



BRAIN TUMOR DETECTION AND EXTRACTION

Nilesh.L.Shimpi¹, G Ahmed Zeeshan², Dr. R Sundaraguru³.

Student ECE Department, Global Institute of Engineering and Technology

Assistant Prof. ECE Department, Global Institute of Engineering and Technology, Moinabad

Professor and HOD ECE Department, MVMIT, Bangalore

Abstract — Brain magnetic resonance image (MRI) segmentation is a complex problem in the field of medical imaging despite various presented method. MR image of human brain can be divided into several sub-regions especially soft tissues such as grey matter, white matter and cerebrospinal fluid the combinatorial algorithm provide a solution to overcome the associated challenges of segmented brain MRI. Asymmetry analysis of brain has great importance because it is not only indicator for brain cancer but also predict future potential risk for the same. In our work, we have concentrated to segment the anatomical region of brain, divide the two halves of brain and to detect each half for the presence of tumour. Bilateral and mathematical analysis using laplacian, gradient operator operate on real pictures, and the results show that the algorithm is flexible and convenient.

Keywords- MRI brain, asymmetry analysis, Bilateral Symmetry anatomical, Laplacian, Gradient.

I. INTRODUCTION

Image segmentation is used to separate an image into several “meaningful” parts. It is an old research topic, which started around 1970, but there is still no robust solution toward it. There are two main reasons; the first is that the content variety of images is too large, and the second one is that there is no benchmark standard to judge the performance. Image segmentation is identification of homogeneous regions in the image. Many algorithms have been elaborated for gray scale images. However, the problem of segmentation for colour images, which convey much more information about objects in scenes, has received much less attention of scientific community. While several surveys of monochrome image segmentation techniques were published, similar surveys for colour images did not emerge.

Image segmentation is one of the primary steps in image processing for object identification. Segmentation can sub-divide the image into constituents parts of non-overlapping region. As an initial step segmentation can be used for visualization and compression through identifying all pixels (for two dimensional images) or voxels (for three dimensional image) belonging to an object, segmentation of that particular object is achieved. In medical imaging, segmentation is vital for feature extraction, image measurement and image display. [3] [5]

1.1. Problem definition

There are number of techniques to segment an image into region that are homogeneous or discontinuity. Not all the techniques are suitable for medical image analysis because of complexity and inaccuracy. There is no standard image segmentation technique that can produce satisfactory for all imaging application like brain, MRI, brain cancer diagnosis etc. Optimal selection of features, tissues, brain and non-brain element are considered as main obstacle for brain image segmentation. Accurate segmentation over full field of view is another hindrance. Operator supervisor and manual thresholding are other barriers to segment brain image. During the image segmentation procedure verification of result is another source of difficulty.

1.2. Objective

Objective of utilizing more meaningful information to improve brain tumour segmentation and extraction

- An approach which employs bilateral symmetry information as an additional feature for segmentation
- Mathematical analysis increase the performance to improvement the general automatic brain tumour segmentation and extraction systems

If the input brain image is colorized, it is converted into gray image. First read the red, blue and green value of each pixel and then after formulation, three different values are converted into gray value. The automated edge detection technique is proposed to detect the edges of the regions of interest on the digital images automatically. The method is employed to segment an image into two symmetric regions based on finding pixels that are of similar in nature. The more symmetrical the two regions have, the more the edges are weakened. At the same time, the edges not symmetrical are enhanced. In the end, according to the enhancing effect, the unsymmetrical regions can be detected, which is caused by brain tumour.

II. LITERATURE SURVEY

2.1. Magnetic Resonance Imaging (MRI)

Magnetic resonance imaging (MRI) is an imaging technique based on the physical phenomenon of Nuclear Magnetic Resonance (NMR). It is used in medical settings to produce images of the inside of the human body. MRI can produce an image of the NMR signal in a thin slice through the human body. By scanning a set of such slices a volume of a part of the human body can be represented with MRI.

2.2. Image Segmentation Methods

We review primarily those studies that are based on finding object regions in grey-level images. We also mention couple of studies that deal with color segmentation to highlight how this has been used for outdoor scene analysis. Image segmentation has been approached from a wide variety of perspectives. Our summary is presented for histogram thresholding, edge based segmentation, tree/graph based approaches, region growing, clustering, and probabilistic or Bayesian approaches, neural networks for segmentation.

2.3. Proposed system

It is based on the image segmentation method, which refers to the major step in image processing, the inputs are images and, outputs are the attributes extracted from those images. It will help to find out symmetric extraction of the brain image.

