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Analysis of brain tumor detection using intelligent techniques

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ABSTRACT

Brain tumour is one of the most important diseases and hence its detection should be fast and more accurate. This can be achieved by using execution of automated tumour detection techniques on medical images. Presently using medical imaging techniques are Magnetic Resonance Imaging (MRI), Computerised tomography (CT) and Micro wave, which cannot detect below 3mm size and it can be detected using Infrared imaging techniques. In this paper we using Near Infrared Imaging Technology to detect the brain tumor of the size below 3mm which could not be detected using CT and MRI images. MRI depends on magnetic activity in the brain and does not use X-rays, so it is considered safer than imaging techniques that do use X-rays. It is a non-invasive method for detecting tumors. Brain tumors have different characteristics such as size, shape, location and image intensities and it may deform neighboring structures and if there is edema with the tumor, intensity properties of the nearby region change. In adults, the most common and cancer-causing tumor type is glial tumors that have a high mortality rate. Over 90% of all tumors in persons over 20 years are glial tumors.

Keywords: Near infrared imaging technology, Brain tumour detection, Non-invasive method, Least Support Vector Machine

1. INTRODUCTION

In near infrared imaging technology (NII) artificial phantom is connected with NII. An infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion. NII sensor output is given to the pre-processor. Preprocessor is a program that processes its input data to produce output that is used as input to another program. The pre-processed output is given to short time Fourier transforms (STFT) to avoid noise in the system. LSVM is a fast technique for training support vector machines (SVMs), based on a simple iterative approach. Finally brain tumor is detected which size is less than 3mm. In Fuzzy clustering and Fuzzy LMS algorithm is used to detect brain tumor area by using classification, segmentation and iteration the input image. Fuzzy c-means (FCM) is methods of clustering which allows one piece of data to belong to two or more clusters. Finally we compare three techniques and decide which technique give accurate and exact result with low time consumption. Fuzzy clustering algorithm is used to classify the input image to detect the tumor affected area accurately. Clustering can therefore be formulated as a multi-objective optimization problem. Clustering can be considered the most important *unsupervised learning* problem; so, as every other problem of this kind, it deals with finding a *structure* in a collection of unlabeled data.

2. LITERATURE REVIEW

A 3-D slot-rotated antenna for a microwave head-imaging system is presented. The antenna is designed to have a wideband and unidirectional performance at the low microwave frequency band that are the requirements of the specified imaging system [1].Brain tumour segmentation works with publicly availablelow-grade glioma BRATS2012 dataset show that our segmentation results are more consistent

and on the average outperforms these methods for the patients where ground truth is made available [2].Two of the limitations on the utility of SPECT and planar Scintigraphies for the non-invasive detection of carcinoma are the small sizes of many tumours and the possible low contrast between tumour uptake and background. This is particularly true for breast imaging. Use of some form of image processing can improve the visibility of tumours which are at the limit of hardware resolution [3].Spectral band selection method for feature dimensionality reduction in hyper spectral image analysis for detecting skin tumours on poultry carcasses. Band selection method of hyper spectral images based on the recursive divergence for the automatic detection of poultry carcasses [4].Automated whole breast ultrasound (ABUS) is an emerging screening tool for detecting breast abnormalities. In this study, a Computer-Aided Detection (CAD) system based on multi-scale blob detection was developed for analyzing ABUS images. The performance of the proposed CAD system was tested using a database composed of 136 breast lesions (58 benign lesions and 78 malignant lesions) and 37 normal cases [5].In thisstudy, immune algorithm (IA) was introduced in searchingfor the optimal feature weights and the parameters simultaneously. One-class immune feature weighted SVM (IFWSVM) was proposed to detect tumours in MR images. Theoretical analysis and experimental resultsshowed that one-class IFWSVM has better performance than conventional one-class SVM [6] .This paper presents a study of performance for a 3-D breast tumour detection system. The system is based on processing the scattered signals when a narrow pulse is transmitted from a set of antennas placed surrounding the breast. The 3-D system performance is evaluated by placing the tumour at any breast position, even at locations near the breast muscle where detection is more difficult [7].Current imaging modalities fail to detect small tumours in the breast. Opt acoustic tomography is a novel technique for early cancer detection with promising diagnostic capability [8].Microwave breast properties between healthy and malignant tissues. Tissue sensing adaptive radar (TSAR) has been proposed as a method of microwave breast imaging for early tumour detection. TSAR senses all tissues in the volume of interest and adapts accordingly. Simulation results have shown the feasibility of this system for detecting tumours of 4 mm in diameter. In this paper, the second generation experimental system for TSAR is presented [9].

3. SYSTEM MODEL

Tumor segmentation from MRI data is an important but time consuming manual task performed by medical experts. Automating this process is challenging due to high diversity in appearance of tumor tissue among different patients and, in many cases, with normal tissue. One other challenge is how to make use of prior information about the appearance of normal brain. The intent of the classification process is to categorize all pixels in a digital image into one of several land cover classes, or “themes”. This categorized data may then be used to produce thematic maps of the land cover present in an image. Normally, multispectral data are used to perform the classification and, indeed, the spectral pattern present within the data for each pixel is used as the numerical basis for categorization. Image segmentation is very important for medical image to detect diseases in particular region. In Fuzzy LMS algorithm helps to detect brain tumor region very accurately when compare to fuzzy–c means algorithm because LMS algorithm done segmentation in image.

