Performance Enhancement in Brain Tumor Identification using Hybrid CNN

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Abstract.
Automation is everywhere. This paper works towards automating the defect identification in MRI brain images. Owing to the volume of information in the image and noisy edges the process of segmentation and classification has been a great challenge for a long time. Through this work we introduce an automatic tumor detection technique to extend the accuracy and yield and to reduce the diagnosing time. The goal is classifying the tissues to 3 categories of traditional, benign and malignant. In MRI images, the number of information is just too lot of for manual interpretation and analysis. Throughout the past few years, tumor segmentation in resonance imaging (MRI) has become an associate degree of promising analysis space within the field of medical imaging system. Correct detection of size and placement of tumor plays a significant role within the diagnosing the tumor. A three stage diagnosing technique is proposed in this paper: pre-processing, feature extraction, and classification. The feature selections from the MRI images are obtained using Discrete Wavelet Transformation (DWT). The feature extraction is primarily designed using Gray Level Co-occurrence Matrix in CNN. In this paper, we propose a Hybrid Convolutional Neural network to classify the tumor and non-tumor brain images. Accuracy of classification is verified by comparing with the traditional learning models Support Vector Machine, CNN and Fuzzy systems.

Keywords: *Convolutional Neural Network, Hybrid-CNN, MRI image, Classification, Accuracy.*

1. INTRODUCTION

Brain is one of the largest and most complex organs in our human body and which consists of billons of cell. The formation of mass of abnormal cells in a human brain is termed as brain tumor. An un-identified tumor may cause unexpected pressure fluctuations and cause brain damage and lead to sudden death. MRI scan of a human skull will generate the brain images that would help in diagnosing a tumor. MRI images are more accurate than any other ultrasound scans. It provides clear picture of any abnormalities in the brain structure and helps in early diagnostics. Many a times, medical practitioners use automated software to locate and identify the details of tumor tissue. Convolutional Neural Networks (CNN) and Support Vector Machine (SVM) were the most predominant methods used in recent years due to their success rate in image processing techniquse[11]. Very recently, Deep learning (DL) models are over taking these models because of their learning capability and accuracy. They represent the complex relationships with least number of nodes like K-Nearest Neighbor (KNN).

II. RELATED WORK

The tumor and non-tumor images are separated using the Fuzzy C means logical system and Discrete Wavelet Transform (DWT) is used for feature extraction from the images[1]. Finally, tumor classification is done with Deep Neural Network (DNN). When DNN is compared with KNN, Linear Discriminant Analysis (LDA) technique the accuracy rate is less with high complexity and poor performance levels. A new bio-physio mechanical tumor development demonstration is exhibited to examine the progression by steps[2]. The technique was applied on Glioma type of tumour with singular edges to seizure the noteworthy tumor impact. The persistent techniques were consolidated to take a tumor development. The method provided the probability to implicitly segmented tumor mind pictures dependent on atlas-based enrollment. This method was predominantly utilized for cerebrum tissue segmentation even though there were computational overheads. A new multi-fractal (MultiFD) was proposed for feature extraction and the brain tumor detection and classification wasdone by using AdaBoost technique. The brain tumor and non- tumor images are classified using the improved AdaBoost classification and it was observed that the computational complexity was a little high[3]. In another method, the voxel of brain was classified by using the local independent projection-based classification (LIPC) method, however with compromises on accuracy[4]. A seeded tumor division strategy was proposed by Hamamci that removed the need to perform explicit regularization [5]. The seed determination and Volume of Interest (VOI) was determined for productive brain tumor division. Additionally tumor cut division was fused into this work with low complexity and hence reduced accuracy. Multi-modal brain cancer segmentation scheme was a combination of two segmentation methods and achieved high performance though complex [6]. The survey of brain tumor classification presents various segmentation methods such as Region based classification, threshold based classification, fuzzy C means classification, Margo Random Field (MRF) classification, deformable model classification [7]. The brain tumor diagnosis process are detected by using hybrid feature selection[8]. By using this GANNIGMAC, Decision Tree, the tumor is classified and features are extracted using this Bagging C based wrapper approach. Decision rules by hybrid selection is a combination decision tree, bagging ensemble classifier and Adaboost. The brain tumor classification and segmentation and classification is done by using a novel fuzzy based control technique [9]. Another technique used for brain segmentation is Fuzzy Interference System (FIS) created using supervised classification. It was recorded with improved performance but with reduced percentage of accuracy. The contrast of the image is removed by using the adaptive histogram equalization[10]. The Fuzzy CMeans method was adapted to classify tumor from the normal whole brain image. Then Gabor features were used in differentiating the abnormal cell from the whole brain image. Abnormality detection of brain MRI image was later done with K-Nearest Neighbor (KNN) classification at high complexity but lesser accuracy levels. Image enhancement with equalizer is used for vein recognition in palm images [19]. There are also optimal parameter choosing methods for medical applications [20].

