International Journal of Engineering Innovation & Research
Volume 1, Issue 5, ISSN : 2277 – 5668

Detection of Brain Tumor and Extraction of Texture Features using Magnetic Resonance Images

Prof. Dilip Kumar Gandhi
Assistant Professor
T.I.T., Bhopal, M.P.
dilipgin23@gmail.com

Kaustubh S. Sagale
M.E. Student
T.I.T., Bhopal, M.P.
19.kaustubh@gmail.com

Prof. Vikas Gupta
Associate Professor
T.I.T., Bhopal, M.P.

***Abstract* – Brain Cancer Detection system is designed. Aim of this paper is to locate the tumor and determine the texture features from a Brain Cancer affected MRI. A computer based diagnosis is performed in order to detect the tumors from given Magnetic Resonance Image. Basic image processing techniques are used to locate the tumor region. Basic techniques consist of image enhancement, image bianarization, and image morphological operations. Texture features are computed using the Gray Level Co-occurrence Matrix. Texture features consists of five distinct features. Selective features or the combination of selective features will be used in the future to determine the class of the query image. Astrocytoma type of Brain Cancer affected images are used only for simplicity.**

***Keywords* – Brain Cancer, MRI, Segmentation, Gray Level Co-occurrence Matrix.**

I. Introduction

Curing cancer has been a major goal of medical researchers for decades, but development of new treatments takes time and money [1]. Human brain tumors are complex and often aggressive pathologies of low prevalence but significant social impact. The accurate diagnosis of these tumors is essential in order to provide a prognosis of tumor development [2]. Tumors are of two types: 1.Benign 2. Malignant. Malignant tumors grow in uncontrollable manner. Benign tumors are no growing but they can also harm delicate brain tissues.

To identify a tumor, a patient will undergo several tests. Most commonly Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) are used to locate brain tumor. The information obtained will influence the treatment a patient will receive. Perhaps the most widely used clinical diagnostic and research technique is MRI. It's an efficient medical imagery tool that has different methods (T1,T2, ARM, …) having each particular property and an effective way that enables to clarify the various tissues and to obtain a 2D, 3D and even 4D sight (3D+T) of a part of the body, in particular of the brain. It's based on the principal of nuclear magnetic resonance (NMR). Due to various sequences various tissues with high contrast can be observed [3].

Segmentation refers to partitioning an image into meaningful regions, in order to distinguish objects (or regions of interest) from background [4]. In order to obtain segmentation the simple image processing techniques like image enhancement, binarization and morphological operations can be used. The success of an image analysis system depends on the quality of segmentation [5].

Feature extraction means to get the information of image in the form of numerical data. The feature extracted gives the property of the text character [6]. Texture features or more precisely, Gray Level Co-occurrence Matrix (GLCM) features are used.

Aim of this paper is to locate the tumor and determine the texture features. Computer aided diagnosis is implemented. The database of MRIs of Astrocytoma type of Brain Cancer affected patients is constructed from the case studies available free on internet.

II. Proppoosed Methodology

For the locating region of brain tumor of given query sample, the image is processed through:

1) Histogram Equalization
2) Binarization
3) Morphological Operations
4) Region Isolation

The above mentioned process is applied on a clustered database consisting of 60 distinct MRI images categorized into 4 classes. Then using Gray Level Co-occurrence Matrix the distinct features are extracted.

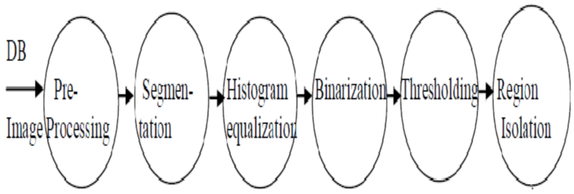

Fig.1. Dataflow Diagram

II. 1 Histogram Equalization

Image preprocessing consists mainly of Histogram Equalization. The main problem in the process of detection of edge of tumor is that the tumor appears very dark on the image which is very confusing. To overcome this problem, Histogram Equalization was performed [1]. The histogram of an image represents the relative frequency of occurrences of the various gray levels in the image. Histogram equalization employs a monotonic, non-linear mapping which re-assign the intensity values of pixels in the input image such that the output image contains a uniform distribution of intensities [6].

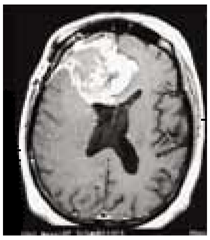

Fig.2. Original Query Image to Test

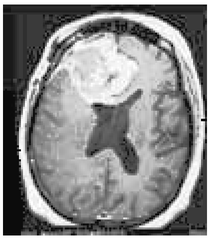

Fig.3. Histogram Equalized Image

II. 2 Binarization

In many vision applications, it is useful to be able to separate out the regions of the image corresponding to objects in which we are interested, from the regions of the image that correspond to background. Thresholding often provides an easy and convenient way to perform this segmentation on the basis of the different intensities or colors in the foreground and background regions of an image [6]. Thresholding has been used for segmentation as it is most suitable for the present application in order to obtain a binarized image with gray level 1 representing the tumor and gray level 0 representing the background [1].

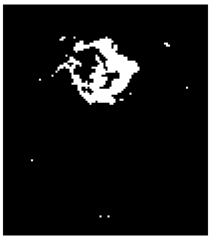

Fig.4. Thresholded Binarized Image

II.3 Morphological Operations

For the text region extraction, we use morphological operators and the logical operator to further remove the non-text regions. In text regions, vertical edges, Horizontal edges and diagonal edges are mingled together while they are distributed separately in non-text regions [6]. The dilation operator is used for filling the broken gaps at the edges and to have continuities at the boundaries [1].