3.1. Brain Tumor

The exact cause of brain tumors is not clear. The symptoms of brain tumors depend on their size, type, and location.

Brain tumor symptoms: Symptoms (signs) of benign brain tumors often are not specific. The following is a list of symptoms that, alone or combined, can be caused by benign brain tumors; unfortunately, these symptoms can occur in many other diseases:

- Vision problems
- Hearing problems

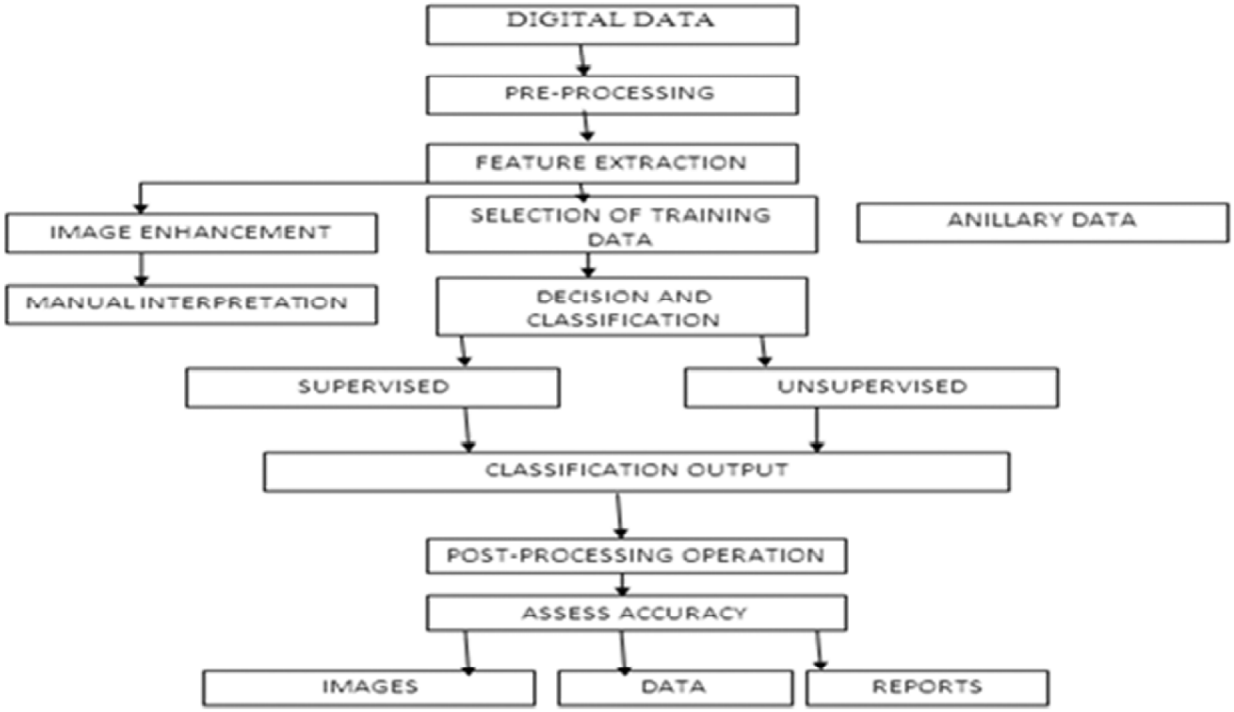

Figure 1: System workflow design

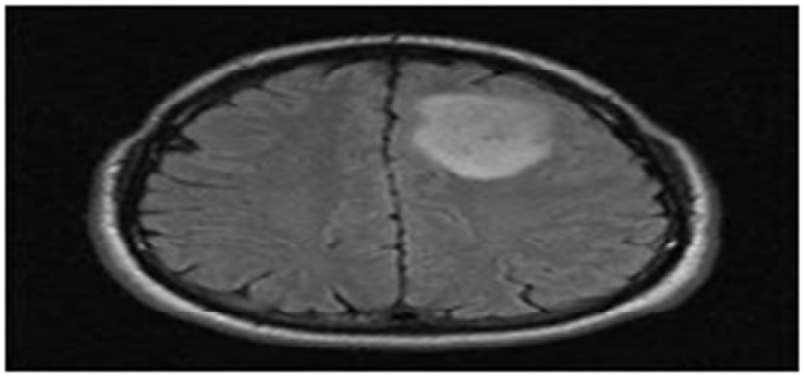

Figure 2: Brain Tumour

- Balance problems
- Changes in mental ability (for example, concentration, memory, speech)
- Seizures, muscle jerking
- Change in sense of smell
- Nausea/vomiting
- Facial paralysis
- Headaches

Options for brain tumor treatment include surgery, radiation therapy, and chemotherapy.