III PROPOSED MODEL

The human brain system is shown by using plan and utilization of neural system. A human neural system is essentially utilized for vector quantization, estimation, information bunching, design coordinating, improvement capacities and order methods. The neural network is isolated into three kinds dependent based on the connections of neurons. Three predominant types of neural networks are feedback networks, feed-forward neural nets and recurrent nets. Feed Forward Neural nets are additionally categorized as single layer and multi-layer. The former consists of input layer and output layer but does not have any hidden layer while the

latter consists of additional hidden layers. In a typical neural network, picture can't adaptable. However, in convolution neural network, picture is adaptable. It would take 3D input volume to 3D yield volume (length, width, height). A typical Convolution Neural Network (CNN) comprises of information layer, few convolution layers, Rectified Linear Unit (ReLU) layer, optional pooling layer and completely associated layer [12]. In the convolution layer, the given information picture is isolated into different little locales. Component insightful actuation work is done in ReLU layer. A pooling layer is mainly utilized in case of need of down testing. The last completely associated layer is utilized in producing a class score or mark score esteem dependent on the possibility in between zero to one.

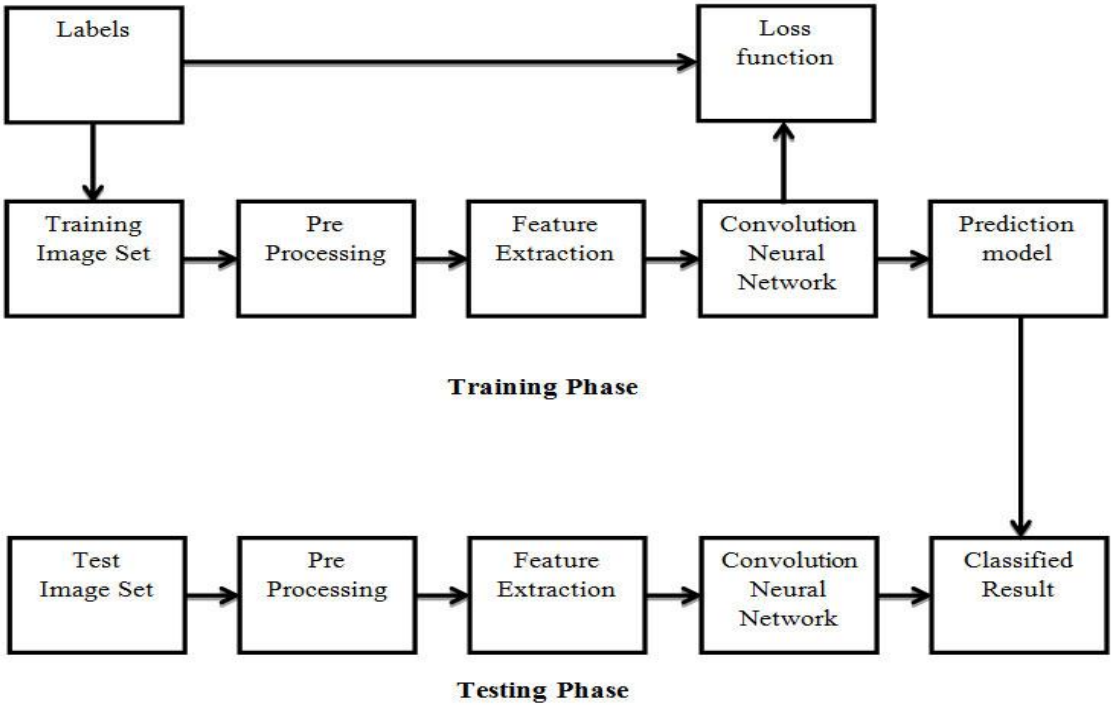

Fig. 1. Block diagram

The block diagram of brain tumor detection using a hybrid convolutional neural network is shown in Fig.1. The HCNN based brain tumor identification is separated into 2 stages, which are training stages and testing stages. The quantity of pictures is isolated into various class by utilizing image name, for example, tumor and non-tumor cerebrum picture. In the training stage, preprocessing, feature exaction and segmentation is performed to design a prediction model. The training data set is given appropriate naming. In the preprocessing stage, picture resizing is applied to alter the dimensions of a picture. At long last, the convolution neural network is utilized for programmed cerebrum tumor order. Cerebrum picture dataset is taken from image net source. Imagenet is a pre-trained model that assists in image processing tasks. On the off chance that is needed to prepare from the initial layer, we prepared the whole layer (i.e) up to closure layer to improve the time utilization. To maintain a strategic distance from this sort of issue, pre-trained brain tumor dataset is utilized for arrangement steps. In the proposed HCNN, the last layer of classification is done with python implementation. The loss function is determined by utilizing gradient decent algorithm .The crude image pixel is mapping with class scores by utilizing a score rating. The nature of specific arrangement of parameters is estimated by loss function. It depends on how well the initiated scores affirmed with the ground truth marks in the preparation information. The loss function score is essential to improve the model precision. Essentially, exactness is always high, whenever

loss function is kept minimum. The parameter 'slope esteem' is determined for misfortune capacity to register angle plunge calculation.

