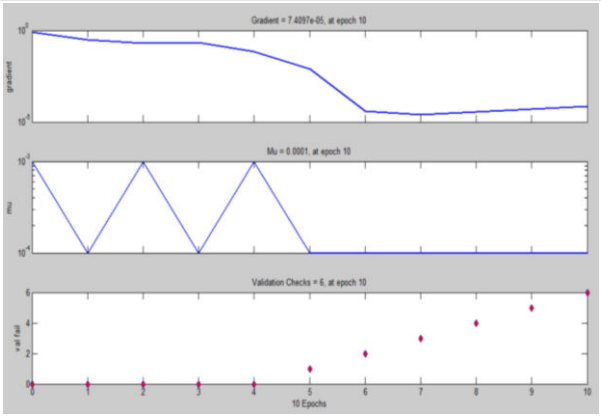
Image dataset consist of 19 images including normal and abnormal images. We are use 10 images are used for training process, and 9 images for test process.



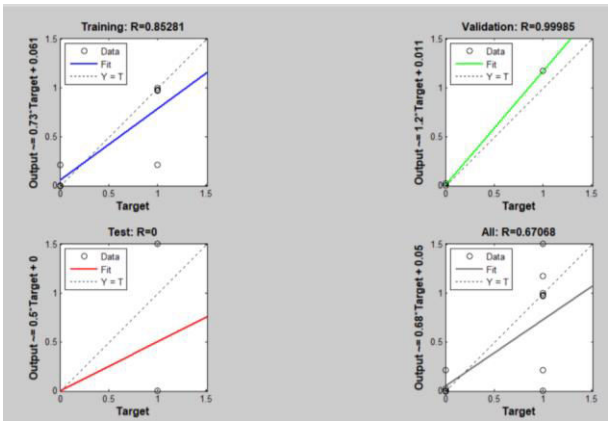
VI. Fig. 7 Neural networ training



VII. Fig. 8 10 Epochs Vs MSE



VIII. Fig. 9 NN performance



IX. Fig. 10

VI.Conclusion

In this work , we are proposed a medical decisionsystem with two class sets as normal and abnormal. This automatic detection system which is designed by gray-level co-occurrence matrix (GLCM) and supervised learning method (ANN) and Wavelet transform obtain promising results to assist the diagnosis brain disease .The methodology in this paper is based on using image features and employing ANN classifier to distinguish normal and abnormal brain MRI .The accuracy of the system is 75% .

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