VARIOUS ALGORITHMS FOR STUDY OF BRAIN TUMOR ANALYSIS

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ABSTRACT: Biomedical image processing is an extending and demanding field. It embraces of many different types of method such as MRI, X-Ray, and CT-Scans. These techniques allow us to identify even small abnormalities in the human body. CT-Scans and MRI are widely use in diagnosis of brain tumor. Brain tumor is one the abnormal growth of cell inside brain cranium which limits the functioning of brain. In this paper we reviewed processes and techniques for diagnosis the tumors. It presents an automated method to detect and segment the brain tumor regions. Even we have developed various image processing algorithms for image segmentation.

Keywords: *Segmentation, Algorithm, Brain tumor, Image processing*

INTRODUCTION

Digital image processing is the technique for the analysis and manipulation of the image obtained from various diagnostic techniques that help to determine any abnormalities in the body tissues or bones. The most common diagnostic technique includes CT scan also known as computed tomography, it uses X-ray for viewing the cross sectional area of any body part through various view angles and allows the radiologist to view inside the body and detect any abnormality. It is a non-invasive technique to provide images of every part of the human body without superimposition of adjacent structures. The most common yet life threatening disease is brain tumor.

The body is made up of many types of cell. Most of the cells of the body grow and then divide to form new cells in order to carry proper functioning of the body. When the cells of the body lose the ability of controlled growth, they divide too often without any order of the growth. This abnormal and uncontrolled division of the cells forms a tumor. Hence, Brain tumor is the abnormal growth of cells in any part of the brain. It can be classified into two types: benign and malignant tumors. Benign tumors are slow growing cancerous tumors whereas malignant tumors are fast growing cancerous tumors. Primary brain tumor originates in the brain. In the secondary type of brain tumor, the tumor expansion in the brain is formed due to other body parts. The diagnosis of such life risking disease plays pivotal role and can be viewed with CT scan.

1. METHODOLOGY

Bio medical image processing techniques used to detect tumor that has mainly following steps:

- Image enhancement
- Image restoration
- Image analysis
- Image synthesis

Image Enhancement

Image enhancement is one of the most important classes of algorithms. Often, the captured image may be not being of good quality because of factors such as noise, poor brightness, contrast, blur or artifacts. Noise is any unwanted signal. Blur is disturbance that makes the image difficult to interpretation. Artifacts are features of the object that are not true. These are observational errors including dust and scratches on the image surface, which complicate the process of accurate image interpretation. Therefore, it may be necessary to reduce the noise and to sharpen the detail. These algorithms form the core image enhancement algorithm to increase the brightness of the image.

Image Restoration

Image restoration is the objective way of improving the quality of the image. The gold of image restoration is the same as that of image enhancement. However, image restoration is different from image enhancement, as image restoration deals with degradations conditions, and artifacts. Image restoration is more mathematical and formal. Hence, image restoration problems are stated mathematically. Image restoration includes techniques such as inverse filtering and blind de- convolution algorithms. Sometimes, complete knowledge of the source of degradation is available. However, if the causes of degradation are not known then the degradation is estimated approximately and a process known as blind de-convolution is used to restore the original image.

Image Compression

Multimedia objects occupy a lot of storage space. Often, these image needs to be transmitted across a channel to a remote imaging system in imaging applications such as telemedicine. Hence in such a case, the storage and transmission of the image becomes an important task. Image compression algorithms reduce the data that are needed to describe the object, by eliminating the redundancies that are present in the image.

There are two classes of image compression algorithms. One class is lossless compression algorithms and the other one is lossy compression algorithms. Lossless algorithms preserve the information that is very critical, and are useful in medical domains where even a subtle feature may contain valuable information. Lossy compressions algorithms used where loss of the image data cannot be perceived by the human observer or the loss of information are acceptable.

Image Analysis

Often, machine vision systems required image measurement. This includes measurement of shape, size, texture, and color of the objects that are present in the image. Hence, image analysis is a very important class of algorithms that takes images as input and produces numerical and graphical information based on the characteristics of the image data. Image analysis comprises, but is not limited to, classification of the objects, performing statistical tasks, and providing extraction and description of the scene for ultimate interpretation.

Histogram is a simple image analysis technique. It illustrates disturbance of grey levels of an image in the form of a table or graph. Based on the histogram, one can obtain information about quality of the image. The darkness of the image is manifested in the histogram, a cluster illustrates that the image needs to be improved. In addition, image analysis involves finding measurements of the objects such as mean and variance.

Image Synthesis

Image synthesis deals with the creation of images from other images or non-image data. Image synthesis is used to create images that are not available physically or cannot be acquired using any imaging procedure. The medical imaging domain uses image synthesis extensively. A CT is a reconstructed image. This simulated image is useful for presentation and experimental purpose as benchmark and test images.

