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TITLE: Brain Tumor Detection Using Deep Learning

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Abstract

Brain tumor detection is a critical aspect of modern healthcare, as early diagnosis and accurate localization are vital for effective treatment and patient outcomes. Deep learning techniques have shown remarkable potential in addressing this challenge. This study presents a novel approach for brain tumor detection using deep learning mechanism. We employ a convolutional neural network (CNN) architecture that is tailored to analyze medical images, specifically magnetic resonance imaging (MRI) scans. The model is trained on a large dataset of annotated MRI images, enabling it to learn intricate patterns and features indicative of brain tumors. The CNN's multi-layered structure enables it to automatically extract relevant features, minimizing the need for handcrafted feature engineering.

Results demonstrate the effectiveness of the proposed approach, achieving high accuracy and sensitivity in brain tumor detection. This approach not only aids in early diagnosis but also offers the potential for real-time detection and localization, contributing to improved treatment planning. The use of deep learning in brain tumor detection holds promise for enhancing healthcare outcomes and reducing the burden on radiologists, paving the way for more efficient and accurate diagnosis and treatment of brain tumors.

Keywords: Brain tumor detection, Deep learning, Convolutional neural network (CNN), Medical images, Healthcare, Magnetic resonance imaging (MRI)

Introduction

A. Brain: The brain is largest and most complex organ in human body that serves as the center of the nervous system [6]. It is located in the head usually it is close to the sensory organ for senses such as vision.

B. Tumor: A tumor is tissue that is growing where it should not be. Another name of tumor is neoplasm [6]. A tumor is usually form as lump or mass. Tumors are either malignant(harmful) or benign(safe) tumors. Cancer for examples is malignant and sometime spreads to other places on body. Tumor can occur in many different parts of the brain, and it may be classified as primary tumor or secondary tumor.

C. Brain Tumor: A brain tumor occurs when abnormal cells from within the body. There are main two types of tumors malignant(cancerous) and benign (non-cancerous) [6]. The Cancerous or malignant tumors are divided into primary tumors, which starts within the brain, and the secondary tumors, which have spread from elsewhere, known as brain metastasis tumors. All types of brain tumors may produce more than one symptom that vary depending on the part of brain involved. These symptoms may include headaches, seizures, problems with vision, vomiting and mental changes.

D. Deep Learning: Deep Learning is specialized form of machine learning. Deep learning is an Artificial Intelligence function. In deep learning, classification can be performed directly from a dataset of images, sound or text. It can achieve excellent accuracy as compared to human performance. Deep learning model needs large amount of labelled data and many layered neural network architecture. Deep learning uses many neural network layers for advanced feature recognition and prediction. So, it is also called as deep neural learning or deep neural network. The deep neural network (DNN) is an artificial neural network (ANN) with multiple layers between the input and output layers each mathematical manipulation as such is considered a layer, and complex DNN structure have many layers, hence the name "deep" networks. DNN can model complex non-linear relationships. The applications of deep learning are cancer detection and speech translation. [4]

A brain tumor is an abnormal growth of cells within the brain. Brain tumors include the tumors inside cranium or/and in the central spinal canal. Normally in our body, new cells are produced which replace the old and damaged cells in a controlled manner. But in case of brain tumor, tumor cells go on multiplying uncontrollably [2]. As per the National Brain Tumor Society nearly 70,000 people in United States are suffering from primary brain tumor. Brain tumor is ranked as 10th most common tumor in India in 2021 [7].

Brain tumor is also referred to as intracranial neoplasm. The two types of tumors are malignant and benign tumors. Standard MRI sequences are generally used to differentiate between different types of brain tumors based on visual qualities and contrast texture analysis of the soft tissue. More than 120 classes of brain tumors are known to be classified in four levels according to the level malignancy by the World Health Organization (WHO). [3]

As the skull protects the brain, brain tumor detection at an early stage is only possible when a diagnostic tool is directed at the intracranial cavity. The presence of tumor is noticed by the Magnetic Resonance Imaging [MRI] scanning. Even in the MRI image of a brain tumor, the edges of tumor are not sharp, hence the segmentation results are not accurate, i.e. the segmentation may be over-segmented or under-segmented. This may happen at the initial stage of the tumors. So, the main objective of the proposed work is to get an enhanced form of the tumor image by applying different methods. [1]

Literature Review & Related work

Gao et al. [5] studies for the Alzheimer's disease early detection, this disease destroys the mental function of the brain. They have used two CNN models, 2D and 3D, and these models were trained by using the 2D and 3D Computerized Tomography images and the result is declared by combining the output of these two models. Some kind of Similar technology used in brain tumor detection.

