Early Detection of Brain Tumor in MRI Images using Open by Reconstruction and Convolution Neural Networks

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Introduction

- MRI is a non-invasive imaging method for studying the human body's internal structure and function.
- MRI images are categorized as T1-weighted and T2-weighted, but they are often affected by noise.
- Manual analysis of brain MRI images is time-consuming and challenging due to noise interference.
- Computer-Aided Detection (CAD) systems assist in accurate and efficient brain tumor diagnosis.
- This paper presents an intelligent CAD system for automatic brain tumor detection and classification.
- Malignant brain tumors, including High-Grade Glioma (HGG), are life-threatening and require early detection.

Objective

- Develop an intelligent Computer-Aided Detection (CAD) system for automatic brain tumor detection and classification.
- Reduce the time-consuming and challenging process of manually analyzing noisy brain MRI images.
- Improve the accuracy of brain tumor diagnosis, especially in distinguishing malignant tumors, including High-Grade Glioma (HGG), which can be life-threatening.

Methodology

- CAD System Development Sequence
- Data Set
- Pre-Processing
- Filtering
- Skull Stripping
- Open by Reconstruction
- Thresholding Segmentation

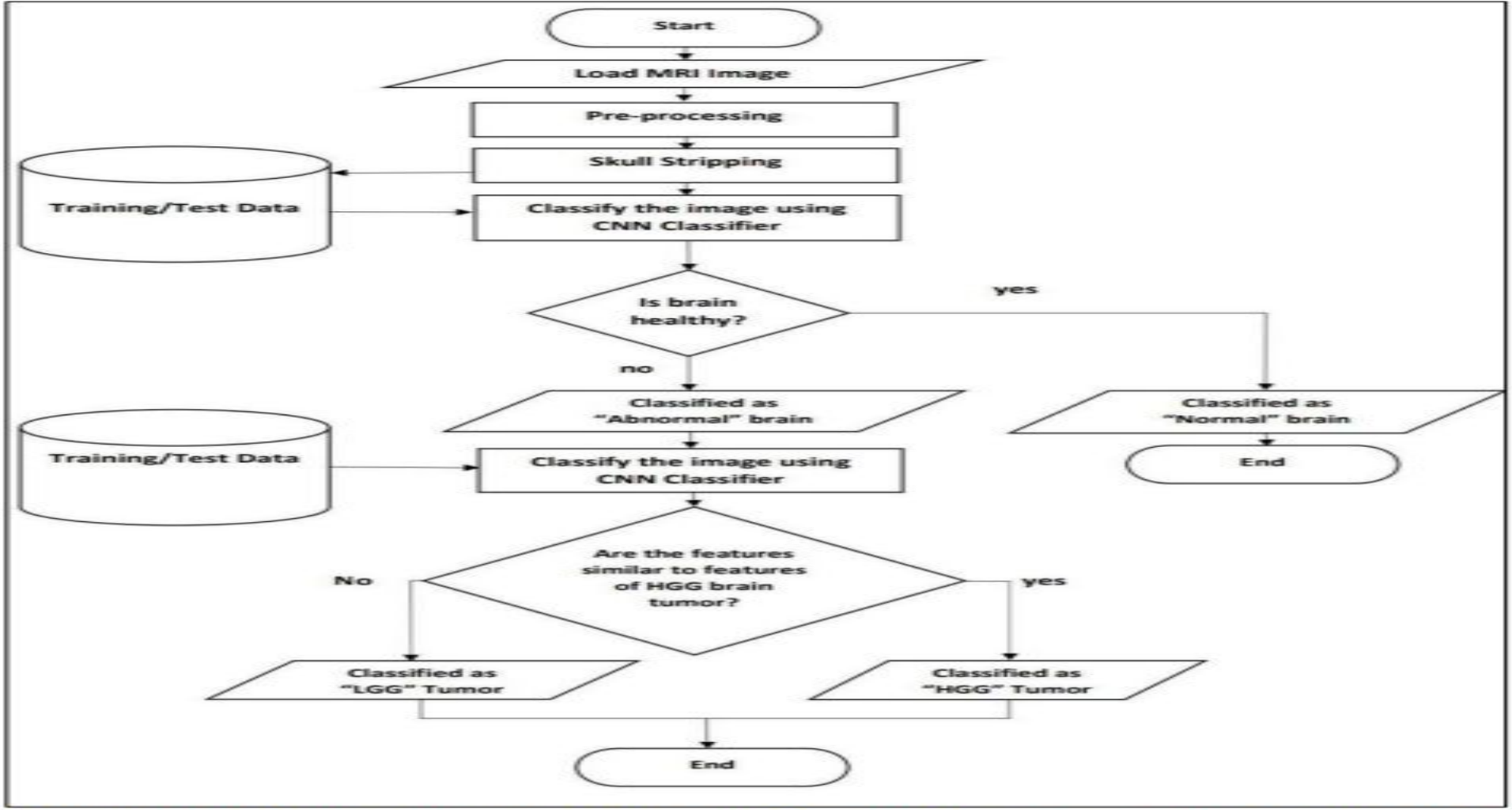

Figure 1: Flowchart of the steps involved in the detection of brain MRI

Results and Discussion

- The CAD system sequentially processes brain MRI images, beginning with pre-processing and skull stripping.
- Two CNNs are employed for classification, where the first CNN distinguishes normal and abnormal brain images, and the second CNN identifies tumor type.
- The achieved accuracy for the first CNN is 92.3%, with a sensitivity of 87.17% and specificity of 97.43%. The second CNN attains an accuracy of 98.4% for classifying HGG.
- Limitations include the system's compatibility with only axial anatomical planes, not covering sagittal and coronal planes.

Conclusion

- Extend testing to larger datasets with diverse age groups and anatomical views of brain MRI for increased accuracy and applicability to other medical domains.
- Enhance the system's compatibility with multiple anatomical planes and MRI image types, such as T1-weighted and flair type MRI images.

Future Work

- presented a CAD system for brain MRI image classification.
- The system processes images through pre-processing, skull stripping, and two CNNs for classification.
- Achieved accuracy: First CNN - 92.3%, Second CNN - 98.4% for HGG classification.
- System limitations: Works only with axial anatomical planes.

Thank you!