A SURVEY PAPER ON THE METHODS FOR CLASSIFYING THE BRAIN TUMOUR CELLS

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Abstract

Tumours are the extra cells that get multiplied by the loss of growth control ability of the cells. Brain Tumours are often dangerous, either being benign or malignant. If it is a malignant brain tumour, it is none other than the brain cancer with tumour cells that may be even fatal. These cells, unlike normal cells multiply at a faster rate and spread to other cells and organs. If the brain tumour cell is benign, it may not be fatal and is a non – cancerous tumour cell. It usually does not spread as it is encapsulated by a substance. But it also has its own problems that include severe headaches, seizures, nausea and drowsiness. This paper is a survey paper that involves the various methods that are available for the detection and classification of the tumours in the brain. Also, it includes the inferences of the different methods that are applied in various papers for the clustering and feature extraction of the brain tumour cells, so as to make it clear to differentiate the tumour cells from the normal cells.

Keywords: *Brain Tumour, Benign, Malignant, Clustering, Feature Extraction, Classification*

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1. INTRODUCTION

The brain is one of the largest and most complex organs in the human body. It consists of more than 100 billion nerves. These nerves help in communicating between different organs of our body and these connections are called synapses. The brain along with the spinal cord and the peripheral nervous system control every part of our body. Any minor fault in the brain or the nervous system leads to the collapse of the entire system. Human Brain may suffer from many disorders, depending on the illness, genetic factors or traumatic injury. Sometimes, tumours which are the mass of tissues form in the brain and can be very dangerous. The cause of the brain tumour is still unknown. It can occur in any people of any age.

1.1 Brain Tumour

Brain Tumour is an abnormal form of massive cells that develop within the brain. Brain tumours are classified as grade 1 to grade 4 according to their behaviour. Low grade brain tumours are usually classified as benign and higher grade tumours are malignant. The brain tumours can be either of benign or malignant type. A benign brain tumour is a non cancerous type of tumour that grows slowly in the brain. It does not spread normally and stays in a single place. A malignant brain tumour is a type of brain cancer that grows at a rapid rate and spreads to the other cells by damaging them. These brain tumours should be diagnosed and treated earlier so as to avoid the effects of brain tumours or even death.

The detection of brain tumour is usually done with the help of human investigation of the CT or the MRIs. But, it is better to have an accurate data regarding the size and position of the tumour. It would be satisfactory, if this detection is performed by using a fully computerized system.

2. BRAIN TUMOUR DETECTION

For detecting the brain tumours, the fully computerized system includes the steps, image collection, pre – processing of the image, clustering into groups and extraction of the features.

2.1 Image Collection

The images of the brain tumour can be obtained either by Computed Tomography or Magnetic Resonance Imaging. Each of the techniques has its own strength and is designed for specific applications. MRI does not use ionizing radiation and is used for diagnosing the soft tissues. Since brain is a soft tissue, we can afford MRI images for the detection of brain tumours.

2.2 Pre – Processing

The images obtained by the MRI images can never be directly applied for the process of extracting the features of the image. Before that the pre – processing of the images is necessary. It involves two main steps that include denoising and skull removal. Denoising is the process of removal of noise from the original image. Skull removal is the process of removing or stripping the non – brain tissues. This process can be also called as Skull – Stripping technique.

2.3 Clustering

Clustering is the process of organizing some objects into groups depending on their characteristics. The similar members are grouped together into a single category. It is one of the unsupervised learning problems and is considered as the most important process. A good clustering algorithm should have good scalability, high dimensionality, interpretability and usability. There are different types of clustering algorithms that include Exclusive Clustering,

Overlapping Clustering, Hierarchical Clustering and Probabilistic Clustering. In exclusive clustering, the members are grouped in an exclusive way, in which already grouped cluster could not be included in another cluster. The overlapping clustering uses fuzzy sets for the clustering of data. In hierarchical clustering, the clustering is based on the union of two adjacent clusters. In probabilistic clustering, the clustering is based on the method of probabilistic approach. Here, the normal brain tissues and the tumour affected tissues are grouped under different categories, so that they can be easily classified.

