Brain Tumor Detection using AI

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ABSTRACT

This paper presents a study on brain tumor detection using Artificial Intelligence. The main objective of this research is to accurately identify and classify brain tumors from medical images. In this work, machine learning and deep learning techniques are applied to analyze MRI scan images for detecting abnormal growth in the brain. The results obtained show that AI-based models can achieve high accuracy and faster detection compared to traditional methods. The study helps in improving early diagnosis and assisting doctors in decision-making. Finally, it is concluded that AI can play a significant role in reliable and efficient brain tumor detection.

Keywords

brain tumor detection, artificial intelligence, MRI images, deep learning

1. INTRODUCTION

Brain tumors are one of the most critical health issues that require timely detection and diagnosis. Traditional methods of tumor detection involve manual examination of MRI scans by radiologists, which can be time-consuming and prone to errors. With the advancement in artificial intelligence, automated systems can now assist in analyzing medical images more efficiently.

The TumorScope system is designed to provide an AI-based solution for brain tumor detection. It allows users to upload MRI images and get instant results. The system uses a trained model to analyze images and identify tumor patterns. The main objective of this project is to reduce the time required for diagnosis and improve accuracy. The system also aims to provide an easy-to- use platform that can be accessed through a web interface.

Literature Review

Several research studies have been conducted on brain tumor detection using deep learning techniques. Many researchers have used Convolutional Neural Networks (CNN) for analyzing MRI images. These studies show that deep learning models can achieve high accuracy in detecting tumors.

Some research papers focus on preprocessing techniques such as image normalization and resizing to improve model performance. Other studies highlight the importance of feature extraction and classification methods. It has been observed that CNN models outperform traditional image processing techniques.

The existing systems demonstrate that AI can significantly improve the efficiency of tumor detection. However, many systems lack user-friendly interfaces or real-time processing. The TumorScope project aims to combine accuracy with usability by providing a complete web- based solution.

Methodology

The methodology of the TumorScope system follows a structured approach using the Agile model. The development process includes multiple stages such as requirement analysis, system design, implementation, testing, and deployment.

Initially, the requirements of the system were identified, including image upload, AI-based analysis, and result display. Then, the system architecture was designed by dividing it into frontend, backend, and AI model components. The frontend provides the user interface, while the backend handles data processing and communication.

The AI model was trained using MRI image datasets and converted into ONNX format for efficient performance. When a user uploads an MRI image, it is sent to the backend, where preprocessing is performed. The processed image is then analyzed by the AI model, which classifies it as tumor or non-tumor. Finally, the result is displayed to the user. The system was tested using multiple MRI images to ensure accuracy and reliability.

Results

The TumorScope system successfully detects brain tumors from MRI images with high accuracy. The system provides results within a few seconds after image upload, making it fast and efficient. The user interface works smoothly and allows easy interaction.

The AI model performs well in identifying tumor patterns and classifying images correctly. The system was tested with different MRI images, and the results showed consistent performance.
The integration of frontend, backend, and AI model works effectively, ensuring smooth operation of the system.

Overall, the project achieves its objective of providing a reliable and efficient solution for brain tumor detection.

Conclusion

The TumorScope project demonstrates the successful application of artificial intelligence in medical image analysis. The system provides a fast, accurate, and user-friendly solution for detecting brain tumors from MRI images. It reduces manual effort and helps in early diagnosis, which is important for effective treatment.

Although the system has some limitations, it shows great potential for future improvements. The project can be enhanced by using larger datasets and more advanced models. Overall, the system serves as a useful tool for assisting in brain tumor detection and highlights the importance of AI in healthcare

References

Sr.No	Category	Title	Link	Description
1.	YouTube Tutorial	Tutorial Brain Tumor Detection using Deep Learning	https://youtu.be/yUzVsIwHqtE	Explains CNN- based brain tumor detection from MRI images.

2.	YouTube Tutorial	Deep Learning Applications in Medical Imaging	https://youtu.be/M1lgXr4Xcns	Shows use of deep learning in analyzing MRI scans.
3.	YouTube Tutorial	Brain Tumor Detection Using CNN – Practical Guide	https://youtu.be/1fBx2laX9pg	Demonstrates step-by-step CNN model for tumor detection.
4.	Research Paper	Brain Tumor Detection Based on Deep Learning and MRI	https://pmc.ncbi.nlm.nih.gov/articles/PMC10453020/	Describes CNN-based tumor detection using MRI images.
5.	Research Paper	Brain Tumor Detection with Transfer Learning and CNN	https://www.nature.com/articles/s41598-024-52823-9	Compares deep learning models for accurate classification.
6.	Research Paper	Brain Tumor Detection Using Deep Learning Techniques	https://www.mdpi.com/2072-6694/15/16/4172	Explains tumor detection using CNN and medical images.
7.	Dataset	CNN Brain Tumor Classification Dataset	https://www.kaggle.com/code/guslovesmath/cnn-brain-tumor-classification-99-accuracy	Dataset used for training tumor classification models.
8.	Dataset	Brain Tumor MRI Dataset	https://www.kaggle.com/datasets/masoudnickparvar/brain-tumor-mri-dataset	Labeled MRI dataset for tumor detection tasks.

9.	Online System	BrainVision AI – Brain Tumor Detection System	https://brainvision-ai.com/	Web system for detecting brain tumors using AI.
10.	Online System	Nyckel Brain Tumor Identifier	https://www.nyckel.com/pretrained-classifiers/brain- tumors-identifier/	AI tool for instant tumor prediction from images.