2. IMAGE PROCESSING

The basic step of image processing is as shown in figure:

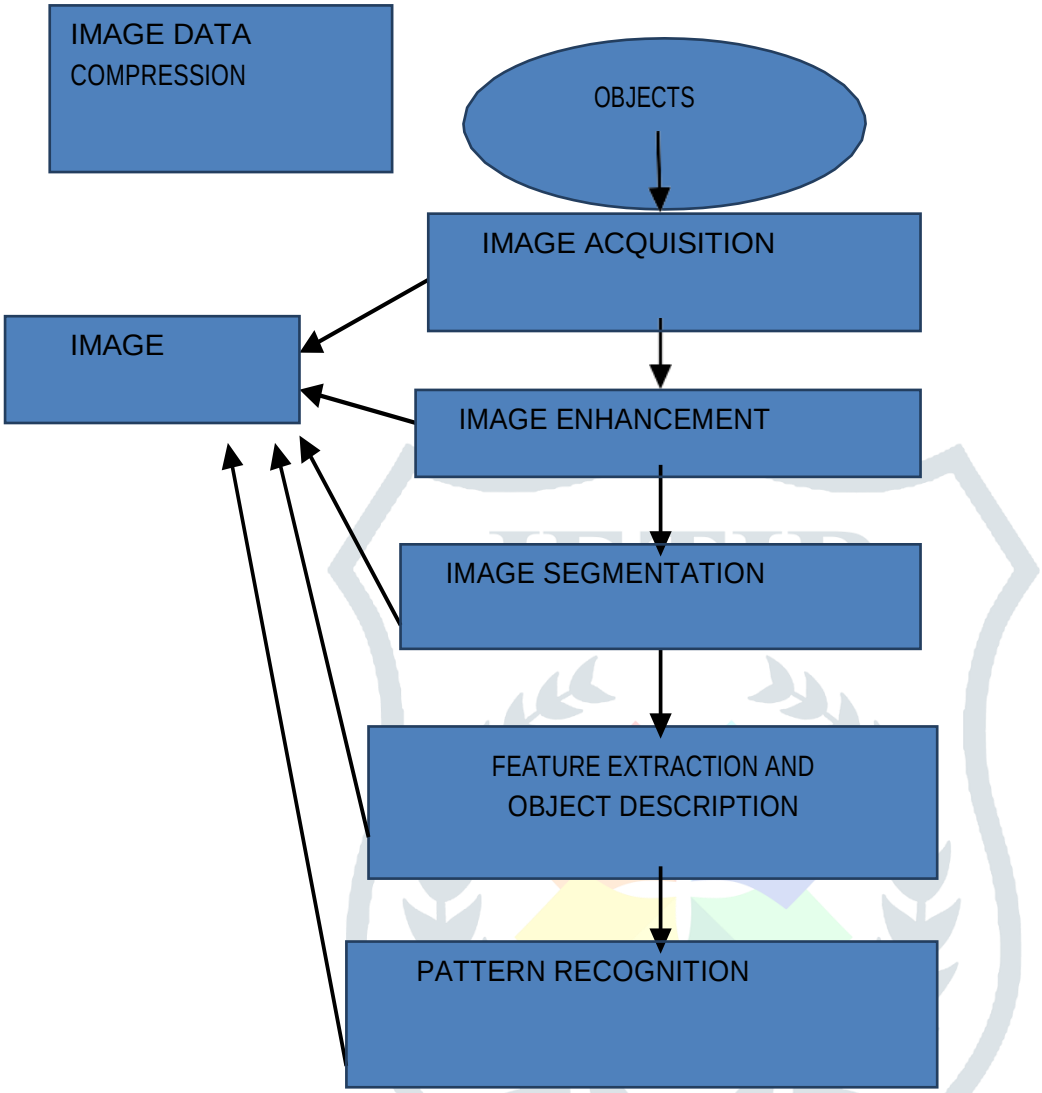

Fig: The Basic Steps of Image Processing

3. FEATURES

These days context of clustering and classification methods are used for detection of brain tumors. Brain cancer finding algorithms is not using machine algorithms for this purpose and only image based method is applied as it leads to reduction in terms of complexity and time in execution the feature need to be highly discriminating to detect the brain tumor.

FEATURES FOR BRAIN TUMOR DETECTION

sr. no	Features selected for brain tumor	Reason
1	Texture, grey values	It gives spatial arrangement of color or intensity of numeric metrics, since active tumors and non-tumor parts have different spatial arrangement all through it maybe fuzzy and overlapping in boundary.
2	Size/volume/ density	There are numerous studies to build the estimation model of growth and size of tumor which includes use of fuzzy set theory, bounding box, volume.
3	Color	This is an essential feature required for detection of tumors.
4	Wavelet packets	Many researchers bring their images into frequency domain from time domain, for this either they convert or convolve the image signal into wavelets.
5	Edge	This is also an essential feature required as the inherent nature of the brain tissue is such it not easy to find the sharp boundaries of the tumor.
6	Contrast	Contrast value plays critical role in getting the real discriminant for tumor.
7	Statistical	Many researchers have used the descriptive statistics to take the decision on tumor and non-tumor parts for highly complex statistical feature combination.