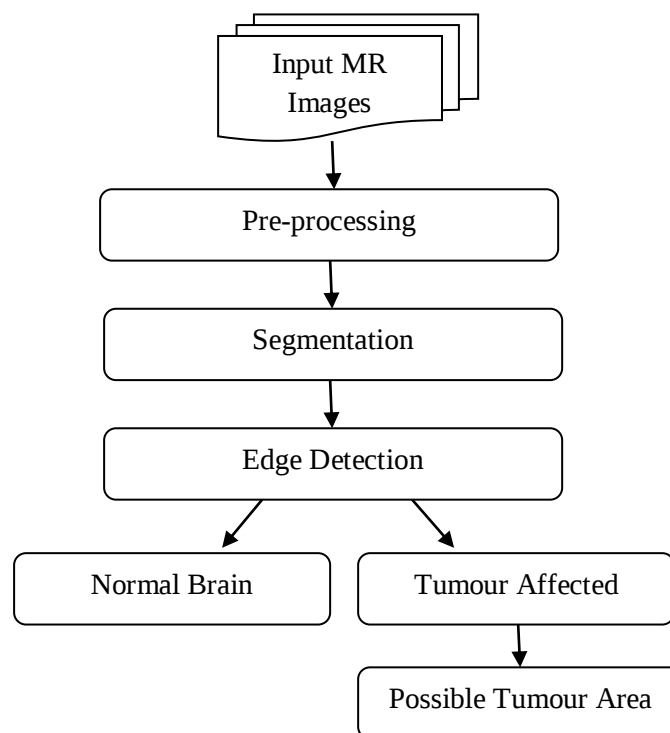


Figure 2.1: Proposed Model

2.3. Data Pre-processing.

The MRI images are subject to various types of noises such as irregularities etc. These noises may degrade the quality of the MR image and consequently it cannot provide correct information for subsequent image segmentation and edge detection. In order to improve the quality of the MR image, operations need to be performed to remove or decrease degradations suffered in its acquisition. Pre-processing is also needed in order to homogenize and separate the intensity distributions of the malignant and benign tissues. This can be achieved by using several demonising techniques, viz., Gaussian filter, median filter.

2.3.2 Bilateral Symmetry Axis

Bilateral symmetry axis defining is a straightforward evaluation method that is commonly used for comparing the corresponding MRI brain images to determine the ROI in the image. Structural and functional asymmetry in the human brain and nervous system is reviewed in a historical perspective. Brain asymmetry is one of such examples, which is a difference in size or shape, or both. Asymmetry analysis of brain has great importance because it is not only indicator for brain cancer but also predict future potential risk for the same. In our work, we have concentrated to segment the anatomical regions of brain, isolate the border line of each to investigate the presence of asymmetry of anatomical regions in MRI. The term asymmetry is often substituted for the term laterality when it comes to left–right differences in psychology and the neurosciences. However, while the term asymmetry can mean both structural and functional left–right dissimilarities, laterality is typically only used in relation to functional asymmetry.[3]

III. METHODOLOGY USED

3.1. Algorithm

Step 1:- canny edge detection method can be use to find the edges in the input brain image.

It consist of five steps

- Smoothing :- Blurring of the image to remove noise present in image
- Finding the gradient: - The edges should be marked where gradients of the image has large magnitude.
- Non-maximum suppression:-Only local maxima should be marked as edge.
- Double thresholding :-Potential edges determined by thresholding
- Edge tracking:- Final edges are determined by suppressing all edges that are not connected to a very certain (strong) edge

Step 2:- Find the curve using LMS and crammer rule.

Step 3:- Curve shows the tumour affected area.

Step 4:- Calculate the tumour affected area.

Step 5:- Extract the affected area from brain image.

IV. PERFORMANCE ANALYSIS

We have applied a proposed method for a segmentation of brain images .In this section we present the experimental result indicating the difference stages of the method.

