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A Review Paper on Automated Brain Tumor Detection

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Abstract - *One of the major leading death causes in the world is brain tumor. Early-stage brain tumor diagnosis has recently become a major topic of research. Many researchers have made their own efforts in diagnosing and predicting brain tumors, and each technique has a different accuracy rate, which varies for different situations and using datasets. Patient's survival rate can be increased by detecting the tumor at its early stages. Medical evidence shows that man-assisted manual classification can lead to inaccurate prognosis and diagnosis. This is mainly due to the diversity and similarity of the tumor and normal tissues. Recently, deep learning techniques to improve the accuracy of brain tumor detection and classification from magnetic resonance imaging (MRI) have shown good results. The main purpose of this review is to highlight some of the previous studies of deep learning used to predict brain tumor*.

Key Words: **Brain Tumor, MRI Images, deep learning**

1. INTRODUCTION

Medical problems related to the brain are the most critical and complex to diagnose and operate on. In India, statistics reveal 40,000 to 50,000 new brain tumor cases each year of which 20% are brain tumor cases in children. Abnormal cell growth in the human brain is called a brain tumor. There are many types of brain tumors. Some brain tumors are cancerous (malignant) and some are non-cancerous (benign). A tumor that develops in the brain or spinal cord is called a glioma and a tumor that develops from the meninges is called a meningioma. Abnormal cell growth in the pituitary tumor.

Early detection of a brain tumor is essential for effective. For medical image diagnosis, image can be obtained from a variety of imaging techniques, including positron emission tomography (PET), magnetic resonance imaging (MRI), and computed tomography (CT). MRI was found to be the best diagnosis for brain tumors. Unlike CT scans, MRI does not use radiation of X-rays which can cause damage. MRI images have a high resolution and are very detailed so they can detect even small things.

The tumor may appear as a white area or as a bright white pattern. Even though, these cells have other parts of the brain that are similar in nature, which can lead to misdiagnosis. Now MR images are very useful in a medical image processing. MRI is harmless because it is based on magnetic field and radio waves and does not pose any radiation risk to the human body. As tens of thousands of patients suffer from brain tumors each year, the use of deep learning techniques for the automatic detection and classification of brain tumors has become an area of interest. The common problems in manual detection of the brain tumors are the significant time requirements and the possibilities of misclassification due to the complexity of the problem.

Automatic brain tumor detection and classification methods are needed to reduce the diagnostic time and avoid human errors before making any decisions. This paper presents a deep learning (DL) strategy for automatic brain tumor diagnosis. Deep learning has been applied to many applications, such as pattern classification object detection, speech recognition and other decisions. Different learning strategies are suggested to detect brain tumors.

2. REVIEW ON DIFFERENT PAPERS

Yakub bhanothu et.al [4] this paper explains the automatic brain tumor detection and classification of MR images using the deep learning algorithm. The rapid R-CNN algorithm was used to locate tumor areas and classify them into three types: glioma, meningioma, and pituitary tumor. VGG-16 used a CNN architecture as the base layer for specific networks. Achieved improved mAP to detect brain tumors.

Ekam singh Chahal et.al [1] brain tumor detection using deep learning model combines two-pathway and cascade architectures to analyze and implement brain segmentation. The input cascade performs better than the MFC cascade.

Mohamed R Shoaib et.al [6] this paper describes a comparative study of four CNN based models for brain tumor detection. The findings are based on a four-class brain tumor MR image database. The CNN model based on transfer learning gives better results compared to the more advanced methods. The inception ResNet v2 model showed effective results with an accuracy of 86.80%.

Hassan ali khan et.al [5] brain tumor detection using three deep learning models mainly VGG-16, ResNet-50 and inception-V3 model. The VGG-16 model showed effective results with an accuracy of 96%.

Neba Sharma et.al [3] the VGG-16 pre-trained CNN model used the transfer learning approach with data enhancement to classify normal and abnormal brain MRI images and achieved 90% accuracy.

Yilmaz et.al [8] Fast R-CNN-based multi-channel architecture suggested to detect brain tumor from MRI. VGG-16, faster R-CNN, DenseNet-201, ResNet-50 and SRN models these are popular deep learning architectures the accuracy and performance of the proposed model are higher.

Arshia Rehman et.al [2] brain tumor classification using three deep learning models mainly AlexNet, GoogleNet and VGGNet. VGG 16 architecture achieved the highest accuracy of 98.69% in classification and detection.

Aykut diker et.al [7] brain tumor classification applied using three deep networks AlexNet, GoogleNet and ResNet-18. AlexNet model achieved the highest accuracy of 96% in classification and detection.

Year	Algorithm	Dataset	Description	Limitation	Accuracy
2019	Two path architecture, CNN, cascade architecture.	https://figshare.com/articles/dataste/brain_tumor dataset/1512427	This model was mainly focused on Glioblastoma. A new model was built which consisted of two path and cascade architecture.	Training time is still high.	Dice Index- 0.95 Sensitivity -0.925 Precision -0.961
2019	AlexNet, GoogleNet, VGG-16	BraTS dataset	Brain tumor classification using three deep learning models mainly AlexNet, GoogleNet and VGGNet.	Complexity of pre-processing. Time-complexity	Accuracy- 98.69%
2020	VGG-16	BraTS dataset	To implement the fast R-CNN algorithm, the VGG-16 deep conventional network architecture was used for the base network.	Very brief results	Glioma Tumor - 75.18% Meningioma- 89.45% Pituitary – 68.18%
2020	R-CNN algorithm, VGG-16	https://figshare.com/articles/dataset/brain_tumor_dataset/1512427	VGG-16, a CNN architecture was used as a base layer for the proposed networks (classifier network and region proposal network). This paper work can be extended further for calculating the percentage area of the tumor with respect to brain region of human.	Testing time is not illustrated. Complexity of region proposal network.	Glioma -75.18 Meningioma -89.45 Pituitary -68.18
2020	VGG-16, ResNet-50, Inception-v3	BraTS dataset	brain tumor detection using three deep learning models mainly VGG-16, ResNet-50 and inception-V3 model.	The model can be compared with more state-of-the-art models	Accuracy-96%.
2021	CNN Inceptionresnetv2	BraTS2015	An automated system was suggested for the diagnosis of brain tumors. The findings are based on a four-class brain tumor MR image database. The CNN model based on transfer learning gives better results compared to the more advanced methods.	Increased computational time because of feature fusion.	Accuracy- 86.80%
2021	AlexNet, GoogleNet, ResNet-18	Kaggle Dataset	comparison of different deep learning-based classification approaches for the classification of brain MRI images is presented.	Time complexity	Accuracy- 90.66%
2021	Fast R-CNN, DenseNet201, ResNet-50, SRN models	BRATS 2018	Fast R-CNN-based multi-channel architecture suggested to detect brain tumor from MRI.	Complexity of region proposal network.	Accuracy- 98.31%

Table-1: Comparison of the Review Paper

3. CONCLUSIONS

The paper presents a comprehensive overview of research activities on the classification of brain tumor MRI images into tumor and non-tumor classes using in deep learning. Automation of the brain tumor is an important task because of its volumetric data preference, sensitive features, and complexity in decision making. Recently, deep learning techniques to improve the accuracy of brain tumor detection and classification from magnetic resonance imaging (MRI) have shown good results. Brain tumor detection from MRI images is done in different ways and in the future different automatic methods will achieve more accuracy and efficiency.

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