REVIEW OF VARIOUS MRI IMAGE PROCESSING METHODS FOR EFFICIENT TUMOUR DETECTION

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ABSTRACT: Image processing is a new era of data mining. Day by day the sizes of digital images are getting increases. In a medical field such as diagnostics of the tumour, cancer MRI images are used. Image mining techniques have a vital role in tumour detection from MRI images. MRI images are widely used in medical fields for analysis and detection of tumour growth from the body. It is a monotonous process for the radiologist to physical segmentation of MRI or medical images. Magnetic resonance images (also called MRI) are basically a technique, which widely used by the radiologist to detect disease from the body such as a tumour or any abnormal disease. An MRI scanner machine uses high-level radio waves, a strong field of magnetic areas, and field gradients to generates and captures images of the complete internal body. There are varieties of efficient brain tumour detection and segmentation methods have been suggested by various researchers for efficient tumour detection. Existing methods encounter with several challenges such as detection time, accuracy and quality of tumour. In this review paper, we are presenting an analysis and study of various tumour detection methods for MRI images. A comparative analysis has been also performed for various methods.

Keywords- Data Mining, Image Processing, Brain Tumour, MRI images, Image Processing and Segmentation

1. INTRODUCTION

In field of data mining and Imaging has undergone certain developments with the advancement of various new technologies, science, and engineering. A medical image data such as MRI images are captured and stored as a digital data into the memory of the computer. Magnetic resonance images (also called MRI) are basically a technique, which widely used by the radiologist to detect disease from the body such as a tumour or any abnormal disease.

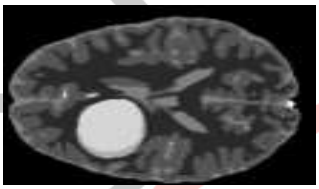

Figure 1 MRI Image

Image processing of MRI images is challenging. In current computer engineering and medical imaging research encounters with several challenges in detection and analysis of brain tumour. MRI images are broadly used by experts to captured images of internal soft tissue of the body. Image segmentation and processing are required for analysis and detection of brain tumour detection. Information can be well interpreted through images [1].

Basically, image processing focuses on bringing out information from an image. This collected information is helped to deal with various issues such as analysis of tumour growth, size, and type. To understanding the images segmentation and processing the first step is to detect and analysis various internal components from these images. With the recent rapid growth of the technological advancements, medical science has also improved. But medical science is dependable on the current improvement of technologies [13].

Due to this technological improvement, it has reached to certain aspects where directly it can detect; diagnose any diseases in a very less time with full accuracy. From the MRI images, the detection diagnosis and analysis of brain tumours, Medical experts such as doctors and researchers integrate their technology, expertise medical practice knowledge to decide correct treatment options. However, from various patients' brain MRI data, it is quite challenging to detect tumour growth, types, and size. So it's highly desirable to develop a new computer-based brain tumour detection, analysis and segmentation method for various brain tumour images. Computerized analysis of MRI image set also overcomes the problem of manual segmentation [15].

A number of methods have been proposed in recent years to seal this break, but still, there is no generally customary automated technique by doctors to be used on the clinical floor due to accuracy and robustness issues. An Artificial Intelligence technology based methods like as machine knowledge, fuzzy logic, Digital Image Processing and Pattern Recognition are so valuable in Image processing and segmentation. The primary and main objective of this review paper is to present and provide a comparative analysis and study of different types of image processing, analysis and image segmentation techniques for efficient tumour detection from MRI images [7].

2. MRI IMAGE PROCESSING

An MRI image is an image which mainly uses a high level of magnetic field area and a strong radio wave-based energy to make pictures of various internal organs and structures of the human body such as the brain, breast.

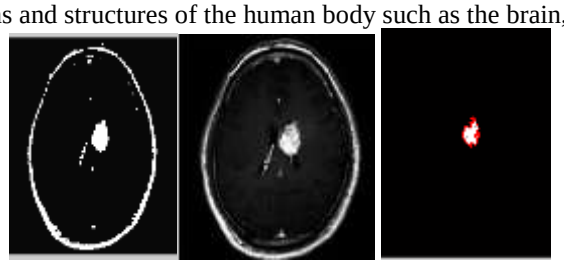

Figure 2- Tumour detection from MRI Images

In many cases, MRI gives a strong and complete view, structures of the human body cells as compared to other methods such as computed tomography (also called CT), X-ray, ultrasound, or scanning method [11].Image mining is a technique which handles the mining of information, image data association, or additional patterns not unambiguously stored in the images [6]. It completely utilizes various techniques of computer-based vision; data mining, image analysis, image processing, image storage, retrieval, machine learning, an artificial intelligence and database, technique.

3. EXISTING WORK

In this research paper [1], researcher mainly presented efficient tumour detection and analysis techniques by using GA method. Brain tumour detection and its analysis such as size, growth, and type are a challenging task for researchers in this current health care society. From MRI images image processing and segmentation are widely used to detect and extract information of all abnormal tumour portion of the brain. Basically, a brain tumour in the body is a collection of various abnormal tissues. These cells help in the rapid growth of abnormal tissues. Various techniques have been suggested and developed by different researchers in the field of detection of a tumour from the brain [1, 7].