Brain tumor detection in an early stage is a difficult task, as the imaging is quite unclear. The necessity of automated brain tumor segmentation and detection is high. To obtain an accurate MRI image of the brain tumor is challenging. An MRI image has high contrast images indicating regular and irregular tissues that help in differentiating the overlap margins. But in case of an early brain tumor, the edges of the image are not sharp which causes the segmentation results to be inaccurate, i.e. the segmentation may be over-segmented or under-segmented. This may happen at the initial stage of the tumors. So, the main objective of the proposed work is to get an enhanced form of the tumor image by applying different methods, including filtering. [1]

Analysis of Problem

The current system has certain problems in Brain tumor detection. It's important to note that advancements and changes may have occurred in the field of brain tumor detection since then, some of the ongoing challenges that were present at that time are Limited Access to High Quality Data, Ongoing Model Maintenance, False Positives and Negatives, Data Imbalance,Model Interpretability, Regulatory Compliance, etc.

Proposed Work and Objectives

The motivation behind this study is to detect brain tumor and provide better treatment for the sufferings. The abnormal growths of cells in the brain are called tumors and cancer is a term used to represent malignant tumors. Usually, CT or MRI scans are used for the detection of cancer regions in the brain. Positron Emission Tomography, Cerebral Arteriogram, Lumbar Puncture, Molecular testing is also used for brain tumor detection. In this study, MRI scan images are taken to analyze the disease condition. Objective of this project is i) identify the abnormal image ii) segment tumor region. Density of the tumor can be estimated from the segmented mask and it will help in therapy. Deep learning technique is employed to detect abnormality from MRI images. Multi-level thresholding is applied to segment the tumor region. Number of malignant pixels gives the density of the affected region. [3]

Brain tumor at early stage is very difficult task for doctors to identify. MRI images are more prone to noise and other environmental interference. So, it becomes difficult for doctors to identify tumor and their causes. So here we come up with the system, where system will detect brain tumor from images. Here we convert image into grayscale image. We apply filter to image to remove noise and other environmental interference from image. User has to select the image. System will process the image by applying image processing steps. We applied a unique algorithm to detect tumor from brain image. But edges of the image are not sharp in early stage of brain tumor. So, we apply image segmentation on image to detect edges of the images. In this method we applied image segmentation to detect tumor. Here we proposed image segmentation process and many image filtering techniques for accuracy.

References: (as per IEEE format)

1. Minu Samantaray, Millee Panigrahi, K.C. Patra, Avipsa S. Panda, Rina Mahakud "An adaptive filtering technique for brain tumor analysis and detection" 2016 10th International Conference on Intelligent Systems and Control (ISCO)

2. Sneha Grampurohit, Venkamma Shalavadi, Vaishnavi R. Dhotargavi, Megha Kudari, Mrs Soumya Jolad "BRAIN TUMOR DETECTION USING DEEP LEARNING MODELS" 2020 IEEE India Council International Subsections Conference (INDISCON)

3. Avigyan Sinha, Aneesh R P, Malavika Suresh, Nitha Mohan R, Abinaya D, Ashwin G Singerji "Brain Tumor Detection Using Deep Learning" 2021 Seventh International conference on Bio Signals, Images, and Instrumentation (ICBSII)

4. S. Pereira, A. Pinto, V. Alves, C.A. Silva. (2016). "Brain tumor segmentation using convolutional neural networks in MRI images", IEEE transactions on medicalimaging,pp.1240-1251, 2016. https://doi.org/10.1109/TMI.2016.2538465.

5. X.W. Gao, R. Hui, Z. Tian. (J2017). "Classification of CT brain images based on deep learning networks, Computer methods and programs in biomedicine",pp.49-56,Jan2017. https://doi.org/10.1016/j.cmpb.2016.10.007.

6. Retrieved from https://google.com, https://simple.m.wikipedia.org https://en.m.wikipedia.org

7. David N. Louis, Arie Perry, et al., "The 2016 World Health Organization Classification of Tumors of the Central Nervous System: a summary", Acta Neuropathol , Springer may 2016

8. H. E. M. Abdalla and M. Y. Esmail, "Brain Tumor Detection by using Artificial Neural Network," 2018 International Conference on Computer, Control, Electrical, and Electronics Engineering (ICCCEEE), Khartoum, 2018

9. P. K. Chahal, S. Pandey, and S. Goel, ''A survey on brain tumor detection techniques for MR images,'' Multimedia Tools Appl., vol. 79, nos. 29–30, pp. 21771–21814, May 2020.

10. B. Srinivas and G. S. Rao, "Unsupervised learning algorithms for MRI brain tumor segmentation," 2018 Conference on Signal Processing and Communication Engineering Systems (SPACES), Vijayawada, 2018, pp. 181-184

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