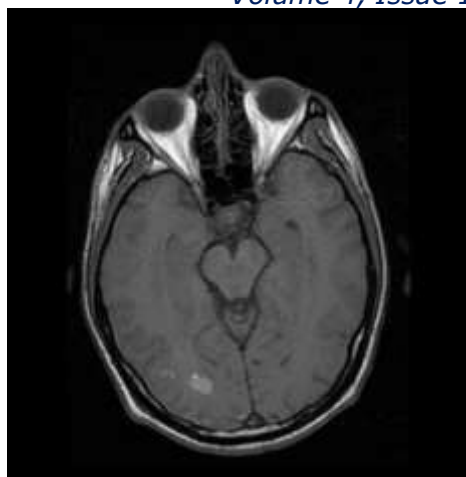
4.1. Experimental Analysis

Several simulated experiments are carried out to demonstrate the validity and feasibility of the segmentation method for segmenting regions from brain images. Measures reflect the effectiveness of a image segmentation method. The system has been implemented using MATLAB because of powerful inbuilt mathematical and image processing functions

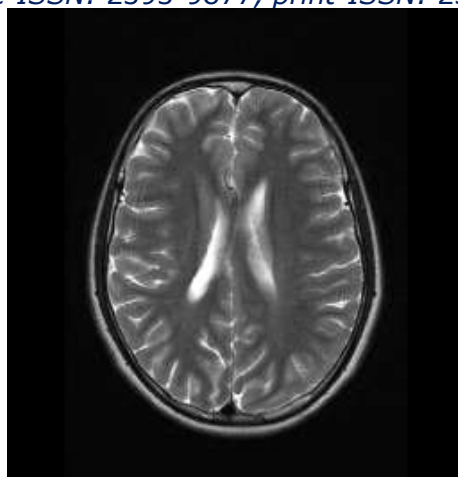
In the first step, the colour image is transformed from RGB to gray scale. Although, traditionally, RGB is the most commonly used model for MRI images. All of our data are acquired on Phillips/Siemens/Wipro 1.5T scanners for brain image segmentation. Table 4.1 show detail description about the patient with their disease and grade which contains original MRI images with tumour used for this study. The input images are of patient ID's 397384 (High Grade) 19430618 (Low Grade) as shown in Figure. 6.1

Table 4.1: Database for segmentation

Patient ID	Age	Gender	Disease	Grade
11	40	Male	Anaplastic Oligodendroglioma	High
22	70	Male	Metastatic Deposits	High
33	58	Male	Metastatic Pathology	High
44	35	Female	Mixed Glioma	Low
55	55	Female	Cystic Glioma	Low



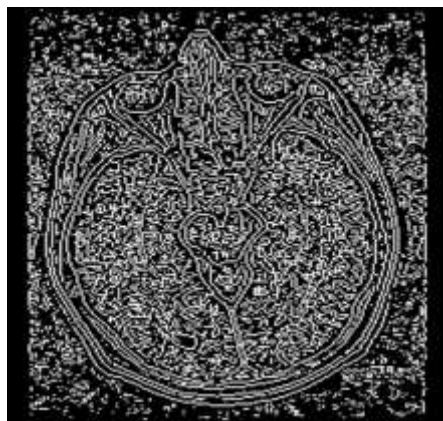
(a) High Grade



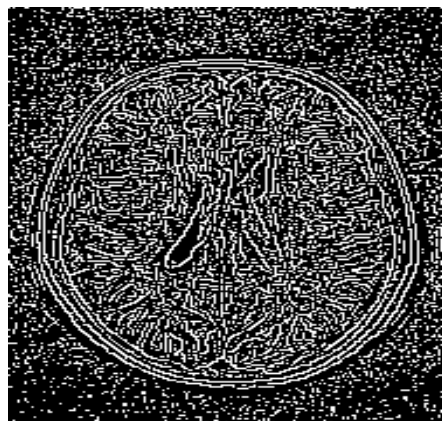
(b) Low Grade

Figure 4.1: Input image from database

Next we use edge detection algorithm for segmentation of a given input image. Following figure shows a different edge detected segmented image.