4. EXISTING METHOD

In existing method CT scan, MRI and microwave imaging technology are used to detect brain tumor but it will not help to detect less than 3mm size of tumor cell.Magnetic Resonance Imaging (MRI) depends on

magnetic activity in the brain and does not use X-rays because X-ray will send high radiation in to the brain and it will damage the tumour cell and it will spread to other parts in the brain so it is considered safer than imaging techniques. SPECT uses gamma rays, which are characteristically safer than other imaging systems using alpha or beta rays. Both PET and SPECT scans require the injection of radioactive materials.

5. PROPOSED METHOD

Near infrared imaging technology is used to detect less than 3mm size of brain tumor. Here instead of using radar technologies, a new infrared imaging is proposed for the tumor detection in brain. This IR imaging uses the 780nm frequency IR LED for imaging. The 780nm LED transmitter and photo detector led (Receiver) is used for the imaging. After detection tumor, to segment tumor part using region growing algorithm. LSVM is a fast technique for training support vector machines (SVMs), based on a simple approach of iterative. The short-time Fourier transform (STFT) or short-term Fourier transform, is a Fourier-related transform used to obtain the sinusoidal frequency and phase content of local sections of a signal as it changes over time. LSVM is used to increase the tumor size and also increase the clarity of the data which are taken from the patients Pre-processing is used to enhance the visual appearance of images. Improve the manipulation of datasets, Image resampling, Image resampling Rescale contrast enhancement, Noise removal, Mathematical operations, Manual correction. *Short-time Fourier transform* (*STFT*), is a signal processing method used for analyzing non-stationary signals. Clustering techniques are mostly unsupervised methods that can be used to organize data into groups based on similarities among the individual data items. Most clustering algorithms do not rely on assumptions common to conventional statistical methods, such as the underlying statistical distribution of data, and therefore they are useful in situations where little prior knowledge exists. The potential of clustering algorithms to reveal the underlying structures in data can be exploited in a wide variety of applications, including classification, image processing, pattern recognition, modeling and identification. Least mean squares (LMS) algorithms are a class of adaptive filter used to mimic a desired filter by finding the filter coefficients that relate to producing the least mean squares of the error signal (difference between the desired and the actual signal). It is a stochastic gradient descent method in that the filter is only adapted based on the error at the current time.

5.1. Block Diagram

5.2. Experimental Results Based On Lsvm

By using artificial phantom to detect tumor cell in the brain. If cancer cell is detected means signal will oscillate and waveform looks like sine wave fig. 4. If cancer cell is not detected means signal will not