IV. HCNN BASED CLASSIFICATION

1. The MRI images are provided as input in the input layer of HCNN
2. The affectability of channel is diminished by leveling the convolution channel using subsampling
3. Sign exchanges starting with one layer then onto the next is constrained by activation layer
4. Speeding up training time is done with rectified linear unit (RELU)
5. The neurons in continuing layer is associated with each neuron in ensuing layer
6. During training Loss layer is appended toward the conclusion

V. RESULTS & DISCUSSION

Datasets were collected from different online resource and which consist of both tumor and non-tumor images. Brain tumor affected real case images are collected from the Radiopaedia. (BRATS) 2015 contains brain tumor segmentation images which are used as testing dataset. In the current work a hybrid convolution neural network is used to detect the brain tumor and the python language is used for simulation. The efficiency of the system is calculated by analyzing the training and validation accuracies. In the SVM method the brain tumor identification was difficult compared to other methods. The CNN method is used for classification and feature extraction. It was void of feature extraction steps. CNN provides feature value. In Fig.3. it shows the tumor and non-tumor images which are classified using CNN. And here the accuracy is proved to be high and computation time is low. In the Fig.3. It has the output of the brain tumor classification. Finally, the classification of tumor or non-tumor images was done by using that result we can calculate the probability score value. The probability score value for normal image is low and the probability score value for tumor image is high when compared to normal brain.

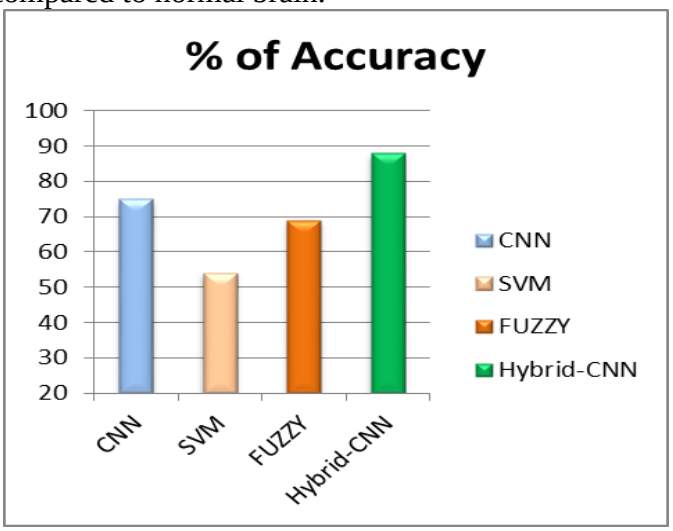

Fig 2. Statistics of proposed model

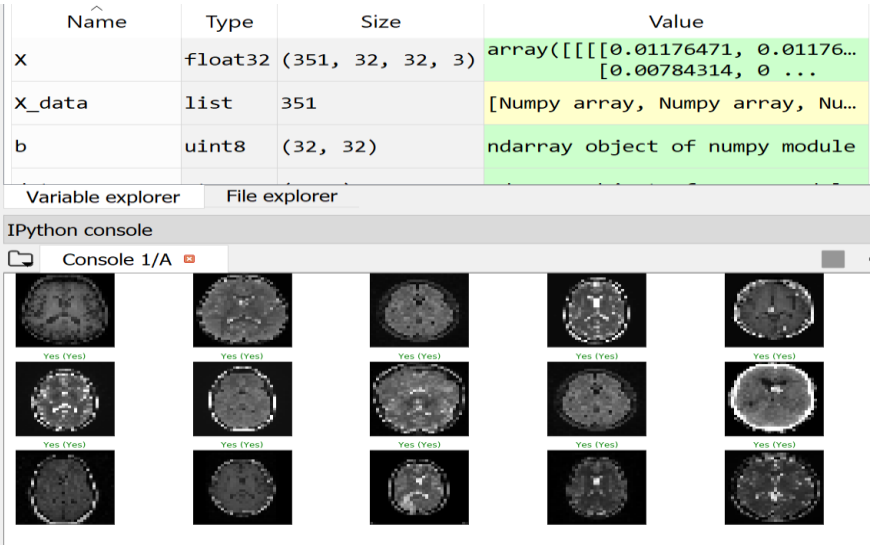

Fig. 3. Tumor and non-tumor images

VI. CONCLUSION

The fundamental objective of the current exploration work is to structure proficient programmed brain tumor grouping with high accuracy, performance and low complexity. Customary brain tumor segmentation was performed by utilizing Fuzzy C Means (FCM) based division. To improve the precision and to diminish the calculation time, a new method of Hybrid Convolution Neural Network based grouping is modeled and tested. Additionally Python language is utilized in the Anaconda framework for the model creation. Also, a Gradient decent based loss function with profoundness, width and accuracy were compared. The obtained results proved to be better than the existing state of art methods.

VII. FUTURE SCOPE

The pandemic situation around the globe raises an inevitable urge to find ways and methods in finding cure for the pandemic threats using technology [13]. Our Proposed model can be further extended with other deep learning techniques like ensemble classifiers, RNN, Reinforcement Learners for performance enhancement [14-18].

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