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A REVIEW ON PREDICTIVE BASED BRAIN TUMOR DETECTION TECHNIQUES

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Abstract—**The brain tumors, are the most common and aggressive disease, leading to a very short life expectancy in their highest grade. Thus, treatment planning is a key stage to improve the quality of life of patients. Generally, various image techniques such as Computed Tomography (CT), Magnetic Resonance Imaging (MRI) and ultrasound image are used to evaluate the tumor in a brain, lung, liver, breast, prostate…etc. Especially, in this work MRI images are used to diagnose tumor in the brain. However the huge amount of data generated by MRI scan thwarts manual classification of tumor vs non-tumor in a particular time. But it having some limitation (i.e) accurate quantitative measurements is provided for limited number of images. Hence trusted and automatic classification scheme are essential to prevent the death rate of human. The automatic brain tumor classification is very challenging task in large spatial and structural variability of surrounding region of brain tumor. In this work, automatic brain tumor detection is proposed by using Convolutional Neural Networks (CNN) classification. If tumor is detected system classified the tumor and conveys patient the stage of tumor he is probably suffering.**

Keywords- **Convolution Neural Network (CNN), MRI, tumors.**

I. INTRODUCTION

Brain tumor is one of the vital organs in the human body, which consists of billions of cells. The abnormal group of cell is formed from the uncontrolled division of cells, which is also called as tumor. Brain tumor are divided into two types such low grade (grade1 and grade2) and high grade (grade3 and grade4) tumor. Low grade brain tumor is called as benign. Similarly, the high grade tumor is also called as malignant. Benign tumor is not cancerous tumor. Hence it doesn't spread other parts of the brains. However the malignant tumor is a cancerous tumor. So it spreads rapidly with indefinite boundaries to other region of the body easily. It leads to immediate death.12

Brain MRI image is mainly used to detect the tumor and tumor progress modeling process. This information is mainly used for tumor detection and treatment processes. MRI image gives more information about given medical image than the CT or ultrasound image. MRI image provides detailed information about brain structure and anomaly detection in brain tissue. Actually, Scholars offered unlike automated methods for brain tumors finding and type cataloging using brain MRI images from the time when it became possible to scan and freight medical images to the computer. Conversely, Neural Networks (NN) and Support Vector Machine (SVM) are the usually used methods for their good enactment over the most recent few years.11 However freshly, Deep Learning (DL) models fixed a stirring trend in machine learning as the subterranean architecture can efficiently represent complex relationships without needing a large number of nodes like in the superficial architectures e.g. K-Nearest Neighbor (KNN)and Support Vector Machine (SVM).Consequently, they grew quickly to become the state of the art in unlike health informatics areas for example medical image analysis, medical informatics and bioinformatics.

A brain tumor is the abnormal growth of cells in the brain. A brain tumor can be primary or secondary. A primary brain tumor originates in the brain itself or tissues adjacent to it, i.e. the brain-covering membranes (meninges), cranial nerves, pituitary gland or pineal gland, while a secondary brain tumor occurs when cancer cells from other organs like lung, kidney, breast, etc. spread to the brain [3]. Primary brain tumor initially arises because of the mutations of their DNA. These mutations allow the abnormal cell to grow and the normal cell dies. It can cause brain damage and sometimes it can be life-threatening. In this work, we proposed a CNN model that is able to accurately classify the brain tumor. Hence, the treatment for the tumor can be started at an early stage..

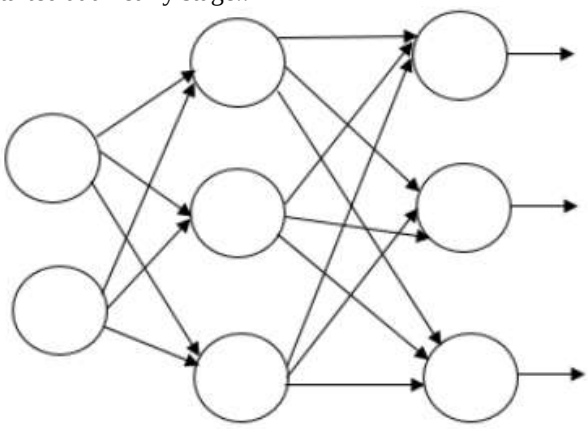


Fig 1. basic neural network architecture

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It has been proved that neural networks with one hidden layer work as approximate function [1]. Hidden layer in neural network represents learned non-linear combination of input features which works as an approximate. Figure 1 below shows the basic neural network architecture. This model simultaneously learns distributed representation of words as well probability function for predicting next word. Distributed representation captures syntactic and semantic features of words which help in generalizing well to word sequences which are not seen in training set.

II. LITERATURE REVIEW

The main motivation of paper [1] is to introduce a class of robust non-Euclidean distance measures for the original data space to derive new objective function and thus clustering the non-Euclidean structures in data to enhance the robustness of the original clustering algorithms to reduce the noise and outliers.

Paper [2] presents a validation study on statistical non supervised brain tissue classification techniques in magnetic resonance (MR) images. Several image models assuming different hypotheses regarding the intensity distribution model, the spatial model and the number of classes are assessed. The methods are tested on simulated data for which the classification ground truth is known. Different noise and intensity non uniformities are added to simulate real imaging conditions. No enhancement of the image quality is considered either before or during the classification process.

