ARTIFICIAL INTELLIGENCE

PROJECT PROPOSAL

Can Machines Think Like Us?

BRAIN TUMOR DETECTION USING DEEP LEARNING

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Abstract

Brain tumor diagnosis using MRI scans is a critical but time-consuming task that requires expert interpretation. Manual analysis of MRI images may lead to delayed diagnosis and human error, especially under high clinical workload. This project proposes a deep learning–based approach for automated brain tumor detection and classification using MRI images. A Convolutional Neural Network (CNN) model is developed to classify MRI scans into multiple categories, including glioma, meningioma, pituitary tumor, and normal cases. The model learns relevant features directly from image data without manual feature extraction. Experimental results demonstrate high classification accuracy, indicating that deep learning can serve as an effective decision-support tool in medical image analysis.

Problem Statement

Brain tumors pose serious health risks, and early detection is essential for effective treatment. Traditional diagnosis relies heavily on radiologists manually examining MRI scans, which is time-intensive and prone to subjective interpretation. With the increasing number of medical images generated daily, there is a need for an automated and reliable system that can accurately detect and classify brain tumors from MRI images. This project aims to address this problem by applying deep learning techniques to improve diagnostic efficiency and accuracy.

Objectives

The main objectives of this project are:

- To develop an automated system for brain tumor classification using MRI images
- To apply deep learning techniques for feature extraction and classification
- To evaluate the performance of the model using standard metrics
- To demonstrate the effectiveness of CNNs in medical image analysis

Proposed Methodology

The proposed system is based on a deep learning approach using Convolutional Neural Networks (CNNs). The methodology includes the following steps:

1. **Dataset Collection**
   MRI brain images are obtained from a publicly available dataset containing labeled tumor and non-tumor cases.
2. **Data Preprocessing**
   Images are resized, normalized, and augmented to enhance model generalization and reduce overfitting.
3. **Model Development**
   A CNN architecture is designed consisting of convolutional layers, pooling layers, and fully connected layers for classification.
4. **Training and Validation**
   The dataset is split into training and validation sets to evaluate model performance.
5. **Evaluation**
   Model performance is measured using accuracy, precision, recall, and confusion matrix.

Algorithms / Tools to be Used

Algorithms

- Convolutional Neural Networks (CNN)
- Softmax classifier
- Backpropagation optimization

Tools & Technologies

- Python
- TensorFlow / Keras
- Google Colab
- NumPy, Pandas
- Matplotlib, Seaborn

Expected Outcomes / Deliverables

- A trained deep learning model for brain tumor classification
- Performance evaluation metrics and visualizations
- Confusion matrix and classification report
- Complete project report and presentation
- Demonstration of the working model

Project Scope

The scope of this project is limited to classification of brain MRI images into predefined tumor categories. The system is intended as a decision-support tool and not as a replacement for professional medical diagnosis.

Conclusion

This project proposes a deep learning–based solution for automated brain tumor detection using MRI images. By leveraging Convolutional Neural Networks, the system aims to achieve high accuracy and reliability while reducing the dependency on manual analysis. The successful implementation of this project will highlight the potential of deep learning in healthcare and medical image processing.

References

1. Brain Tumor MRI Dataset – Kaggle
2. TensorFlow and Keras Documentation
3. Research articles on deep learning for medical image analysis