

Deep Learning Model for Enhanced Joint Classification of Parkinson's and Alzheimer's Diseases from Challenging Datasets

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CHALLENGE

Overlapping features between Parkinson's and Alzheimer's diseases in brain regions, posing a challenge for doctors to accurately make diagnostic decisions during analysis of medical images.

PROBLEM STATEMENT

Parkinson's and Alzheimer's diseases are life-threatening diseases that, annually, cause millions of deaths worldwide. The widely used traditional practice to diagnose these neurological diseases involves manual intervention, a time-consuming and relatively inaccurate approach. In essence, Parkinson's and Alzheimer's diseases are characterized by overlapping features that can hardly be distinguished. This challenge has invited researchers to devise advanced methods, including those based on deep learning, to effectively classify salient features of the diseases. Concerned by the challenge and continuing efforts by researchers, we have developed a deep learning model that generates promising classification results, outperforming the existing classical models.

MAIN OBJECTIVE

Our research project aims to enhance the performance of classifying Parkinson's and Alzheimer's diseases. This aim will generally be achieved by devising effective deep learning models that can more accurately classify the diseases.

SPECIFIC OBJECTIVES

- ❑ Establishment of requirements for joint classification between Parkinson's and Alzheimer's diseases by using deep learning methods;
- ❑ Development of a deep learning model for a joint classification of the diseases;
- ❑ Performance evaluation of the proposed model.

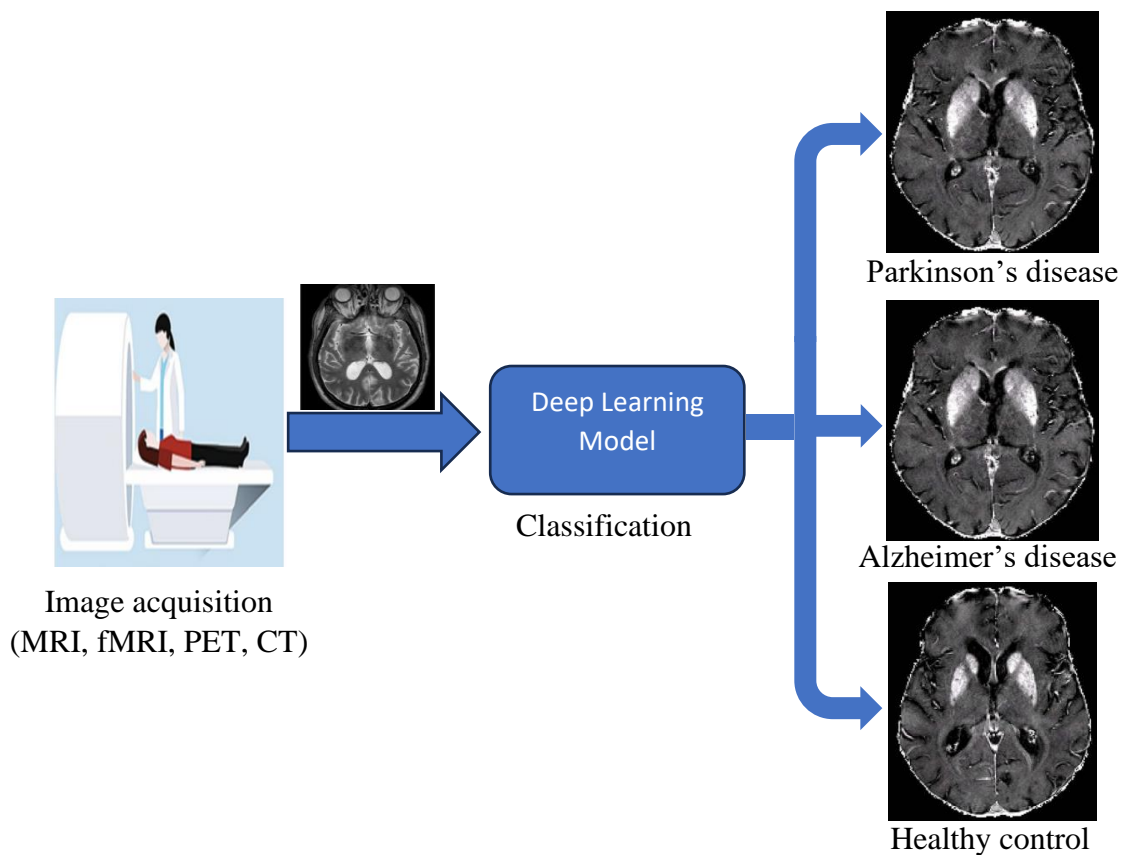
SIGNIFICANCE

Our study can positively impact the medical field by improving the traditional practice of diagnosing Parkinson's and Alzheimer's diseases.

