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Classification and Extraction of Brain Tumor using Hybrid Algorithm

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Abstract

Rapid growth of unwanted cells or abnormal accumulation of tissues that leads in the formation of tumor in brain is called Brain tumor. Tumor is always considered to be a dreadful disease, if not detected at the initial stage. As this has been a rapid growing threat among human race. Detection and extraction of such vulnerable dangerous diseases has become the most demanding one. In spite of existing techniques of detection, the accuracy has always been a challenging task. Misinterpretation is occurred during the evaluation of data sets of images, in detection of tumor which leads to a contradictory validation. Extraction of the tumor region from large data sets is has always been a grim. The extant innovations are Non- negative factorization (NMF) Principle Component Analysis (PCA), Convolutional Neural Network (CNN), K-means clustering algorithm, one-way analysis and variance (ANOVA) etc. In this research paper a proposed solution for the classification and extraction has been resolved by using hybrid algorithm. The hybrid consists of two algorithms further classified into two modules which consist of Convolutional Neural Network (CNN) and Deep Neural Network (DNN) respectively.

Keywords: *classification, CNN, DNN, extraction, hybrid, tumor.*

1. Introduction

The bizarre growth of the malignant tissues or cell which can causes serious hazard in brain that leads to a life threating scenario is called as brain tumor. The detection of the tumor is considered to be a vigorous and a perplexing task. Negligence of tumor detection ranges between 2 – 20% of error in clinical signification or radiology investigation. Hence this leads to the cutback accuracy rate in the survival of tumor detected patients. Grading of the tumor cells can genre from grade I to grade IV depending upon the consequential grade of the case .According to the grading of tumor cells grade I and grade II are considered to be in the early stage or benign tumor cells whereas grade III and grade IV is defined to be the compelling stage or malignant tumor cells.

Brain tumor is segregated into benign cells and malignant cells. Benign cells are not cancers cells and don't spread to nearby cells. But malignant cells are cancer cells and can spread rapidly to nearby cells causing extensive tumor. If benign cells recur it can be removed or requires further treatment such as radiation or chemotherapy. Malignant cells require aggressive treatment, including surgery, radiation, chemotherapy, and immunotherapy medications. In these cases, the survival rates of brain tumor affected in children are 70 % and in adults with a life span survival of 5 years depending upon the age group.

The input for this analysis is achieved using MRI images. Differentiation of grey matter and white matter using the other radiation (functional magnetic resonance imaging) helps in tumor detection of brain. This helps in determining the active region of tumor existence in the brain. In order to avoid the negligence of radiological investigation or clinical significance, in this analysis scheme usage of Convolutional Neural Network (CNN) and Deep Neural Network (DNN) is enforced for better accuracy rates.

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2. Literature Review

A. Hazra, et al. [1]. observed a technique in "Brain tumor detection based on segmentation using MATLAB" to detect and identify the tumor in brain from MRI images. The proposed idea consists of three stages: pre-processing, edge detection and segmentation. K-means clustering algorithm was used in the identification of tumor. But the drawback resulted in excess region besides the tumor section which caused in contradictory conclusion.

Rohini Paul Joseph, et al. [2]. analyzed a solution in "Brain tumor MRI image segmentation and detection in image processing". This existing concept claims to segment and cluster the MRI images using k- means clustering and morphological filter was used to gauge the missing portion. This helped in extraction only of the tumor portion in the brain which leads to fend of the other parts of the brain.

T.M. Shahiar Sazzad, et al. [3]. proposed a method "Development of automated brain tumor identification using MRI images". The objective is to assist the pathologist to detect brain tumor quickly with higher accuracy. This proposed method uses the technique of Principle Component Analysis (PCA) to detect the ROI (Region of Interest). The main advantage of this model is it reduces time and provides higher accuracy. The limitation of this model is that they possess a variability issue which has to be minimized for better result.

Rupsa Bhattacharjee, et al. [4]. analyzed a concept named "Brain tumor detection from MRI images: Image processing, slicing and PCA based reconstruction". The concept used is ANOA for the separation of variation due to the group of causes from the variation. The advantage is that the processed output remains intact with the tumor mass and volume as in the original MRI images. This method leads to the drawback with the inability in zooming and highlighting the tumor region.

