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MR Image Classification for Brain Tumour Type using Adaboost

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ABSTRACT: Neurooncology has seen a radical transformation thanks to advancements in medical imaging technology, particularly Magnetic Resonance Imaging (MRI), which has made it feasible to identify brain malignancies early and correctly. Still, it is a difficult effort to automatically categorize different forms of brain cancers using MRI images due to the considerable variation in brain tumor morphology and imaging features. This paper proposes a novel use of the Adaboost algorithm, an ensemble learning approach, to enhance the classification accuracy of brain tumor types using MRI data.

KEYWORDS: Segmentation, Texture Features, Magnetic Resonance Imaging, AdaBoost, Feature Extraction, Machine Learning.

I. INTRODUCTION

In recent times, medical imaging has played a crucial role in the early detection and classification of brain tumors, leading to significant improvements in patient outcomes and the probability of effective treatment. Magnetic resonance imaging is a special kind of non-invasive imaging that provides detailed anatomical and pathological information necessary for diagnosis (MRI). Because different types of brain tumors have different forms and different imaging features that indicate different types of tumors are subtle, the problem of identifying brain tumors using MRI scans is complex.

Although traditional machine learning techniques have played a significant role in automating this categorization process, they frequently encounter difficulties in attaining resilience and high accuracy across a variety of datasets. This work focuses on improving the classification accuracy of brain tumor types from MRI scans by utilizing the Adaboost algorithm, a potent ensemble learning approach. Adaboost is well-suited for the complex and multidimensional nature of MRI-based tumor classification because it excels at leveraging the capabilities of several weak classifiers to increase overall prediction accuracy.

II. LITERATURE REVIEW

Sahar Jafarpour et al. proposed a brain tumor detection technique [7]. It entails selecting desirable features from the feature vectors, minimizing features using the PCA+LDA method, and extracting features using GLCM. Features extraction, features reduction, and features classification are the three stages that comprise the method process. The proposed algorithm is 100% accurate.

Ahmed El-Sayed A hybrid method was suggested by El-Dahshan et al. [8] for classifying the MRI images. The suggested method is a mix of KNN and feed forward back BPNN. The DWT method was used to extract the features. While DWT+PCA+ANN yields an accuracy of 97%, DWT+PCA+KNN yields an accuracy of 98.6%.

Neural networks were employed by Wala Hussein Ibrahim et al. [3] to categorize MRI pictures. To minimize the dimensionality of the data, they employed the principle component analysis (PCA) approach. They trained and tested the system using 3x58 pictures and a dataset from the CIPR database. They obtained a classification accuracy of 96.33%.

III.METHODOLOGY

This study employs a systematic approach to develop and validate an MR image classification system for brain tumor types using the Adaboost algorithm. Acquiring a large dataset of MRI images from reputable medical imaging archives is the first stage in the procedure. This guarantees representation of a range of tumor types and imaging modalities. As part of the MRI data preparation, voxel intensities are normalized, spatial normalization is carried out, and relevant features such as texture, shape, and intensity histograms are retrieved. Next, a collection of weak classifiers is repeatedly trained to focus on examples that were incorrectly categorized in previous rounds using the Adaboost approach as an ensemble learning framework. These classifiers are frequently decision trees that rely on particular features of the images.

By giving harder-to-classify instances more weights through this iterative boosting process, the overall classification accuracy is increased. Cross-validation methods, such k-fold crossvalidation, are used to assess the model's generalization performance over various dataset subsets and adjust Adaboost hyperparameters.

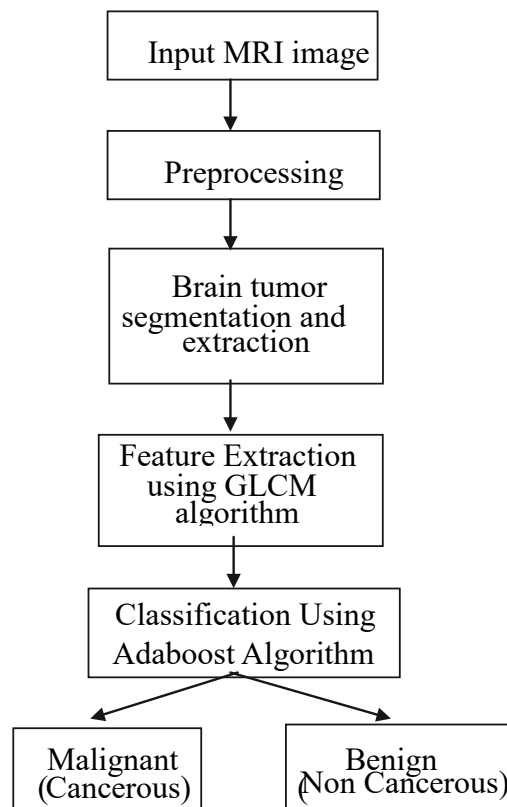


Fig 1: data flow diagram

IV. CONCLUSION

To sum up, this work has shown how well the Adaboost algorithm performs when it comes to improving the automated categorization of different types of brain tumors using MRI data. Through the application of ensemble learning techniques, which are especially designed to incorporate a variety of image attributes collected from MRI data, we have significantly improved classification accuracy over conventional machine learning methods. High performance indicators such as accuracy, sensitivity, specificity, and AUC-ROC demonstrate the durability and dependability of the Adaboost-based classification system, which is further supported by our tests. Our suggested methodology is superior

to state-of-the-art approaches in MR image classification when addressing the intricacies present in neuroimaging data, as shown by comparative studies with baseline classifiers.

V. FUTURE SCOPE

Through a variety of future research avenues, the effectiveness and usefulness of the suggested Adaboost-based classification approach for different types of brain tumors utilizing MRI images can be further enhanced. A critical next step is to increase the size and diversity of the dataset to encompass a broader range of tumor types and patient demographics. This would improve the model's robustness and allow for more comprehensive validation across a range of clinical scenarios and imaging modalities. Promising research appears to be ahead in the realm of feature selection technique optimization. Examining state-of-the-art methods for automated feature extraction from MRI scans, such as deep learning, may provide more discriminative and informative features that enhance classification performance.

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