METHODOLOGY

The following methodologies were followed to generate results:

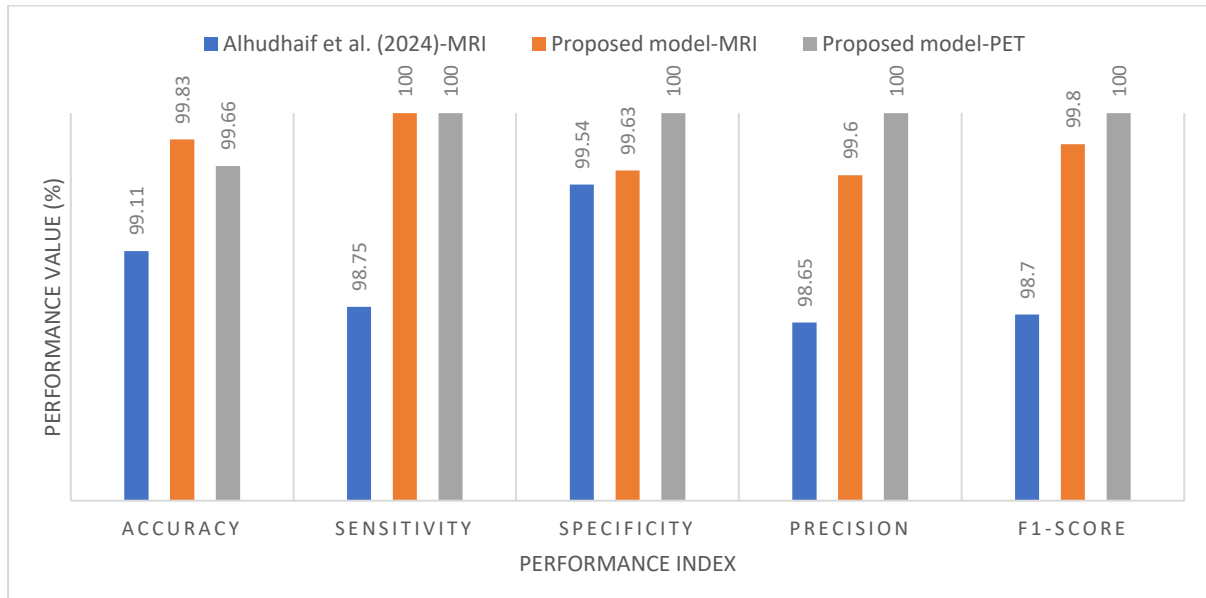
- ❑ Dataset collection from online credible sources; dataset pre-processing;
- ❑ Design and training of a deep learning model without transfer learning from pre-trained models;
- ❑ Simulation of the designed model on the JupyterLab using Python;
- ❑ Evaluation of the model using performance metrics: accuracy, sensitivity, specificity, precision, and F1-score.



RESULTS

Dataset characteristics:

- ✓ Dataset format: PNG
- ✓ Dataset modality: MRI, PET
- ✓ Dataset source: Kaggle for MRI, ADNI and PPMI for PET
- ✓ Dataset size: 7,367(MRI), 7329(PET)



OUTPUTS

- Deep learning model and algorithm for joint classification of Parkinson's and Alzheimer's diseases;

OUTCOMES

This research project has the following prospective outcomes:

- Improved experience and increased efficiency of doctors in diagnosis of Parkinson's and Alzheimer's diseases;
- Reduced time and improved convenience in generating diagnostic classification results of Parkinson's and Alzheimer's diseases;
- Improved accuracy of classification results;
- Improved quality of delivery of medical services to patients with Parkinson's and Alzheimer's diseases.

CONCLUSION

The proposed model generates outstanding results with competitive performance values of accuracy, sensitivity, specificity, precision, and F1-Score against exiting research works.