A genetic algorithm [1, 4, 7] is basically based on the new concept of natural evolution method. GA also uses an advanced searching scheme that helps to optimize the resulting gene structures. An efficient and high-level accurate detection rate feature of a genetic algorithm makes it's more popular in the field of image processing. GA helps in the processing of medical images such as brain MRI images, CT images etc. [8].

In genetic algorithm based image processing method, different types of chromosomes are used to describes various population generation schemes for each of the individuals. These are iteratively updated and add directly by using some GA-based operators such as selection operator, mutation operator and finally crossover operator to solve the complete problem. In GA techniques each of the individuals is directly evaluated by a strong and efficient fitness function. These functions control the complete population and evolution in various orders to optimize it. In the field of image processing, a genetic algorithm is used to detect various optimal labels for each image pixel and also to analyze and determine the various optimal parameters required by an image segmentation method. It also provides values to merge various image regions to achieve the best segmentation result. In this review paper researcher mainly focused on the interest of soft threshold DWT for enhancement and genetic algorithms schemes for various image processing and image segmentation [10].

In this image mining research paper [5] authors worked on various image segmentation techniques. Also, provides a comparative performance analysis for different MRI image mining schemes to detection of a brain tumour. Image segmentation basically desired the brain abnormal region. It helps to detect growth of tumour from various MRI images. Various segmentation algorithms with ICA as denoising method for delectation and removal of image noise such as salt noise, pepper noise and speckle noise at 5 dB noise level has been analyzed and its performance is evaluated by MRI or PET brain medical images in RGB scale and gray scale by objective measures.

In this paper [4] author worked on brain tumour detection and analysis for human brain MRI images. The author works on MRI image processing and segmentation. An Image processing and segmentation is a new form of data mining technique which helps to resolve challenges in are of medical sciences. It is widely used for the detection of tumours.

This paper [14] mainly deals with the analysis and detection of the tumour from various MRI images captured for various brain tumour patients. The brain is the anterior most part of the nervous system. A Brain Tumour is a basically an abnormal growth of body tissues and cells. A Magnetic Resonance Imaging (also called MRI) is the medical device required to detect and diagnose tumour from the various parts of the body such a brain, breast or ovary. A normal MR image is not that much suitable for fine analysis, so segmentation is an important process required for efficient analysis of the various tumour images. A Clustering method is suitable for biomedical image processing and segmentation. Clustering is based on the concept of the unsupervised learning process.

In this research paper [3] author worked on method K-Means clustering for tumour detection, where the detected tumour from data sets shows some noise and abnormality in the results which is then rectified and analysis by using a strong operator called

morphological operators. It also uses basic image segmentation and processing methods to analyze all the abnormal tissues and normal cells. It helps to separate the tumour cells and normal cells for the brain.

In this research paper [8] researcher proposed a model based scheme for an automated bias field correction of MRI brain images. The Magnetic resonance signals mainly modeled on the concept of a random process with a parametric probability distribution that is corrupted by a smooth polynomial inhomogeneity or bias field. The method they proposed applies iterative expectation maximization (also called EM) methods that directly interleaves all the pixel classification by using a clear estimation of different class distribution schemes and bias field parameters. The experimental results clearly influenced that the proposed model improves various performance measuring parameters over existing model after any iteration.

A method, which can directly, handles and manages various multi-channel resulting data and different slice-by-slice constant are very useful in tumor detection. It basically initialized with data and information captured by an MRI machines for a brain tumour patient. The algorithm is robust for such errors because it automatically assigns a low weight to bias field regions or areas. An SVM method (also called as Support vector machines) was applied by various researchers in their different types of research [2].

In this paper [12] author mainly worked on the processing of various MRI brain cancer images. In this work SVM classification were uses. A Support Vector Machines (or SVM) was directly applied to classifications of various brain images. In this research paper, a feature extraction scheme is suggested for brain images. An MRI Image processing was carried out by using various properties such as color, grayscale type, asymmetrical and texture based features. In this work, author achieved a good result.

In this research paper [4] authors presented a study and analysis of images by using SVM-based classification of various soft tissues and cells of the brain MRI and CT images, by using wavelet dominant scheme and a gray level run length texture features. In this research authors mainly emphasized on the method of various medical CT images as one of the widely used reliable methods to analyze and detect by SVM.

In this research paper [6, 9] author mainly proposed a new concept for image processing by using a novel fuzzy scheme which uses the concept of bit plane scheme FCMBP. For slicing process, a bit plane filter scheme is widely used. It also provides an efficient image classification and helps to detects affected the abnormal area of the images. In this concept, a sliced image is normalized with the help of existing old methods.

And later these methods are compared with various fuzzy schemes for a better clustering and classification of the spoiled or affected area of the completed image. Thereby control points are extracted that are further needed for reconstruction of the images. The performance of the fuzzy approach with bit plane technique is evaluated with the help of simulation and it is found that our approach yields better results when compared to other access methods. Their demerit is it only efficient when MSB or most significant bit planes concepts are used.

