LITERATURE SURVEY ON DETECTION OF LUMPS IN BRAIN

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Abstract: Broadly, to produce images of soft tissue of human body, MRI images are used by experts. In medical research field faces the challenge of identifying brain lumps or cancer or tumor through Magnetic Resonance Images (MRI). For brain lumps or cancer detection, image segmentation is required. Systematizing this process is a tricky task because of the high diversity in the appearance of lumps tissues among different patients and in many cases similarity with the usual tissues. Physical segmentation of medical image by the radiologist is a monotonous and prolonged process. MRI is a highly developed medical imaging method providing rich information about the person soft-tissue structure. There are varied brain lumps recognition and segmentation methods to detect and segment a brain lumps from MRI images. This is well thought-out to be one of the most significant but tricky part of the process of detecting brain lumps. A variety of algorithms were developed for segmentation of MRI images by using different tools and methods. Alternatively this paper presents a comprehensive review of the methods and techniques used to detect brain lumps through MRI image.

Keywords: Brain Lumps, Magnetic Resonance Image (MRI), Segmentation, Clustering

I. INTRODUCTION

Brain is the centre of human central nervous system. The brain is a complex organ as it contains 50-100 billion neurons forming a gigantic network. Brain lumps is a group of abnormal cells that grows inside of the brain or around the brain. Brain lumps can be benign or malignant, benign being non-cancerous and malignant is cancerous. Malignant lumps are classified into two types, primary and secondary lumps. Benign lumps is less harmful than malignant as in malignant lumps it spreads rapidly invading other tissues of brain, progressively worsening the condition causing death. Brain lumps detection is very challenging problem due to complex structure of brain. The exact boundary should be detected for the proper treatment by segmenting necrotic and enhanced cells. Magnetic Resonance Imaging (MRI) is an ideal source that provides the detailed information about the brain anatomy.

Fig. 1 shows some of the data sets of MRI images of brain. The MRI of the brain can be divided into three regions: white matter, grey matter and cerebrospinal fluid because most brain structures are defined by boundaries of these tissue classes and a method to segment tissue into these categories is an important step in brain lumps detection.

In brain lumps diagnosis, doctors integrate their medical knowledge and brain magnetic resonance imaging (MRI) scans to obtain the nature and pathological characteristics of brain lumps and to decide on treatment options. However, in brain MRI, where a great number of MRI scans taken for every patient, physically detecting and segmenting brain lumps is monotonous. Therefore, there is a need for computer aided brain lumps detection and segmentation from brain MR images to overcome the problems involved in the manual segmentation. Number of methods has been proposed in recent years to seal this break, but still there is no generally customary automated technique by doctors to be used in clinical floor due to accuracy and robustness issues. Artificial Intelligence methods such as Digital Image Processing when cooperative with others like machine knowledge, fuzzy logic and pattern recognition are so valuable in Image techniques. The prime objective of this paper is to develop methodologies for an automated brain MR image segmentation scheme.
The paper is organized as follows the details of related work are given in section II. In section III methods of Pre Processing and Enhancement are discussed. Section IV describes the Segmentation methods. And later on Clustering Techniques are given in section V.

II. EXISTING WORK

Jaskirat Kaur et al., described clustering algorithms for image segmentation and did a review on different types of image segmentation techniques. They also proposed a methodology to classify and quantify different clustering algorithms based on their consistency in different applications. [8]

B. Jyothi and Y. Madhavee Latham presented Integrated Multiple Features for Tumor Image Retrieval Using Classifier and Feedback Methods. This paper presents an effective approach in which the region of the object is extracted with the help of multiple features ignoring the background of the object by employing edge following segmentation method followed by extracting texture and shape characteristics of the images. The former is extracted with the help of Steerable filter at different orientations and radial Chebyshev moments are used for extracting the later. Initially the images similar to the query image are extracted from a large group of medical images. Then the search is by accelerating the retrieval process with the help of Support Vector Machine (SVM) classifier. The performance of the retrieval system is enhanced by adapting the subjective feedback method of Support Vector Machine (SVM) classifier. The performance of the retrieval system is enhanced by adapting the subjective feedback method. [1]

A study on applications of data mining techniques in brain imaging. In their paper these techniques are effective for predicting and preventing a disease. In their work they have described the data mining methods that have employed in the analysis of brain images and introduce statistical methods for brain patterns discovery. [2]

L.S. Kumar and A. Padampriya discussed that technology of data mining as a user oriented approach, used for collecting, searching and analysing large amount of data-base. They determined that data mining algorithm can be efficiently used in medicine domain. Their research work is related to prediction of system designed with the aid of neural network, where data is extracted and then clustering is performed on pre-processing data, using k=means clustering algorithm with k values so as to extract data relevant to common disease. [3]

The classification of brain tumor using MRI, they used neural network for classification of MRI. Their neural network consists of three stages, pre-processing, dimensionality reduction, and classification. [4]

Roy et al., calculated the lumps affected area for symmetrical analysis. They showed its application with several data sets with different lumps size, intensity and location. They proved that their algorithm can automatically detect and segment the brain lumps. MR images gives better result compare to other techniques like CT images and X-rays. Image pre-processing includes conversion of RGB image into grayscale image and then passing that image to the high pass filter in order to remove noise present in image.[9]

B. Sathya et al., proposed four clustering algorithm; k mean, improved k mean, c mean and improved c mean algorithm. They did an experimental analysis for large database consisting of various images. They analyzed the results using various parameters [6]
Hui Zhang et al, compared subjective and supervised evaluation methodology for image segmentation. Subjective evaluation and supervised evaluation, are infeasible in many vision applications, so unsupervised methods are necessary. Unsupervised evaluation enables the objective comparison of both different segmentation methods and different parameterizations of a single method.[12]

Martial Heber et al, presented an evaluation of two popular segmentation algorithms, the mean shift-based segmentation algorithm and a graph-based segmentation scheme.