Walaa Hussein Ibrahim, et al. [5]. proposed in "MRI brain image classification using Neural Network". They developed the model using linear regression. This is efficient in classification, easy in implementation and fast in execution with accuracy rate of 96.33 %. The disadvantage leads us to the usage of huge memory space which can cause shortage or overwhelming of memory storage.

Tonmoy Hussain, et al. [6]. proposed in "Brain tumor detection using Convolutional Neural Network". They obtained the analysis using FCM to segment the tumor in first model and Convolutional Neural Network in second model for tumor detection. FCM retains most of the relevant information when compared to other algorithms as its advantage. Limitations lead in the inability of working with large data sets and require more execution time.

3. Proposed Methodology

The Fig. 1. sequential diagram exhibits the flow of the functioning model beginning with the multiclass brain tumor datasets and tumor mask datasets that are fed to the model. This is then followed with the pre-processing of MRI images for CNN and DNN analyzers respectively. The model result depicts the type of tumour classified and segments the tumor region from the brain.

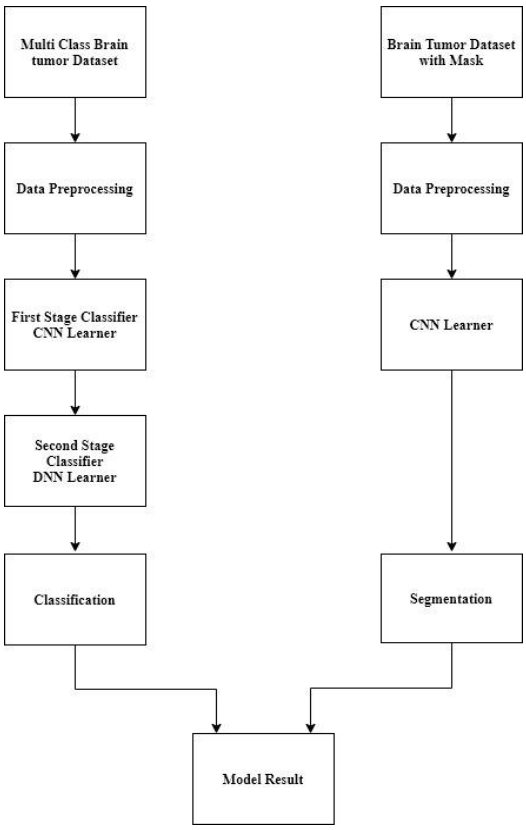

Figure 1: Sequential Diagram

The suggested model consists of one basic cycle with two phases that is implemented using Convolutional Neural Network (CNN) and Deep Neural Network (DNN) algorithm. The first phrase consists of classification and the second phase consists of segmentation for better accuracy rate when compared. Google co-lab environment helps in giving a real time replication of the process of the model. The two phases are classification phase and the segmentation phase respectively. The classification phase implies two sub flow sequence one using CNN and other DNN. In the segmentation phase only, CNN is used for the segmenting of the masked tumor. This leads in the progression of hybrid algorithm model.

A. Datasets: Multiclass brain tumor and Brain tumor mask

Multiclass brain tumor dataset consist of two or more types of tumor classes. This paper mainly focuses only on the primary multiclass brain tumor such as meningioma, glioma and pituitary. The Fig. 2. shows the Multiclass brain tumor dataset. **Brain tumor mask** is defined as the marking or the colour differentiation in and around the hidden tumor region in the MRI image of the brain which is demonstrated in Fig. 3. In which the tumor

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region has a lighter colour as compared to the non-tumor region.