In this research paper [13] authors proposed an image mining concept called knowledge driven or knowledge based image mining method. Here authors mainly addressed the main issue of automatically mining method called the multi-spectral images by using the concept of Mercer Kernels. The main aim of this complete work is to identify an efficient method to automatically construct various tags for images that can denote the total percentage of the cover area and also the (%) percentage of the presence of any other geophysical processes like as snow or ice or melting regions or drought regions or any fire hazard. A kernel function can be defined as a strong and efficient inner product for the complete mapped data of the feature space.

In this research paper [6, 11] authors proposed a new technique for analysis and study of an automatic information and knowledge driven image mining scheme. This scheme is based on the concept and theory of "Mercer-Kernels" or (MK). An MK theory is a basically based on nonlinear symmetric positive mapping scheme. This mapping is defined by the original image space to a very high, probably infinite dimensional feature space.

In that high dimensional feature space, linear clustering, prediction, and classification techniques can be used and the results can be mapped back down to the original image space. Therefore, a highly non-linear and complete structure can be obtained into the image by using popular linear mathematical functions in the feature space.

4. CHALLENGES IN EXISTING METHODS

Following methods are widely used for analysis and processing of several MRI medical images for detection of various abnormal tissues from the body such as a tumour, cancer cells etc.

4.1 Genetic Algorithm Based- A genetic algorithm or GA is mainly based on a concept of natural evolution based analysis and search process for data, to optimize the complete structures. A genetic algorithm mainly uses learning of unsupervised quantitative scheme, which measures the complete results for segmentation or another concept can use a supervised learning scheme by using few of the prior knowledge. A genetic algorithm method mainly concerns with the fitness function. In this survey paper, we mainly deal with a various general scheme for detection of the tumour from various MRI image segmentation that involves a GA. A Genetic method is mainly used in this work as an optimization scheme for various optimal combinations of the image segmentation and image processing results.

Demerits- In GA scheme a time and precession values for are still a challenging factor.

4.2 Fusion based- In this scheme an overlapping of the training images of the victim image area over a testing image data set of the same group, thereby analysis and detection the brain tumour.
Demerits-The overlapping creates complexity due to different dimensions of both images and it also consumes more time.

4.3 Canny Based - To overcome the problem of detecting the edges, the better way to use the efficient image edge detection method name canny based edge detection.
Demerits –It does not support color images. This scheme takes more time to find the optimal solution

4.4 K-Mean Clustering Based- For image processing a k-means clustering method mainly aims to divide the various n partitions into the 'K', clusters. In this scheme, each observation mainly related to a cluster of the nearest mean value. If there are a huge number of data variables are available than this K-Means clustering scheme performs outstanding but when the variable K keeps small, deprecates the total performance.
Demerits- It takes more time; it is quite difficult to detect or predict the correct value for variable K. Another issue is that a k-means clustering scheme can not able to find various non-convex based clusters. Various initial partitions perform by the scheme can directly add as a result into the final clusters. This scheme does not work efficiently with a variety of clusters.

4.5 C -Mean Clustering- It is well known that the output of K-Means algorithm depends hardly on the initial seeds number as well as the final clusters number. Therefore to avoid such obstacle FCM method is suggested. A fuzzy C-means based scheme mainly relaxes the total given condition by allowing the various feature vectors to have multiple types of membership grades for various clusters of different interest. This scheme mainly considers only image intensity. Unlike a k-means clustering scheme where data point must exclusively belong to one cluster center here data point is assigned to two or more data clusters.
Demerits- In a fuzzy c mean method a prior specification of the various numbers of clusters is required. By using this scheme we can achieve better results but it will increase the total cost and time.

4.6 Fuzzy C-Means & SVM Based- Fuzzy c-means (or FCM) clustering is used for the segmentation and processing of the image to analyze and detect the various suspicious tumour region in the various brain MRI images.

In this scheme, an advance matrix is used named "Gray level run length matrix" (or GLRLM). It extracts all the features from the brain image after which an SVM scheme is directly applied to classify and analyses the complete brain MRI images, which provide more accurate and effective results for image classification of brain MRI images.
Demerits- Performs better in the case of the small data set. Classifiers function needs to improve.

5. CONCLUSIONS & FUTURE WORK

In this survey paper, we are presenting an analysis and overview of different image processing and image segmentation schemes for detection of brain tumour from various MRI images. A Tumour inside the body part such as the brain is a serious problem for the patient and detection and analysis of the tumour manually is challenging for doctors. Efficient and precise detection and analysis of the brain tumour is always desirable research work for researchers. Various data mining and image processing methods are widely used for detection and analysis of the tumour. This paper describes study and challenges in existing methods.

In future work, we will develop a new efficient MRI image processing and segmentation method and compared this proposed method with various existing methods based on comparison parameters such as precession value, detection time, PSNR and noise.

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