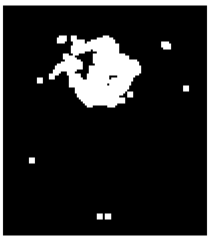

Fig.5. Morphological Operated Dilated Image

II.4 Region Isolation

Onto the dilated image a filling operator is applied to fill the close contours. After filling operation on an image, centroids are calculated to localize the regions [1].

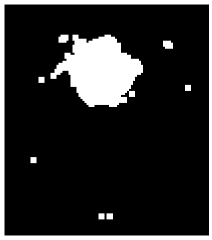

Fig.6. Morphological Operated Dilated Image

II.5 Feature Extraction

The work involves extraction of the important features for image recognition. The features extracted give the property of the texture, and are stored in knowledge base [1]. Texture features or more precisely, Gray Level Co occurrence Matrix (GLCM) features are used to distinguish between normal and abnormal brain tumors [6]. Different features are enlisted as:

1. Angular Second Moment

$$F = \sum_{i,j=0}^{N-1} {P_{i,j}}^2 \quad (1)$$

2. Contrast

$$F = \sum_{i,j=0}^{N-1} P_{i,j} (i-j)^2 \quad (2)$$

3. Entropy

$$F = \sum_{i,j=0}^{N-1} P_{i,j} (-\ln P_{i,j}) \quad (3)$$

4. Inverse Difference Moment

$$F = \sum_{i,j=0}^{N-1} \frac{P_{i,j}}{1+(i-j)^2} \quad (4)$$

5. Dissimilarity

$$F = \sum_{i,j=0}^{N-1} P_{i,j} |i-j| \quad (5)$$

III. Result and Analysis

MRI images are taken as input. Different MRI samples are collected and given as input for the query phase. Database is a clustered database consisting of 60 distinct MRI images categorized into 4 classes. Any automated, computerized assessment of disease requires establishment of healthy norms against which a test subject can be compared. A high-quality, carefully designed image database of healthy subjects could be of value to many groups for creation of healthy atlases, for assessment of disease, and for evaluation of the effects of both gender and healthy aging.

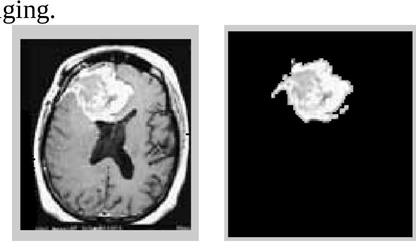

Fig.7. a) Input image b) extracted tumor region

All images were screened for the presence of disease. Images include T1, T2, MRI, and diffusion tensor. We aim to make this database work efficiently.

Figure 7b illustrates the recognition of the tumor from the given MRI image 7a by using simple image processing techniques. Table 1 illustrates the features extracted from

International Journal of Engineering Innovation & Research
Volume 1, Issue 5, ISSN : 2277 – 5668

affected MRI. The features are evaluated by using GLCM in four different angles (0º, 45º, 90º, 135º).

Table 1 Features Extracted

Angle	ASM	Contrast	Entropy	IDM	Dissimilarity
0	4578	2341894	-76.9528	3.0731	29370
45	4190	3236016	-53.3858	3.0464	34456
90	4804	1964810	-145.0278	13.089	25346
135	4156	2901768	-51.9995	3.0697	32744

IV. Conclusion

This paper presents an automated system for locating brain tumor in the MRI image using the simple image processing techniques. It is observed that the system result in better detection of location of tumor. The considerable accuracy level is found and it extracts the important features which can be used in the future to recognize the class of the tumor.

V. Future Work

The system proposed in this paper can be used in future to detect the class of a particular tumor. The system can be used in the detection of any kind of tumor in the body if we have MRI of that part. The combination of MRI, CT, and PET etc. can improve the performance of the system.

VI. 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] Carlos Arizmendi, Juan Hernández-Tamames, Enrique Romero, Alfredo Vellido, Francisco del Pozo, “Diagnosis of Brain Tumors from Magnetic Resonance Spectroscopy using Wavelets and Neural Networks”, Annual International Conference of the IEEE EMBS 2010, pp-6074-6077
[3] Ahmed Kharrat, Mohamed Ben Messaoud, “Detection of Brain Tumor in Medical Images”, International Conference on Signals, Circuits and Systems 2009, pp-1-6
[4] 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
[5] Jayabalan Jaya, Keppanagowder Thanushkodi, “Implementation of Classification System for Medical Images”, European Journal of Scientific Research ISSN 1450-216X Vol.53 No.4 (2011), pp.561-569
[6] 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
[7] Gonzalez, R.C. Richard, E.W, “Digital Image Processing,” (2004), II Indian Edition, Pearson Education, New Delhi, India.
[8] Sonka, M. Hlavac, V. Boyle, R. “Image processing, Analysis, and Machine Vision,” (2004). II Edition, Vikas Publishing House, New Delhi

Author’s Profile

Prof. Dilip Kumar Gandhi
He is assistant professor at Technocrats Institute of Technology, Bhopal. His qualification is M.Tech. in Telecom Technology. He is having 7 years of experience.

Kaustubh S. Sagale
He is a post graduate student at Technocrats Institute of Technology, Bhopal. He has completed B.Tech. in Electronics and Communication.

Prof. Vikas Gupta
He is associate professor and Head of Department of Electronics and Communication at Technocrats Institute of Technology, Bhopal. His qualification is M.Tech.