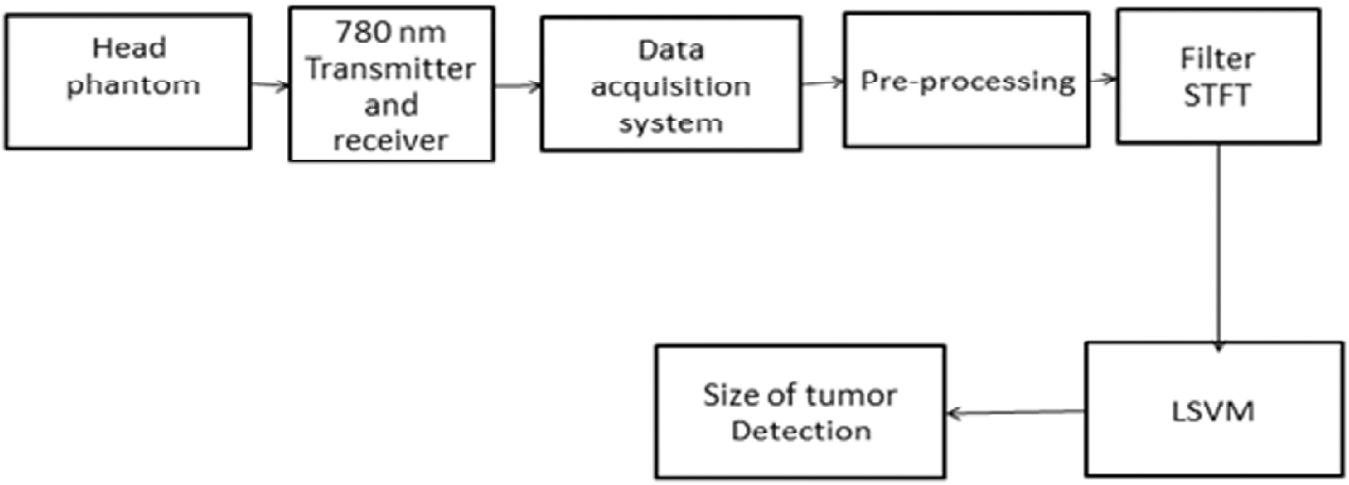

Figure 3: Block Diagram

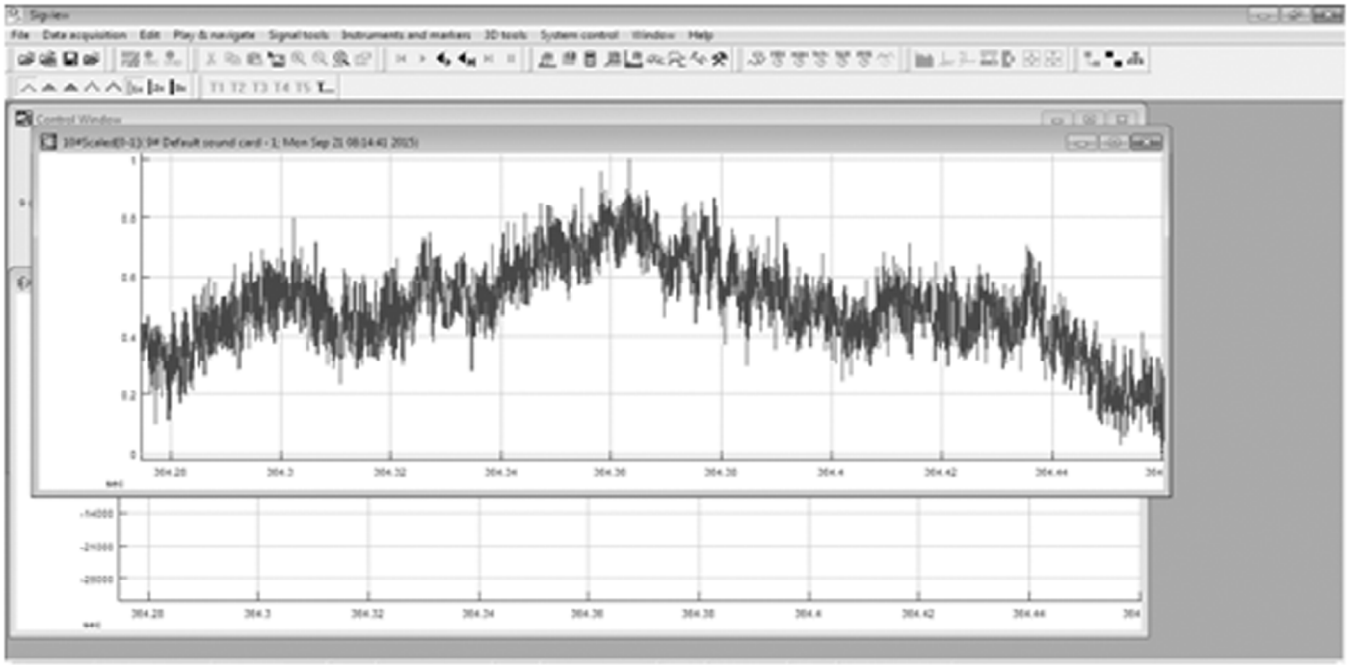

Figure 4: Waveform with Brain Tumor

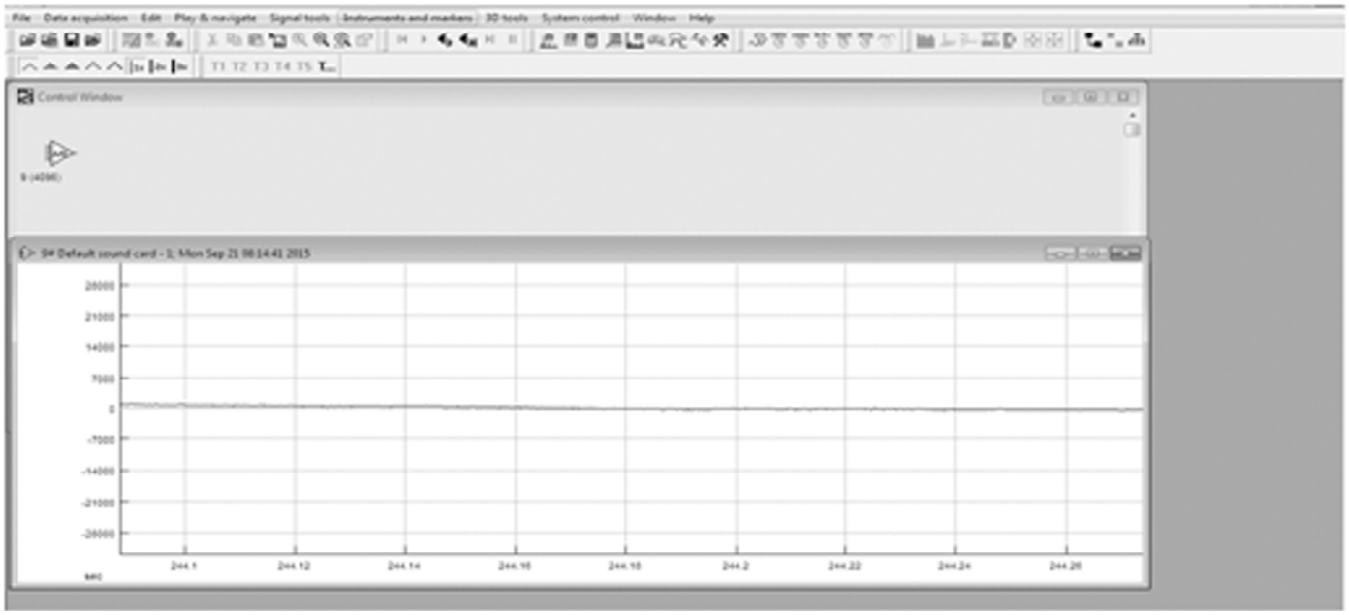

Figure 5: Waveform without Brain Tumor

oscillate and waveform looks like straight line Fig. 5. SIGVIEW is a real-time and offline signal analysis software package with wide range of powerful signal analysis tools, statistics functions and a comprehensive visualization system. The amplitude of a periodic variable is a measure of its change over a single period (such as time or spatial period. There are various definitions of amplitude (see below), which are all functions of the magnitude of the difference between the variable's extreme values Fig. 6 & 7. In older texts the phase is sometimes called the amplitude.