4.TECHNIQUES

In the last few decades there is a huge interplay of machine learning for solving problems and it is problematic by the fact that machine learning
combines methods n modeling's which are useful for
detection of brain tumor. The algorithms involve some combination of data pre-processing and optimization which helps to find correct value of factors that help to differentiate between the tissues. The most common reason why these days optimization algorithms are too bio inspired as
algorithm can scale up to large problem, secondly
they offer good performance in practice in terms of memory requirements and execution time.

DETECTION OF BRAIN TUMOR

Sr. no	Machine learning algorithms	Use in brain tumor detection
1	Artificial network	Analyzing the CTs to detect the tumors is a time consuming process. Having it automated has the advantage of the speeding it up and the faster.
2	Support vector machine	Non-linear, non separable data, non-parameterized classification methods which is extensively used in medical field.
3	Fuzzy/ K-means clustering	Analyzing material on tumor detection using clustering, it can be safely said that delicate figuring gives a foreseeable, more amazing and better results in the field of computerizing a methodology of recognition like tumor. However, the differentiation of different unsupervised calculation like fuzzy/ K-means and self organized peculiarities

CONCLUSION

From the review of the above papers and different features it can be concluded that many different techniques to detect and segment the brain tumor from CT images. To extract and segment the tumor we used different techniques such as fuzzy and K-mean clustering techniques. In conjugation with these different methodologies proposed by researchers are considered to conclude that machine learning also play important role in brain tumor detection and classification together with appropriate segmentation approach.

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REFERENCES

M. Yaqub, R. Napolitano, C. Ioannou, A.T Papageorghiou, J.A. Noble, "Automatic detection of local fetal brain structures in ultrasound images," In IEEE International Symposium, Biomedical Imaging, pp.1555-1558, 2-5 May 2012
[1] M. Yaqub, R. Napolitano, C. Ioannou, A.T Papageorghiou, J.A. Noble, "Automatic detection of local fetal brain

structures in ultrasound images," In IEEE International Symposium, Biomedical Imaging, pp.1555-1558, 2-5 May 2012

[2] D. Sridhar and I.V. Murali Krishna, "Brain Tumor Classification using Discrete Cosine Transform and Probabilistic Neural Network," In International Conference on Signal Processing Image Processing & Pattern Recognition, pp.92-96, 7-8 Feb. 2013

[3] S. Goswami and L.K.P Bhaiya, "A hybrid neuro- fuzzy approach for brain abnormality detection using GLCM based feature extraction," Emerging Trends in Communication Control Signal Processing and Computing Applications, 2013

[5]H.M Moftah, N.I Ghali, A.EllaHassanien, M. A. Ismail." Volume identification and estimation of MRI brain tumor," In International Conference on Hybrid Intelligent Systems, 2012

[6]R. Bhattacharjee, M. Chakraborty, " Braintumor detection from MR images : image processing, slicing and PCA based reconstruction," Third International Conference on Emerging Applications of Information Technology, pp.97-101, 2012

[7] S. Mohanapriya and M. Vadivel, "Automatic retrival of MRI brain image using multiqueries system," International Conference on Information Communication and Embedded Systems, pp.1099,1103, 21-22 Feb. 2013

[8]Lashkari, "Full automatic micro calcification detection in mammogram images using gartificial neural network and Gabor wavelets," Machine Vision and Image Processing pp.1,7, 27-28 Oct. 2010

[9] P. Juneja, P. M. Evans and E. J. Harris, "The validation index : a new metric for validation of segmentation algorithms using two or more expert outlines with application to radiotherapy planning," In IEEE Transactions on Medical Imaging, vol.32, no.8, pp.1481,1489, 2013

[10] A. Rueda, O. Acosta, P. Bourgeat, J. Fripp, E. Bonner, N. Dowson, M. Couprie, E. Romero, O. Salvado, "Partial volume estimation of brain cortex from MRI using topology-corrected segmentation," Biomedical Imaging: pp.133-136, 2009

[11] A. P. Nanthagopal, R. Sukanesh, "Wavelet statistical texture features-based segmentation and classification of brain computed tomography images," Image Processing, IET , vol.7, no.1, pp.25- 32, February 2013

[12] Vijay, J. Subhashini, "An efficient brain tumor detection methodology using K-means clustering algoriftnn," In International Conference On communication and signal processing, pp.653-657, 2013

[13] J. Selvakumar, A. Lakshmi, T. Arivoli, "Brain tumor segmentation and its area calculation in Brain MR images using K-means clustering and Fuzzy C- means algorithm" International conference on advances in Engineering science and Management, pp. 186-190, 2012

[14] A. Islam, S. M. S. Reza, K. M. Iftekharuddin, "Multifractal Texture Estimation for Detection and Segmentation of Brain Tumors," IEEE Transactions on Biomedical Engineering,, vol.60, no.11, pp.3204,3215, Nov. 2013

[15] Maiti and M. Chakraborty, "A new method for brain tumor segmentation based on watershed and edge detection algorithms in HSV colour model," In National Conference, Computing and Communication Systems, 2012.