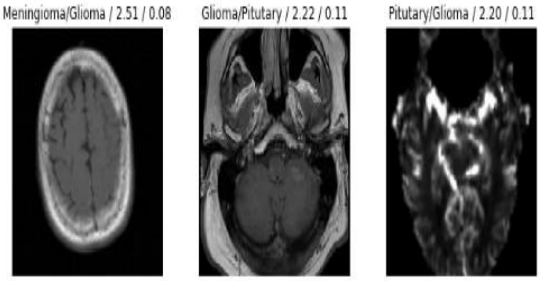

Figure 2: Primary Tumors

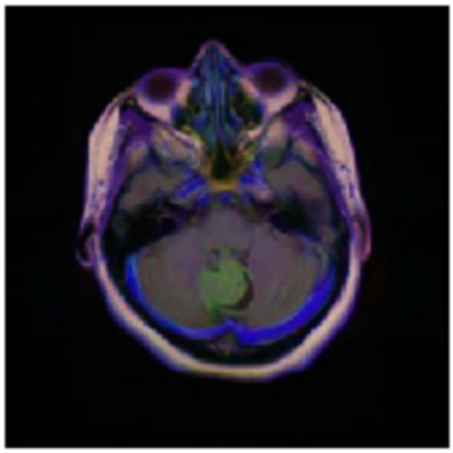

Figure 3: Brain Tumor Mask

B. Data Pre-processing

Data pre-processing is the method of collecting data from scratch and making it apt for the processing of the machine. In this model the datasets are pre-processed using CNN and DNN algorithms. The MRI- images are broken down into patches for activation of other layers before processing in CNN. In case of DNN the images are broken down to perceptron before the forward propagation process of MRI- images takes place.

C. Operation of Convolutional Learner / Convolutional Neural Network

Convolutional neural network is simply a neural network that is derived from biologically derived models. It has special operational linear equation that is used to analyse the images. The pre-processed datasets are further broken down to convolutional and pooling layer where the activated filter is used for the process of splitting, with altered functions. This process takes place till the extraction of the specific region of the tumor present in the brain is extracted from the fully connected network of nodes. In Fig 4. The classification analyzer helps in endorsing that the predicted result must be identical with the actual result. This aids in avoiding the confusion of classifying the type of tumor.

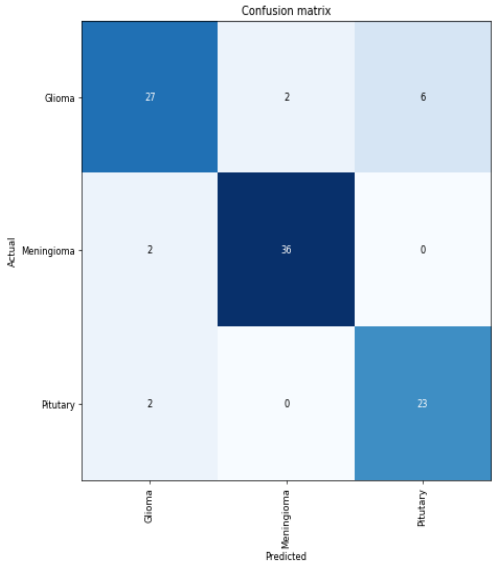

Figure 4: Classification Analyzer

D. Operation of Deep Neural Network

Deep neural networking is a type of neural network with higher level of complexity. These complexities are solved using special operational equations. The pre- processed MRI- image are broken down into neutrons or input vectors where each of these neutrons have an assigned value in the weighted channel. They consist of unique biased numbers. These biased numbers are then adjusted to the weighted sum of neutrons and the use of activated function takes place. This results in the activation of neurons; every activated neuron passes on the information to the next layer. This is carried on till the second last layer forming the network layer. The final activated neuron corresponds to the input image specification.

Figure 5: Segmentation Analyzer

The Fig. 5. consisting of an MRI image is obtained when segmentation analyser has been executed. The figure shows colour differences between the tumor boundary and the brain.

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E. Classification

The output obtained in the DNN algorithm is identified and labelled to the set of categories it belongs to. After the new observation made, according to the datasets used they are classified as the meningioma, glioma and pituitary which are the primary tumor types.

F. Segmentation

The process of segmentations is one of the crucial procedures that help in simplifying the result obtained byCNN. This technique helps is in limiting the specific region that is required. This aids in the precise mining of certain tumor region from the entire MRI-image.

4. Performance Comparison

In comparison with the previous work and this model, it has been witnessed [2] only the segmentation has been proposed and not detecting the type of tumor which is overawed with detection of tumor type. Similarly, in [3] the limitation that is found is variability issues that minimize the better result but, in this model cross verification is done to extract the best result. The limitation in paper in [6] is the inability of working with large dataset has been conquered in this model, providing the ability to work with larger dataset.

