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Brain MRI Processing and Feature Extraction Analysis

Mr. Vinay Gupta, Mr. Murlimanohar Hinnwar

Abstract – **The paper is base on detection of brain tumor of a patient using artificial Neural network algorithm.A artificial neural network algorithm is design using back propagation training algorithm. The tumor data of patients' is in the form of Magnetic Resonance Image (MRI). This implemented algorithm helps doctor to make their impression about the MRI features to diagnosing the tumor.**

Keywords – **MRI, GLCM, ANN, ASM, Contrast, Entropy, IDM, Dissimilarity.**

I. Introduction

A brain tumor is any intracranial mass created by an abnormal and uncontrolled growth of cells either normally found in the brain. Detection of the brain tumor in its early stage is the key of its cure. There are many different types of brain tumors and their diagnose techniques includes Computed Tomography (CT) scan. Magnetic Resonance Imaging (MRI) scan. Nerve test. Biopsy and etc. Here we can design the algotrithm base on feed-forward neural network. Magnetic resonance imaging (MRI), formerly referred to as magnetic resonance tomography (MRT) or nuclear magnetic resonance (NMR), is a method used to visualize the inside of living organisms as well as to detect the amount of bound water in geological structures. It is primarily used to demonstrate pathological or other physiological alterations of living tissues and is a commonly used form of medical imaging.

For the brain Cancer Detection and Classification System uses computer based procedures to detect tumor blocks or lesions and classify the type of tumor using Artificial Neural Network in MRI images of different patients with Astrocytoma type of brain tumors. The image processing techniques developed for detection of the brain tumor in the MRI images of the cancer affected patients is classified into 6 major parts as Histogram Equalization, Binarization, Morphological Operations, Region Isolation, Feature Extraction, Classification. The extraction of texture features in the detected tumor has been achieved by using Gray Level Co-occurrence Matrix (GLCM). These features are compared with the stored features in the Knowledge Base. We can applied this process on a clustered database consisting of 60 distinct MRI images categorized into 4 classes. For the automated recognition of tumor cell in given MRI image a neuro classifier is realized. The classifier module implements a backpropagation algorithm integrating neural network. Neural approach found to have more accurate decision making as compare to their counterparts. The obtained features are processed before passing it to neural network.

The designed system works in two phases namely Learning/Training Phase and Recognition/Testing Phase. In Learning/Training Phase the ANN is trained for recognition of different Astrocytoma types of brain cancer. The known MRI images are first processed through various image processing steps such as Histogram Equalization, Thresholding, and Sharpening Filter etc. and then textural features are extracted using Gray Level Co-occurrence Matrix. The main problem in the process is that the tumor appears very dark on the MRI image which is very confusing in the edge detection process. To overcome this problem, two steps were performed. First, histogram equalization has been applied to the image to enhance the gray level near the edge. Second, thresholding has been applied to the equalized image in order to obtain a binarized image with gray level 1 representing the tumor and gray level 0 representing the background.

II. Feature Extraction

All the slices processed by the system have been automatically classified as abnormal. They are known to contain Astrocytoma tumor based on radiologist pathology report. The brain image which is to be tested for tumor is given in figure 2

Fig.1. Image to be tested.

Texture features or more precisely, Gray Level Co-occurrence Matrix (GLCM) features are used to distinguish between normal and abnormal brain tumors. Five co-occurrence matrices are constructed in four spatial orientations horizontal, right diagonal, vertical and left diagonal (0°, 45°, 90°, and 135°). A fifth matrix is constructed as the mean of the preceding four matrices.

Texture Features (Gray Level Co-occurrence Matrix Features)

To the extracted region the feature extraction process is applied for the calculation of 5 invariant features.