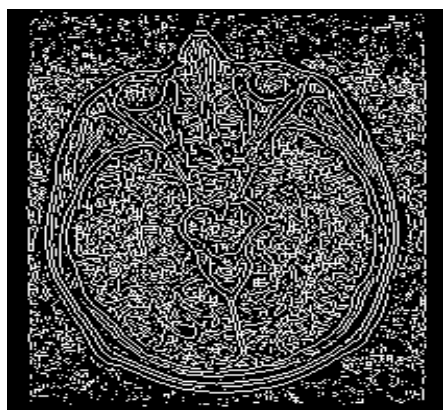


(a) High Grade

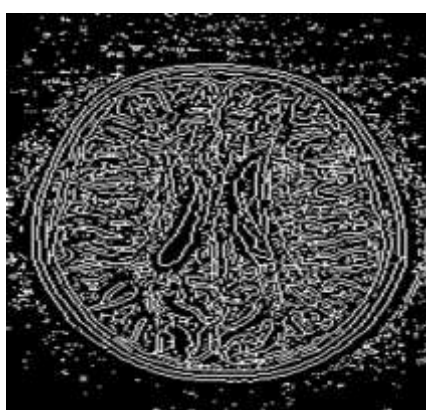


(b) Low Grade

Figure 4.2: Edge detected by Robert filter

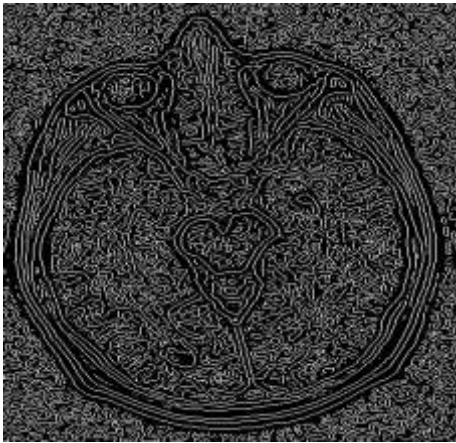


(a) High Grade



(b) Low Grade

Figure 4.3: Edge detected by Prewitt filter



(a) High Grade



(b) Low Grade

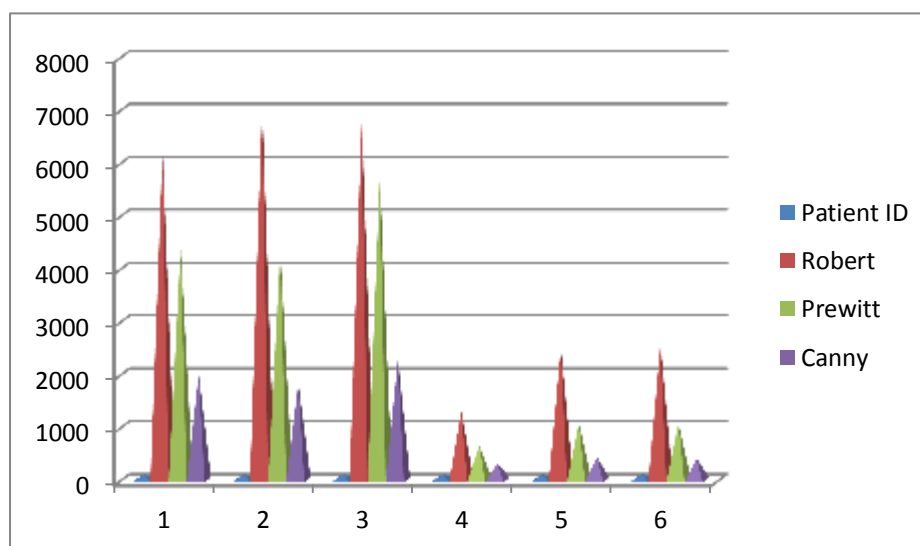
Figure 4.4: Edge detected by Canny filter

The above figure demonstrates the results of each edge detection algorithm for given input image. The Roberts and Prewitt method finds edges using the Roberts and Prewitt approximation to the derivative respectively.

Table 4.2: Number of detected edges

Patient ID	Grade	Number of Detected Edges		
		Robert	Prewitt	Canny
101	High	6259	4382	1997
102	High	7120	4323	1836
103	High	6807	5757	2302
104	Low	1291	649	317
105	Low	2509	1080	433
106	Low	2567	1072	417

Evaluation of the images showed that under noisy conditions Canny, Prewitt, Robert, exhibit better performance, respectively. Canny yielded the best results as shown in Figure 4.4. This was expected as Canny edge detection accounts for regions in an image. Canny yields thin lines for its edges by using non-maximal suppression. Canny also utilizes hysteresis with thresholding.



Graph 4.1: Number of Detected Edges

During the image processing, edge information is the main clue in image segmentation. But, unfortunately, it can't get a better result in analysis of the content of images without combining other information. So, we combine edge information with bilateral symmetry axis to improve the effect of segmentation.