The graph in the Fig.7 delivers the model accuracy rate with every iteration performed that helps in avoiding the conflicting conclusion that radiologist faces. It has been observed from the fig.7 that there has been a constant increase in the iteration after increasing the number layers present in each iteration and fine tuning the batches of datasets depending upon the parameters requirement which leads the training process that was initially low due to model accuracy prediction. This study achieves an accuracy rate of 91% with the code implementation. Therefore, there is a better accuracy rate on the practice of hybrid algorithm when compared to individual characteristic models.

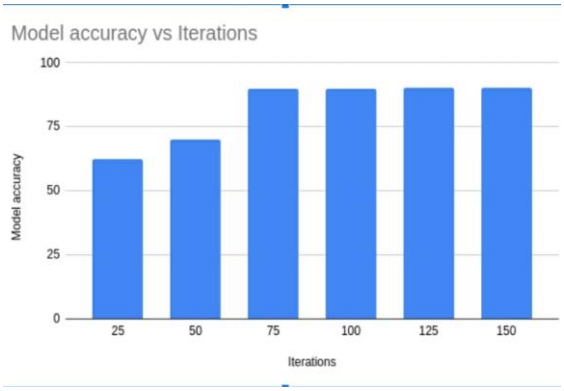
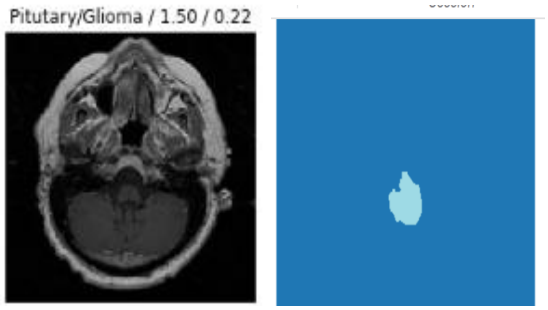


Figure 6: Efficiency of the Hybrid algorithm

5. Experimental Results

This model is justified by the proposed technique in which the result is obtained by acknowledging the output of CNN into DNN for better accuracy rates and as a result of double verification. It is then combined with the result of segmentation leading to the final experimental result that consists of the segmented tumor region and classified tumor type. The Fig.6. shows the model result obtained after the application of the analysers.



(a) (b)

Figure 7: (a) Classified MRI image, (b) Segmented MRI image

6. Conclusion and Future Scope

Detection of brain tumor has numerous approaches but finding the appropriate solution will help in giving better accuracy to avoid confusion in the field of radiology. This model is a combination of multiple characteristic methods, usage of CNN and DNN approaches are found to be suitable in order to produce an accurate and spontaneous result when it comes in classification and segmentation of the tumor. This model can be easily understood by any radiologist and can be used for a cross verification process to avoid contradictory statements. The future scope can be done in two ways, conversion of this model to view the classification and segmentation of 3 Dimensional images and building up the accuracy rate can be a challenging task due to the multiple mechanism taking place.

References

[1] A.Hazra “Brain tumor detection based on segmentation using MATLAB” 2017 International Conference on Energy, Communi- cation, Data Analytics and Soft Computing (ICECDS).

[2] Rohini Paul Joseph “Brain tumor MRI Image Segmentation and Detection in Image Processing “International Journal of Research in Engineering and Technology.

[3] T. M. Shahiar Sazzad “Development of Automated Brain Tumor Identification Using MRI Images” 2019 International Conference on Electrical, Computer and Communication Engineering (ECCE).

[4] Rupsa Bhattacharjee “Brain Tumor Detection from MR Images: Image Processing, Slicing and PCA Based Reconstruction” 2012 Third international Conference on Emerging

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ISSN: 0193-4120 Page No. 4503-4507

Applications of Information Technology (EAIT).

[5] Walaa Hussein Ibrahim "MRI Brain Image Classification Using Neural Networks"2013 International Conference on Computing, Electrical and Electronics Engineering (ICCEEE).

[6] Tonmoy Hossain" Brain Tumor Detection Using Convolutional Neural Network"2019 1st International Conference on Advances in Science, Engineering and Robotics Technology (ICASERT).