Therefore, further work is needed for localized measurement like impact on tumor or lumps boundary or volume determinations

III. PRE-PROCESSING AND ENHANCEMENT

Pre-processing and enhancement techniques are used to improve the detection of the suspicious region from Magnetic Resonance Image (MRI). This section presents the gradient-based image enhancement method for brain MR images which is based on the first derivative and local statistics. The pre-processing and enhancement method consists of two steps; first the removal of film artifact such as labels and X-ray marks are removed from the MRI using tracking algorithm. [12] Second, the removal of high frequency components using weighted median filtering technique. It gives high resolution MRI compare than median filter, Adaptive filter and spatial filter. The performance of the proposed method is also evaluated by means of peak single-to noise-ratio (PSNR), Average Signal-to-Noise Ratio (ASNR),[12] and Enhancement [17]

IV. SEGMENTATION METHODS

Image segmentation is the primary step and the most critical tasks of image analysis. Its purpose is that of extracting from an image by means of image segmentation. The mechanization of medical image segmentation has established wide application in diverse areas such as verdict for patients, treatment management planning, and computer-integrated surgery.

There are three broad approaches to segmentation, termed, Boundary approach (thresholding), Edge-based approach, Region-based approach.

1. Boundary Approach (Threshold)

In thresholding, pixels are allocated to categories according to the range of values in which a pixel lies. Thresholding is the simplest and most commonly used method of segmentation. Given a single threshold, t, the pixel located at lattice position (i, j), with greyscale value fij, is allocated to category 1 if fij ≤ t or else, the pixel is allocated to category 2.

2. Edge-Based Approach

In edge-based segmentation, an edge filter is applied to the image, pixels are categorized as edge or non-edge depending on the filter output, and pixels which are not divided by an edge are owed to the same category. Edge-based segmentation is based on the fact that the position of an edge is given by an extreme of the first-order derivative or a zero crossing in the second-order derivative. There a pixel is classified as an object pixel judging solely on its gray value independently of the context. To improve the results, feature computation and segmentation can be repeated until the procedure converges into a stable result.

3. Region-Based Approach

Region-based segmentation algorithms operate iteratively by grouping together pixels which are neighbours and have similar values and splitting groups of pixels which are dissimilar in value.
Segmentation may be regarded as spatial clustering. Clustering in the sense that pixels with similar values are grouped together whereas spatial in that pixels in the same category also form a single connected component. Clustering algorithms may be agglomerative, conflict-ridden or iterative.

Clustering is the group of a collected works of patterns into clusters based on similarity. Patterns within a valid cluster are more analogous to each one other than they are to a pattern belonging to a dissimilar cluster. Clustering is useful in pattern-analysis, grouping, decision-making, and machine-learning situations, data mining, document recovery, image segmentation, and pattern organization. On the other hand, many such problems, there is little prior information existing about the statistics, and the decision -maker must make as few suppositions about the data as probable

V. CLUSTERING TECHNIQUE

Clustering is a learning task, where one needs to identify a finite set of categories known as clusters to categorize pixels. Clustering is primarily used when module are known in progress. A resemblance criteria is defined between pixels [2] and then similar pixels are grouped together to form clusters. A good quality clustering method will produce high quality clusters with high intra-class similarity – similar to one another within the same cluster low inter-class similarity and dissimilarity to the objects in further clusters. [9]The superiority of a clustering result depends on both the similarity measure used by the method and its achievement. The eminence of a clustering method is also calculated by its ability to discover. Clustering refers to the classification of objects into groups according to criteria of these objects. In the clustering techniques, an attempt is made to extract a vector from local areas in the image. A standard procedure for clustering is to assign each pixel to the nearest cluster mean. Clustering algorithms are classified as hard clustering (k- means clustering) fuzzy clustering, etc.

1. The K-Means Algorithm

K-means algorithm is the most well-known and widely-used unsupervised clustering technique in partitioned clustering algorithms. Purpose of this algorithm is to minimize the distances of all the elements to their cluster centres.

Most of the algorithms in this field are developed by inspiring or improving k-means. The algorithm upgrades the clusters iteratively and runs in a loop until it reaches to optimal solution.[11] Performance of K-means algorithm depends on initial values of cluster centers. Therefore the algorithm should be tested for different outcomes with different initial cluster centers by multi-running.[12]

VI. CONCLUSION

In this study, the overview of various segmentation methodologies is explained. In spite of huge research, there is no universally accepted method for image segmentation, as of the result of image segmentation is affected by lots of factors. Thus there is no single method which can be considered good. All methods are equally good for a particular type of image. Due to this, image segmentation remains a challenging problem in image processing.

The medical image segmentation has difficulties in segmenting complex structure with uneven shape, size, and properties. In such condition it is better to use unsupervised methods such as fuzzy-c-means algorithm. For accurate diagnosis of lumps patients, appropriate segmentation method is required to be used for MR images to carry out an improved diagnosis and treatment. Through examination of the literature, we found that the Fuzzy C--means algorithm should be used because of its simplicity and it is also preferred for faster clustering.

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