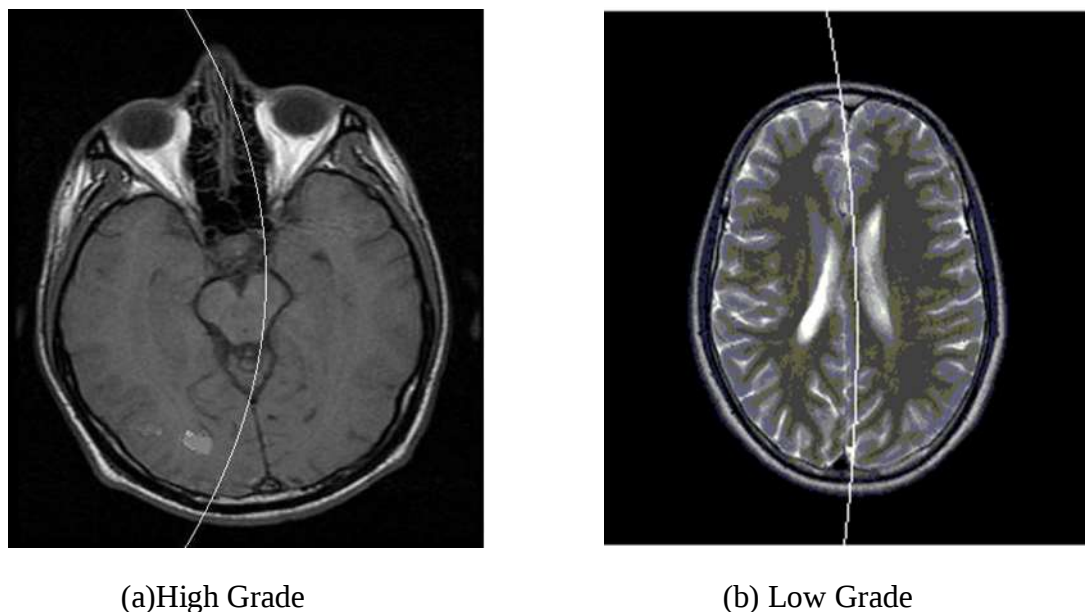


Figure 4.5: Bilateral Axis

Now to detect the position and boundary of tumours automatically of given input. The more symmetrical the two regions have, the more the edges are weakened. At the same time, the edges not symmetrical are enhanced. In the end, according to the enhancing effect, the unsymmetrical regions can be detected, which is caused by brain tumor. The possible tumor area is of given input as shown in Figure. 4.6