1. Contrast

$$f1 = \sum_{i,j=0}^{N-1} P(i,j) * (i-j)^2$$

2. Inverse Difference Moment (Homogeneity)

$$f2 = \sum_{i,j=0}^{N-1} \frac{P(i,j)}{1+(i-j)^2}$$

3. Angular Second Moment (ASM)

$$f3 = \sum_{i,j=0}^{N-1} P_{i,j}^{2}$$

4. Dissimilarity

$$f4 = \sum_{i,j=0}^{N-1} P(i,i) * |(i-j)|$$

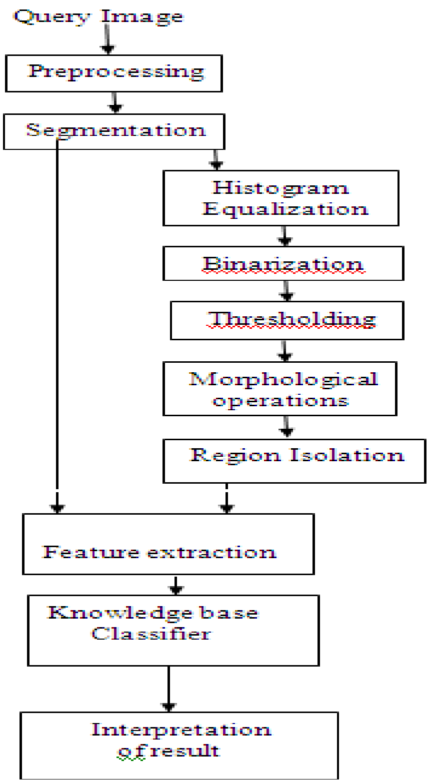
5. Entropy

$$f5 = \sum_{i,j=0}^{N-1} P(i,j) * [-\ln(P(i,j))]$$

III. Methodology for Feature Extraction

The feature extraction extracts the features of importance for image recognition. The feature extracted gives the property of the text character, which can be used for training in the database. The obtained trained feature is compared with the test sample feature obtained and classified as one of the extracted character. Feature selection concerns the reduction of the dimensionality of the pattern space and the identification of features that contain most of the essential information needed for discriminating between normal and abnormal cases. Selection of efficient features can reduce significantly the difficulty of the classifier design. Therefore feature selection based on the correlation coefficient between features is performed. The correlation matrix was calculated for the set of 9 texture features for both normal and abnormal spaces.

Flowchart of implemented design:



Any two features with correlation coefficient that exceeds 0.9 in both spaces can be combined together and thought as one feature reducing the dimensionality of the feature space by one. Therefore the maximum probability and contrast can be removed and the numbers of features are reduced.

```
function [fetr0]=feature0(I)
as00=I;
za=waitbar(0,'Extracting feature for 0 degree tracing .....');
[m,n]=size(as00);
I1=as00;
contrast = 0;
entropy = 0;
idm = 0;
dis = 0;
as02=(as00)^2;
asm0=sum(sum(as02));
for i = 1:m
   waitbar(i/m);
   for j = 1:n
      if I1(i,j)~=0
      contrast = contrast + (i-j)*(i-j)*I1(i,j);
      idm=idm+I1(i,j)/(1+(i*j)^2);
      dis=dis+I1(i,j)*abs(i-j);
      entropy = entropy + I1(i,j)*(-log(I1(i,j)));
   end
end
end
fetr0 = [asm0, contrast, entropy, idm, dis];
close(za);
```

IV. Conclusion

Texture features or more precisely, Gray Level Co-occurrence Matrix (GLCM) features are used to distinguish between normal and abnormal brain tumors. Five co-occurrence matrices are constructed in four spatial orientations horizontal, right diagonal, vertical and left diagonal (0°, 45°, 90°, and 135°). A fifth matrix is constructed as the mean of the preceding four matrices.

Texture Features (Gray Level Co-occurrence Matrix Features)

At 0 ^{o} angle, ASM=4578, Contrast=2341894, Entropy= -76.95, IDM = 3.07, Dissimilarity= 29370

At 90^{o} angle, ASM= 4804, Contrast= 1964810,Entropy= --145.027, IDM = 13.089, Dissimilarity= 25346

This paper implements an efficient system for the detection of cancer from a given brain MRI and recognizes the extracted data for further applications. It finds efficient usage under biomedical early cancer detection. The work can be efficiently used in the area of medical science such as Computer aided diagnosis & Mammography , for predicting early brain cancer cells using texture features and neuro classification. etc. We design cancer recognition system for the classification and estimation of cancer affect on given MRI image and evaluate the performance of classification rate and the efficiency for the implemented automated recognition system.

REFERENCES

[1] Dipali M. Joshi, Dr. N. K. Rana and V. M. Mishra, “Classification of Brain Cancer Using Artificial Neural Network”, International Conference on Electronic Computer Technology 2010, pp-112-116

[2] G Vijay Kumar, Dr GV Raju,”BIOLOGICAL EARLY BRAIN CANCER DETECTION USING ARTIFICIAL NEURAL NETWORK”, International Journal on Computer Science and Engineering Vol. 02, No. 08, 2010, 2721-2725

[3] Hassan Khotanlou, Olivier Colliot, Jamal Atif, Isabelle Bloch, “3D brain tumor segmentation in MRI using fuzzy classification, symmetry analysis and spatially constrained deformable models”, Elsevier, Fuzzy Sets and Systems 160 (2009) 1457–1473.

[4] Kadam D. B., Gade S. S., M. D. Uplane and R. K. Prasad, “NEURAL NETWORK BASED BRAIN TUMOR DETECTION USING MR IMAGES”, International Journal of Computer Science and Communication Vol. 2, No. 2, July-December 2011, pp. 325-331

[5] Mehdi Jafari, Shohreh Kasaei, “Automatic Brain Tissue Detection in Mri Images Using Seeded Region Growing Segmentation and Neural Network Classification”, Australian Journal of Basic and Applied Sciences, 5(8): 1066-1079, 2011.