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Innovative Approaches and Breakthroughs in Brain Tumor Diagnosis through MRI Technology

Shabir Ahmad Rather

Department of Computer Applications, GDC Dooru, Anantnag, Jammu and Kashmir, India.

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ABSTRACT

The detection of brain tumors has been transformed by advances in medical imaging. The aim of this research article is to perform a thorough comparative analysis of several methods for using MRI technology to detect brain tumors. A thorough assessment of the literature, an analysis, and advancements in the use of MRI technology for brain tumor diagnosis are all included in this study. The study evaluates these methods' effectiveness, precision, and dependability in an effort to enhance brain tumor identification in medical practice.
Keywords: Brain Tumor, MRI, Deep Learning, Dataset

1. INTRODUCTION

Since MRIs, or magnetic resonance imaging, offer superior anatomical information and functional information without ionizing radiation, it has become a cornerstone in the evaluation of brain malignancies. The diagnosis, characterization, and treatment planning of brain tumors have been completely transformed in the last few years by creative methods and advancements in MRI technology.Numerous advancements have advanced the profession, from the use of machine learning algorithms to the improvement of neurosurgical operations, and from advanced imaging techniques to the integration of multimodal data.

2. LITERATURE REVIEW

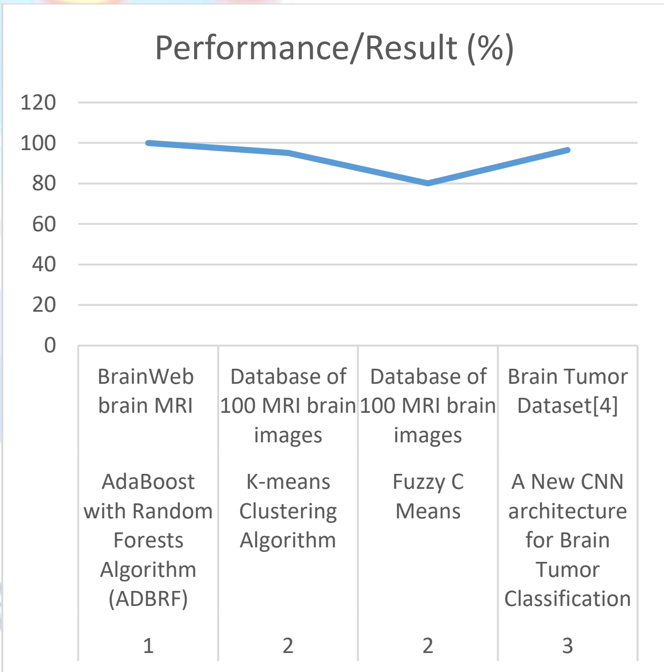
A brain tumor is an abnormal cell growth in the brain or central spinal canal. We take advantage of the artificial neural network technique, specifically the Probabilistic Neural Network (PNN) and Backpropagation Neural Network (BPN), to classify brain MRI scans as either malignant or noncancerous tumors. In image processing, picture segmentation is important because it makes it easier to identify questionable areas in medical images. In this study, we propose to use the K-means clustering algorithm to segment brain MRI images. Gray Level Co-occurrence Matrix (GLCM) has been used to extract textural information from the identified tumor. Training and Testing were the two phases of the suggested methodology's operation. The training phase yields the percentage of 6 as does the testing phase-correctness of each neural network parameter, providing the notion to select the optimal one for use in subsequent research.LeCun et al discusses the applications of deep learning in medical image analysis, including brain tumor detection in their study.Havaei et al Presents a deep learning approach for brain tumor segmentation in MRI scans.A non-contrast technique called MR CEST can detect and amplify metabolic substrates in tumor tissue that other MRI sequences are unable to pick up on. Aiming to differentiate between low-grade and high-grade gliomas, amide-CEST MRI has demonstrated efficacy in the clinical setting by helping to distinguish tumor from treatment-related changes, such as pseudo-progression, predicting treatment response of brain metastases following radiation, and providing early imaging biomarker evidence of GBM response to chemotherapy-radiation therapy. Finally, MGMT methylation in high-grade tumors and IDH mutation status in low-grade cancers may be detected by amide-CEST MRI. A strong magnetic field that is constant across the scan volume down to a few parts per million is required for MRI. The magnet field strength in commercial systems is expressed in Teslas, which range from 0.2 to 7 T. Most systems operate at 1.5 T.Research-grade whole-body magnetic resonance imaging systems run at 9.4T, 10.5T, 11.7T, and other energies. Higher field whole-body MRI systems, like those with a T value of 14 or higher, are currently in the conceptual proposal or engineering design phases.Digital picture usage is becoming a topic of great interest in various fields, including medical technology applications among others. There are numerous instances where decision-making, analysis, and interpretation are aided by image processing. The main purpose of image processing is to enhance the quality of images for either human interpretation or machine perception alone.The goal of this work is to provide an overview and comparative analysis of the various approaches used in automatic MRI brain tumor detection. Techniques for classifying brain images are investigated. The identification of brain tumors by magnetic resonance imaging (MR imaging) is crucial for medical diagnosis as it offers insights into anatomical structures that are essential for treatment planning and patient monitoring.This research develops a system for the detection and classification of brain tumors. Preprocessing and feature extraction are two image processing approaches that have been used to identify brain tumors in MRI data. In this research, the Gray Level Co-occurrence Matrix (GLCM) is used to extract textural information from the discovered tumor.To distinguish between an aberrant and healthy MRI brain image, SVM and the K-Nearest Neighbor classifier are utilized.