2.4 Feature Extraction

Feature Extraction is the process of reduction of the amount of resources that are required to describe a large set of data. It is a difficult process to analyze an image with a large number of variables requires more memory and power of computation. To reduce the amount of memory and the computational power, specific features that are more important should be extracted to describe an image which could make it easier to classify the brain tumour cells.

3. RELATED WORK

There are still so many people relying on the research of brain tumour detection. We present here the works of various authors for classifying the different types of brain tumours. Entire coverage of their works is impossible and so we give a brief outline of their methods. Also, we include the various inferences of the techniques.

The first and the foremost step in the detection of brain tumours is the pre – processing of images. Most of the authors use only the removal of noise and not the skull – stripping technique. For the removal of noise, they use median filters as in [2], [3],[7] and [10]. Some other filters like Gaussian Blur filter [5] and Wiener filter [12] has been also employed. Median filter is a non – linear filter, which is less – sensitive to outliers. Also, it may affect the quality of the image and so Gaussian filter is one of the better ways to improve the results. In some cases [8], Gabor filters has been proposed where super – pixel segmentation is used. [4] has been projected a skull – stripping algorithm along with denoising for pre – processing.

Imran Ahmed et.al [12] has been schemed Otsu's method for image segmentation in which the array is segmented into classes by means of Otsu's N – thresholding method. This algorithm follows bi – modal histogram and then calculates the optimum threshold. The overlay based image fusion has been then followed to enrich the perceptibility of the tumour region. K – Means along with Meyer's flooding watershed algorithm has been used by Ajeet Kumar Panda et.al.[10]. Though it gives better performance for clusters with huge variables, it does not work well with clusters having different size and density. [6], [9] and [11] have been proposed edge based segmentation of Canny, which detects and links edges to form contours. Also [11] used Ford – Fulkerson Technique, which calculates the maximum flow in a flow network. [8] used separate analysis methods of feature extraction that includes texton analysis for terton features, fractal texture analysis for fractal features and minimum redundancy and maximum relevance method for feature selection. Also ERT method has been used for segmentation which is better when compared with random forest method. Hidden – Markov Random Field – EM Algorithm has been used for segmentation in [6] which easily differentiates the tissue intensity from the skull intensity. This method can be used only for multi – spectral data sets and they are not always available.

Some authors [2], [3] and [7] preferred Grey Level Co – occurrence Matrix Technique, which mainly considers the spatial relationship of pixels for texture analysis. These functions analyze the texture of an image by estimating how often the pixel pairs and the stipulated spatial relationship exist in an image. The main disadvantage of GLCM technique is that the selection of the region of interest is depends on the operator and if this selection is not worthy, loss of information of adding up of unnecessary information may occur. Also, [3] has been proposed Support Vector Machine Classifier, which is quite appropriate for the binary categorization purposes. It achieves the flexibility in threshold by familiarizing the kernel. Having a convex optimality problem, it provides an extraordinary elucidation. The main disadvantage of the SVM classifier is that it lacks unambiguousness of the results.

Dual Tree Complex Wavelet Transform (DTCWT) is a feature extraction technique which is an improvement over discrete wavelet transform (DWT). It is based on an effective and distinguishable filter bank. The Haar Transform of DTCWT has symmetric filter banks unlike others and it has been preferred by [1]. A soft computing technique like Self Organizing Map (SOM) has been used in [4], which is a type of Artificial Neural Network (ANN). It produces low dimensional discrete training samples called the map by unsupervised learning. But the main problem is that it needs a good deciding factor along with the necessary and sufficient data to develop significant clusters. Also, it uses stationary wavelet transform, where the translation – invariance is fulfilled by eliminating the upsamplers and downsamplers of the DWT. In [13] fast fourier transform has been used for the segmentation, which converts the spatial domain into frequency domain by decomposing it into sine and cosine components at a rapid rate of computation. But it is well suited in complex units and may introduce window issues.

4. CONCLUSION

We have projected various methods of brain tumour detection from the pre – processing of images to the final extraction of the tumour, if present. Also, we have included the inferences of the methods of brain tumour detection in our paper. For this purpose, we have presented here the works of various authors for extracting the presence of the tumour along with its size, shape and other factors.

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BIOGRAPHIE

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