A variation of fuzzy c-means (FCM) algorithm that provides image clustering is proposed in [3]. The proposed algorithm incorporates the local spatial information and gray level information in a novel fuzzy way. Experiments performed on synthetic and real-world images show that FLICM algorithm is effective and efficient, providing robustness to noisy images.

Paper [4] presents an unsupervised distribution-free change detection approach for synthetic aperture e-radar (SAR) images based on an image fusion strategy and a novel fuzzy clustering algorithm. The image fusion technique is introduced to generate a difference image by using complementary information from a mean-ratio image and a log-ratio image. Experiments on real SAR images show that the image fusion strategy integrates the advantages of the log-ratio operator and the mean-ratio operator and gains a better performance.

In [5], an improved FCM method based on the spatial information is proposed for IR ship target segmentation. The improvements include two parts: 1) adding the nonlocal spatial information based on the ship target and 2) using the spatial shape information of the contour of the ship target to refine the local spatial constraint by Markov random field. In addition, the results of K-means are used to initialize the improved FCM method. Experimental results show that the improved method is effective and performs better than the existing methods, including the existing FCM methods, for segmentation of the IR ship images.

Medical image classification has gained tremendous attention in recent years, and Convolutional Neural Network (CNN) is the most widespread neural network model for image classification problem. CNN is designed to determine features adaptively through back propagation by applying numerous building blocks, such as convolution layers, pooling layers, and fully connected layers. In [6], author mainly focused on developing a CNN model for classifying brain tumors in T1-weighted contrast enhanced MRI images. The proposed system consists of two significant steps. First, preprocess the images using different image processing techniques and then classify the preprocessed image using CNN. The experiment is conducted on a dataset of 3064 images which contain three types of brain tumor (glioma, meningioma, pituitary). We achieved a high testing accuracy of 94.39%, average precision of 93.33% and an average recall of 93% using our CNN model. The proposed system exhibited satisfying accuracy on the dataset and outperformed many of the prominent existing methods.

The brain tumors, are the most common and aggressive disease, leading to a very short life expectancy in their highest grade. Thus, treatment planning is a key stage to improve the quality of life of patients. Generally, various image techniques such as Computed Tomography (CT), Magnetic Resonance Imaging (MRI) and ultrasound image are used to evaluate the tumor in a brain, lung, liver, breast, prostate…etc. Especially, in this work MRI images are used to diagnose tumor in the brain. However the huge amount of data generated by MRI scan thwarts manual classification of tumor vs non-tumor in a particular time. But it having some limitation (i.e.) accurate quantitative measurements is provided for limited number of images. Hence trusted and automatic classification scheme are essential to prevent the death rate of human. The automatic brain tumor classification is very challenging task in large spatial and structural variability of surrounding region of brain tumor. In [7], automatic brain tumor detection is proposed by using Convolutional Neural Networks (CNN) classification. The deeper architecture design is performed by using small kernels. The weight of the neuron is given as small. Experimental results show that the CNN archives rate of 97.5% accuracy with low complexity and compared with the all other state of arts methods.

III. PROPOSED SYSTEM

The main goal of this research work is to design efficient automatic brain tumor classification with high accuracy, performance and low complexity. In the conventional brain tumor classification is performed by using Fuzzy C Means (FCM) based segmentation, texture and shape feature extraction and SVM and DNN based classification are carried out. The complexity is low. But the computation time is high meanwhile accuracy is low. Further to improve the accuracy and to reduce the computation time, a convolution neural network based classification is introduced in the proposed scheme.

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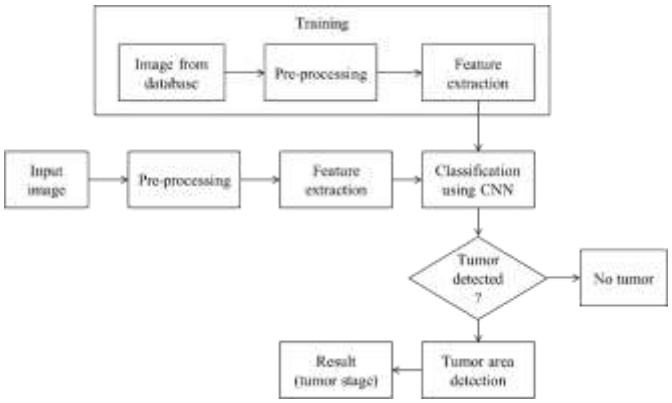


Fig.2. Proposed System

Input image is image from database (for training) and real time image (brain tumor detection). Pre-processing is a common name for operations with images at the lowest level of abstraction both input and output are intensity images. The aim of pre-processing is an improvement of the image data that suppresses unwanted distortions or enhances some image features important for further processing. Before discussing the extraction of feature points it is necessary to have a measure to compare parts of images.

The extraction and matching of features is based on these measures. Besides the simple point feature a more advanced type of feature is also presented. Feature extraction technique is used to extract the features by keeping as much information as possible from large set of data of image. Dataset is given to train CNN. Classification is performed using CNN.

IV. CONCLUSION

Brain tumor classification is very crucial in the domain of medical science. In this paper, we concentrated on developing a CNN classifier which classifies tumor. Initially, the proposed system preprocesses the image data. The preprocessing includes filtering images. Then the system classifies the images using the CNN model. Also the classification results are given as tumor or normal brain images. CNN is one of the deep learning methods, which contains sequence of feed forward layers. Also python language is used for implementation.

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