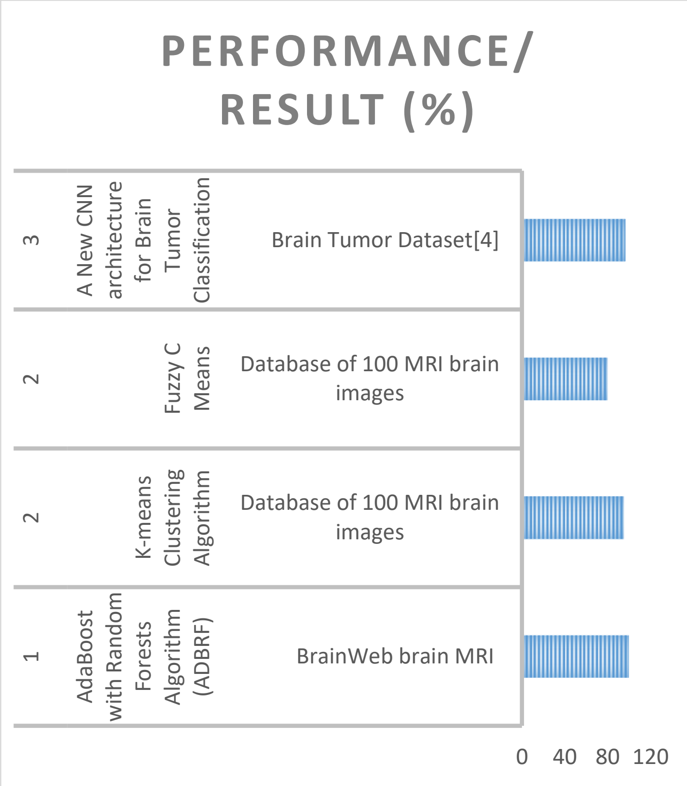
3. COMPARATIVE STUDY

Ref.	Technique/s Used	Dataset	Performance/Accuracy/Result (%)
1	AdaBoost with Random Forests Algorithm (ADBRF)	Brain Web brain MRI	100
2	K-means Clustering Algorithm	Database of 100 MRI brain images	95
2	Fuzzy C Means	Database of 100 MRI brain images	80
3	A New CNN architecture for Brain Tumor Classification	Brain Tumor Dataset [4]	96.56

4. FIGURES

The figures shown below explain very easily that whatever we have mentioned in the comparative table can be understand easily.





5. CITATION

The following sources are all cited in this article with references.

- Forajournalarticle,refer[1]-[3],[5]-[19]
- Foraonlinesource,refer[4],[20]-[25]
- Forathesis,refer[26]-[27]

6. CONCLUSION

Every method has benefits and drawbacks and overall, this study emphasizes how crucial it is to use a variety of methods when using MRI technology to diagnose brain tumors. The study provides insights into a few techniques' performance, opening the door for better healthcare approaches that will enable more precise and trustworthy brain tumor identification

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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