5.2. Simulation Result Based On Lsvm

A mathematical representation of the degree of similarity between a given time series and a lagged version of itself over successive time intervals in fig. 8. It is the same as calculating the correlation between two

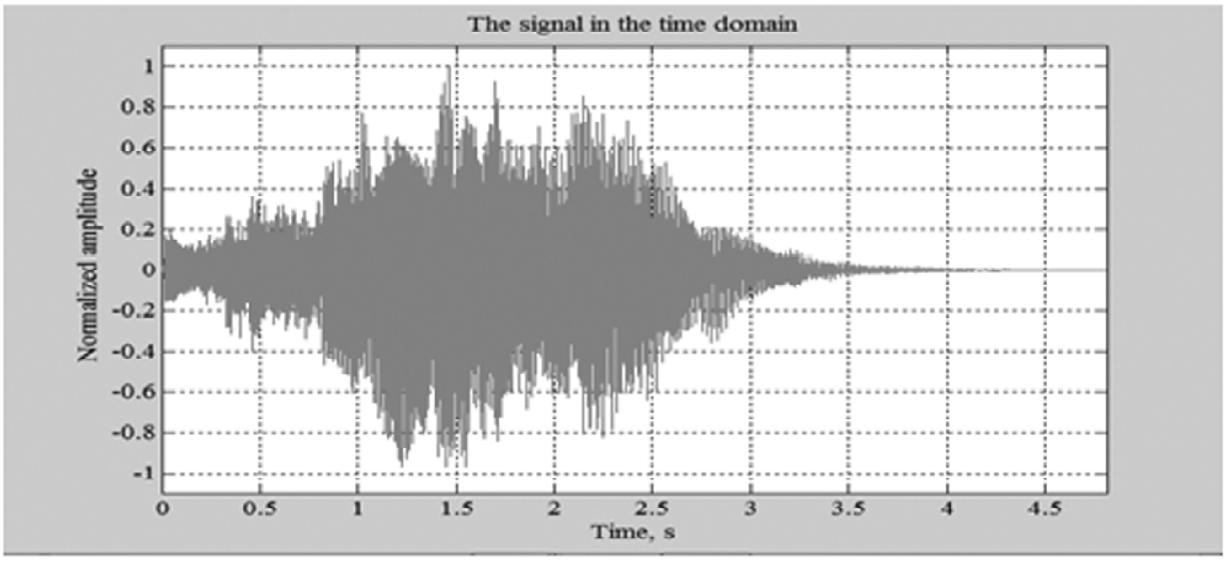

Figure 6: Time vs. Amplitude Graph

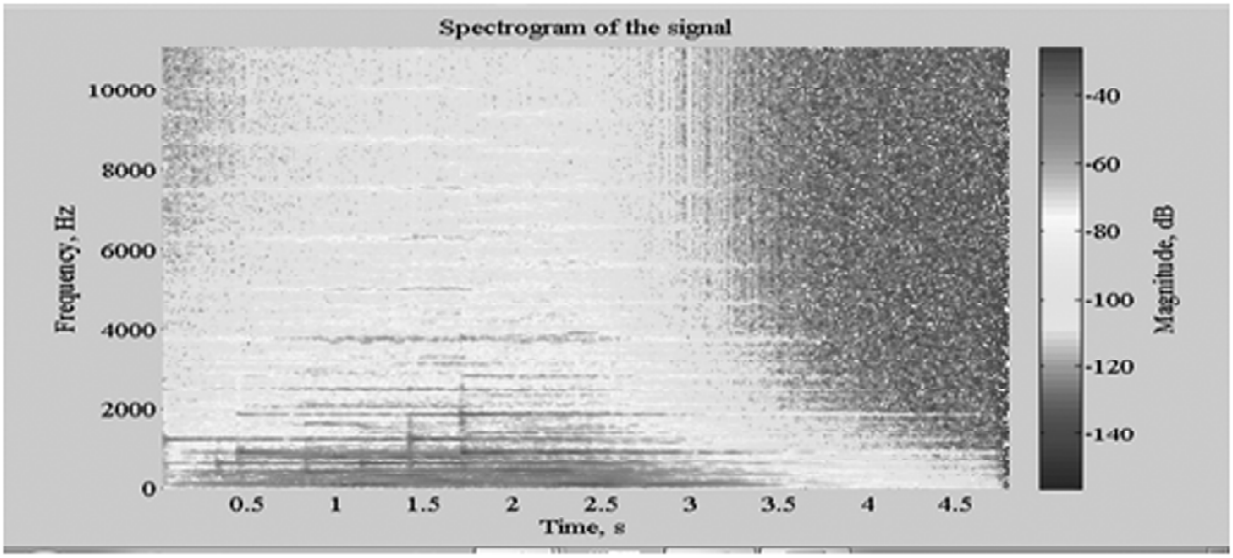

Figure 7: Spectrum of Signal

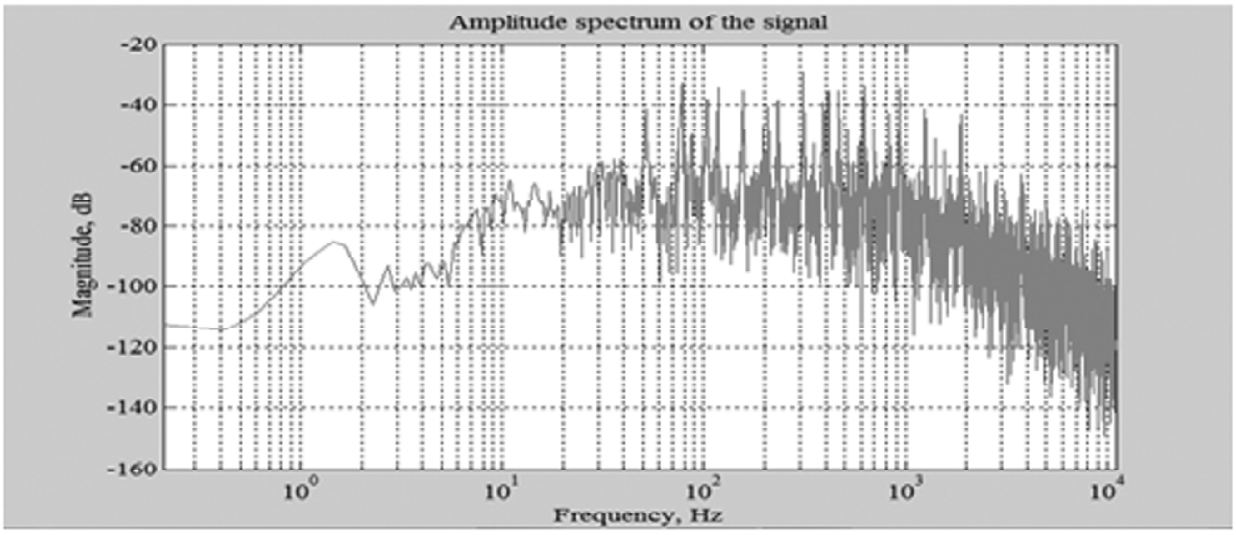

Figure 8: Amplitude of the signal

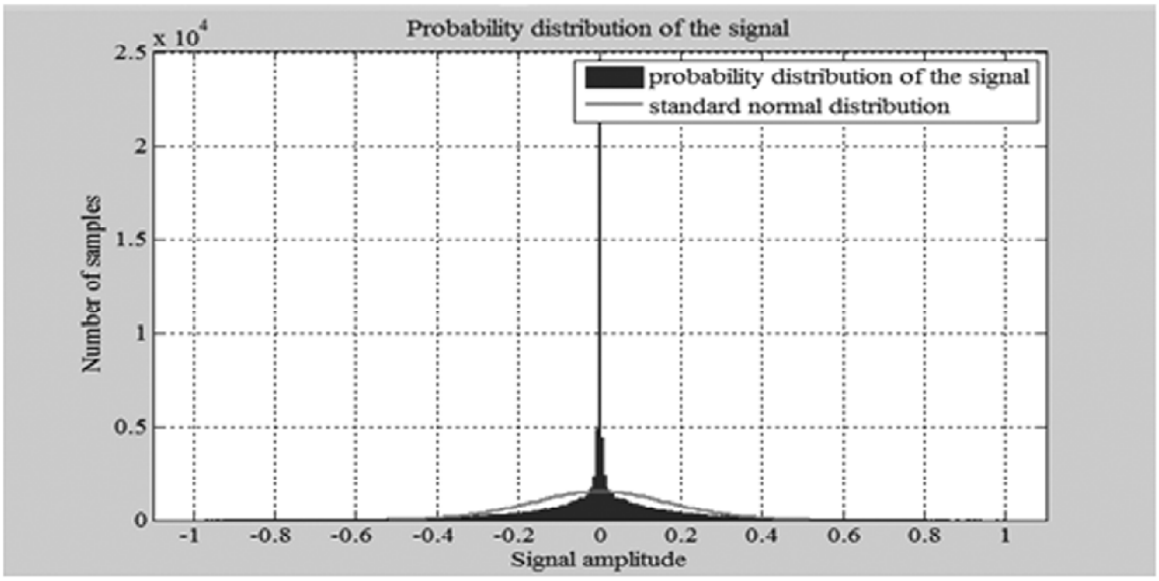

Figure 9: Probability distribution of the signal

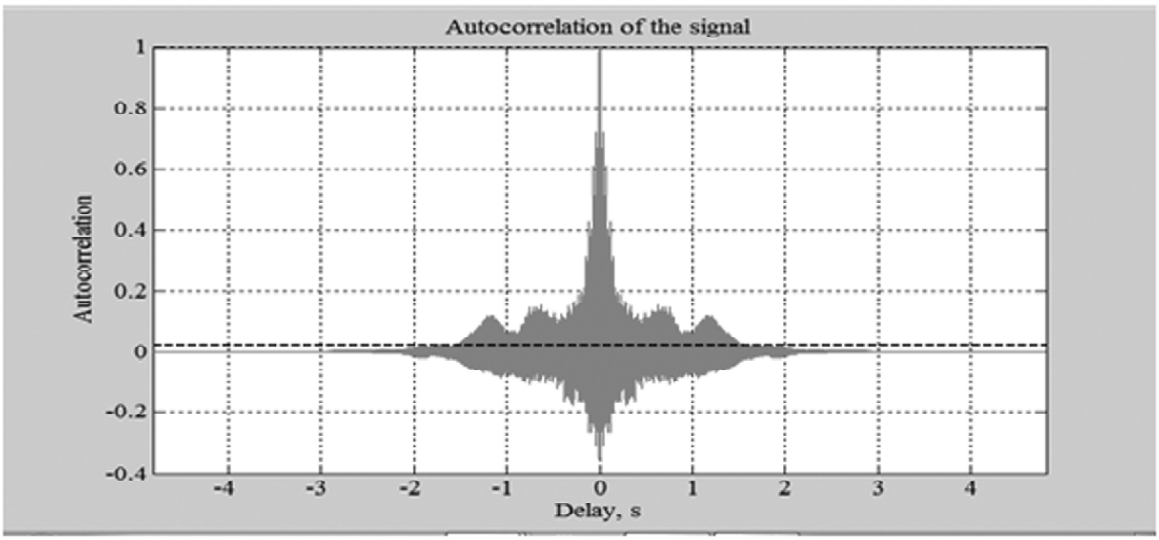

Figure 10: Autocorrelation of the signal

different time series, except that the same time series is used twice-once in its original form and once lagged one or more time periods. In *probability* and statistics, a *probability distribution* assigns a *probability* to each measurable subset of the possible outcomes of a random experiment, survey, or procedure of statistical inference fig.10.

6. SIMULATION RESULT BASED ON FUZZY-C MEANS ALGORITHM

Fuzzy clustering algorithm is used to classify the input image to detect the tumor affected area accurately.Clustering can therefore be formulated as a multi-objective optimizationproblem. Clustering can be considered the most important *unsupervised learning* problem; so, as every other problem of this kind, it deals with finding a *structure* in a collection of unlabeled data

6.1. Simulation Result Based on Fuzzy Lms

Image segmentation is very important for medical image to detect diseases in particular region. In Fuzzy LMS algorithm helps to detect brain tumor region very accurately when compare to fuzzy–c means algorithm