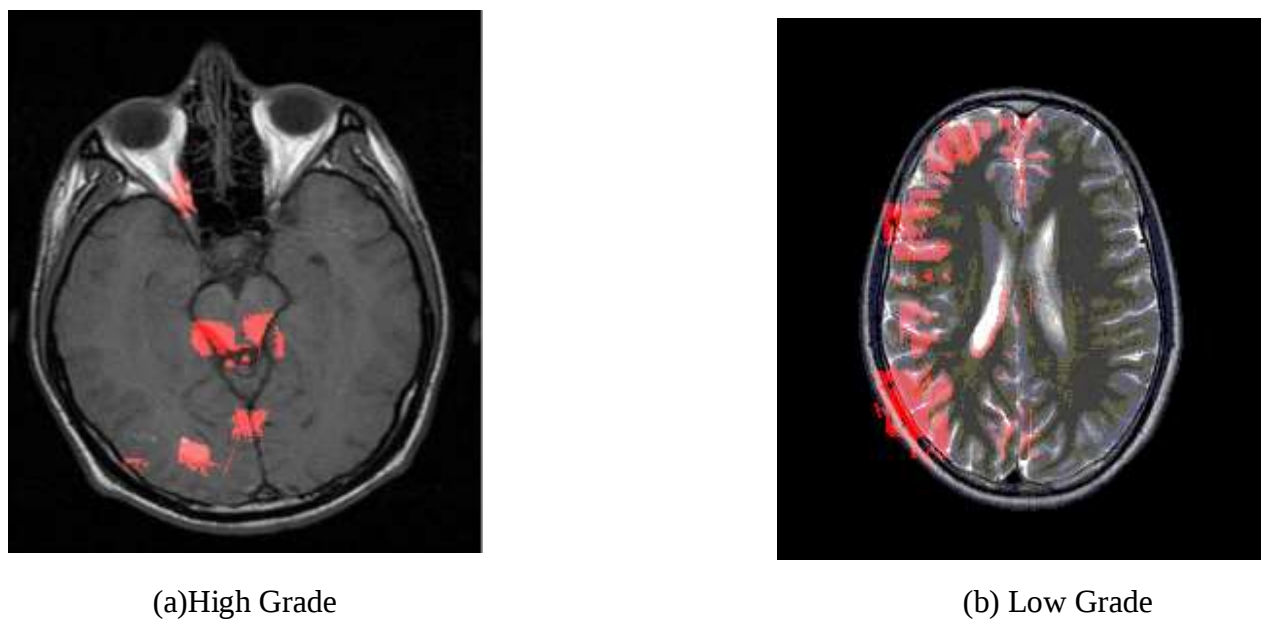


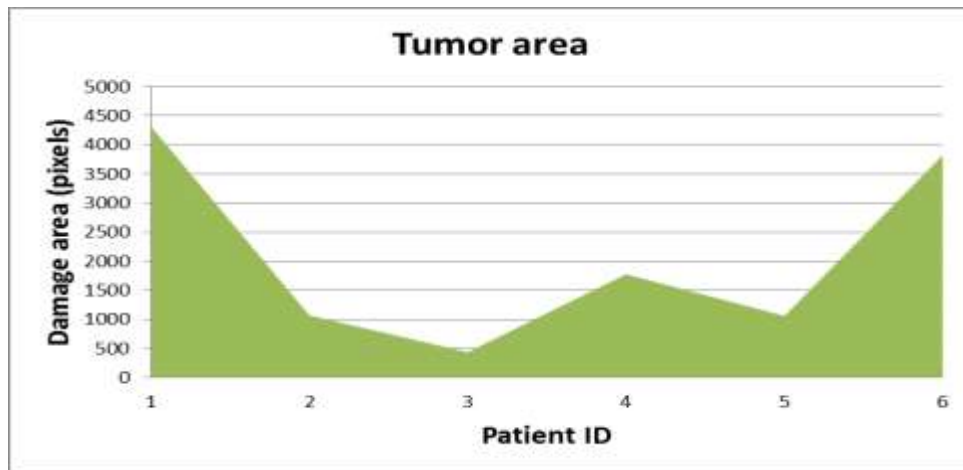
Figure 4.6: Possible tumour area

In this study, we also apply the automatic brain tumour detection method to segment five 256x256 MRI brain images. In the brain tumour, a lesion, most the bigger area of a tumour is identified in left frontal/ high parietal and left temporal lobe for Table 4.3

Table 4.3: Tumour Area

Patient ID	Volume of tumor areas (Pixels)	% of Damage area
11	4315	17.26
21	1068	4.27
31	225	1.74
41	100	7.10
51	1060	4.24

We are representing the above calculated tumour area with the help of following graph.



Graph 4.2: Histogram of possible tumour area

VI. CONCLUSION

In this project, we have presented an algorithm to detect special region from brain MRI. Brain MR Image is a complex system to be segmented with efficient method for having variable kind of tissues. It determines whether an input MRI brain image represents a healthy brain or tumour brain. At first, MRI of health brain has an obviously character almost symmetrical. However, if there is macroscopic tumour, the symmetry characteristic will be weakened. we develop a segment algorithm to detect and extract the tumour region automatically

REFERENCES

- [1] Kung-hao Liang and Tardi Tjahjadi, "Adaptive Scale Fixing for Multi-scale Texture Segmentation", IEEE Transactions on Image processing, Vol. 15, No.1, January, pp.249-256, 2006.
- [2] Mathews Jacob and Michael Unser, et al, "Design of Steerable Filters for Feature Detection Using Canny-Like Criteria ", IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 26, NO.8, August, pp.1007-1019, 2004.
- [3] Wiley Wang, et al., "Hierarchical Stochastic Image Grammars for Classification and Segmentation", IEEE Transactions on Image processing, Vol. 15, No.7, July, pp.3033-3052, 2006.
- [4] T.J.Davis and D.Gao, "Phase-contrast imaging of weakly absorbing materials using hard x-rays," Nature, Vol.373,pp.595-597, 1995.
- [5] Jiao Feng and Fu Desheng, "Fast Gray-Contrast Enhancement of X-ray Imaging for Observing Tiny Characters", Proceedings of ICBBE 2007, Vol.2, pp.694-697.
- [6] Hongxia Yin, et al, "Diffraction Enhanced X-ray Imaging for Observing Guinea Pig Cochlea", Proceedings of the 2005 IEEE Engineering in Medicine and Biology 27th Annual Conference,pp.5699-5701, 2005.
- [7] Kamber, M., Shingal, R., Collins, D., Francis, D., et al., "Model-based, 3-D segmentation of multiple sclerosis lesions in magnetic resonance brain images", IEEE-TMI, pp.442-453, 1995.
- [8] Kjaer, L., Ring, P., Thomson, C., Henriksen, O., "Texture analysis in quantitative MR imaging: Tissue characterization of normal brain and intracranial tumors at 1.5 T", Acta Radiologic,1995.