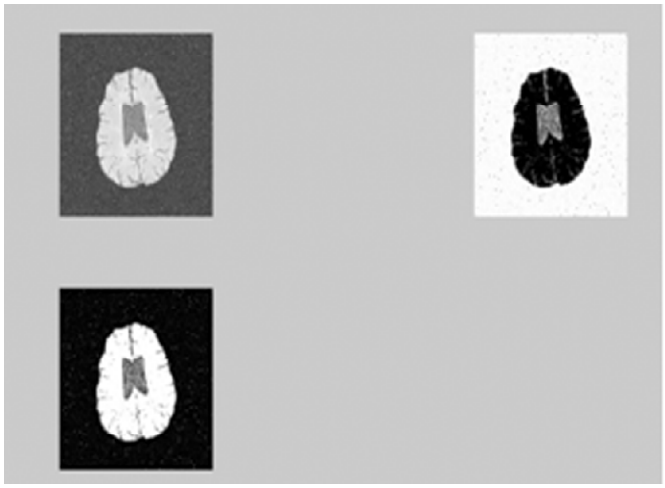

Figure 11: Classification of input image

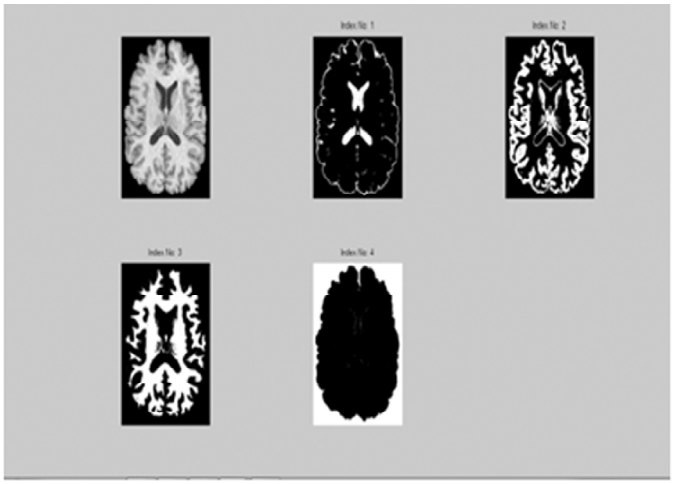

Figure 12: Segmentation of image

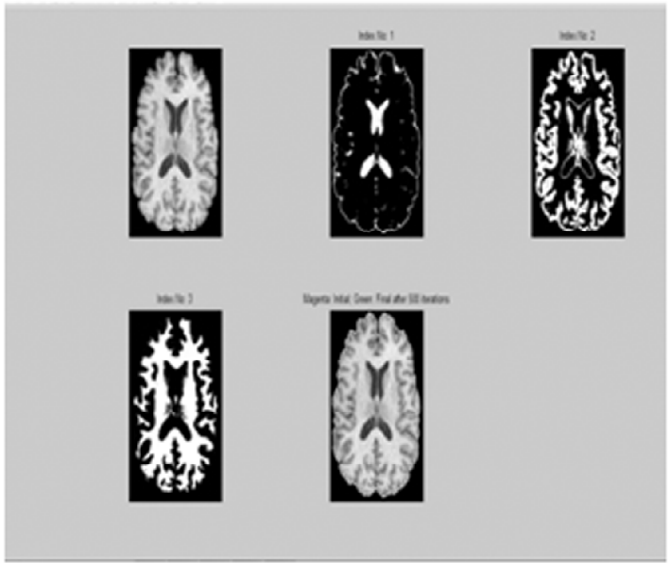

Figure 13: After 500 iteration

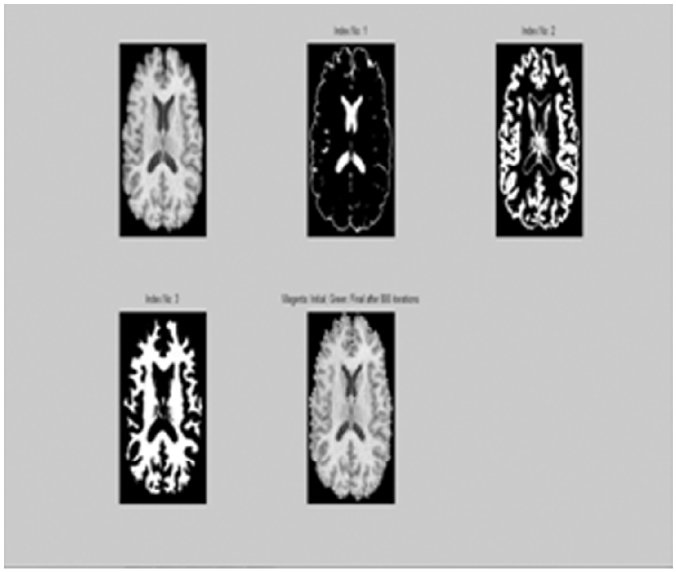

Figure 14: After 800 iteration

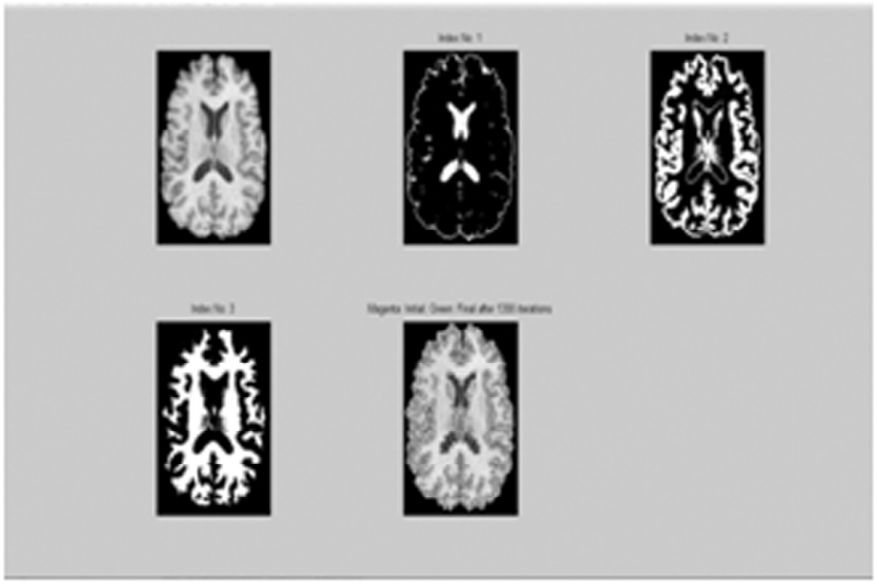

Figure 15: After 1300 iteration

because LMS algorithm done segmentation in image. One input image is segmented in to four images and then iteration will occur to get exact output. Brightness and contrast is very important factor in image. Better contrast and brightness will achieve in fuzzy LMS algorithm. Iteration is the of repeating same step to reach desired goal. Iteration in computing is the repetition of block of statements within a computer program. Iteration will increase to get accurate result.

7. CONCLUSION

Brain tumor is most important part in our human body. Brain tumor can be detected by using MRI, CT scan, and microwave. But it could not find less than 3mm size of brain tumor because it will send high radiation wave in to the brain. If tumor size is less than 3mm size means the high radiation will damage the cell or break the cell quickly and it will spread the tumor to other parts in the brain. The less than 3mm size of brain tumor detected by using near infrared imaging technology was implemented and the performance of near infrared imaging technology and Lagrangian Support Vector Machine has been verified in a head imaging system. Brain tumor was successfully detected in an artificial head phantom. Compare to other algorithm fuzzy LMS give accurate result.

Table 1
Comparison of fuzzy-c means and fuzzy LMS Algorithm

parameter	*Fuzzy-c means algorithm*	*Fuzzy LMSalgorithm*
Brightness	0.47	2.7248
Contrast	0.5	–0.9

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