G H RAISONI COLLEGE OF ENGINEERING AND MANAGEMENT, PUNE

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Department of Artificial Intelligence

Innovative Deep Learning Approach for Parkinson's Disease Prediction: Leveraging Convolutional Neural Networks for Early Detection

Parkinson's disease (PD) is a complex neurodegenerative disorder that affects millions of people worldwide. The disease is progressive, meaning that it gets worse over time. There is no cure for PD, but early diagnosis and treatment can help to slow the progression of the disease and improve quality of life. In this study, we introduce an innovative automated diagnostic model using CNN that gives an appropriate output about if the person is diagnosed with PD or not.

Dataset and Features:

The dataset is gathered from the Parkinson's Progression Markers Initiative (PPMI). We are Specifically using, the dataset containing a total no of 31,436 MRI scans in the Digital Imaging and Communication in Medicine (DICOM) format. Within this dataset, there are 18,690 MRI scans related to Parkinson's Disease (PD) and 12,746 scans representing Healthy Controls (HC). Further, the input dataset is divided into three proportions: 80% for training, 10% for validation and 10% for testing.

Deep Learning Approach:

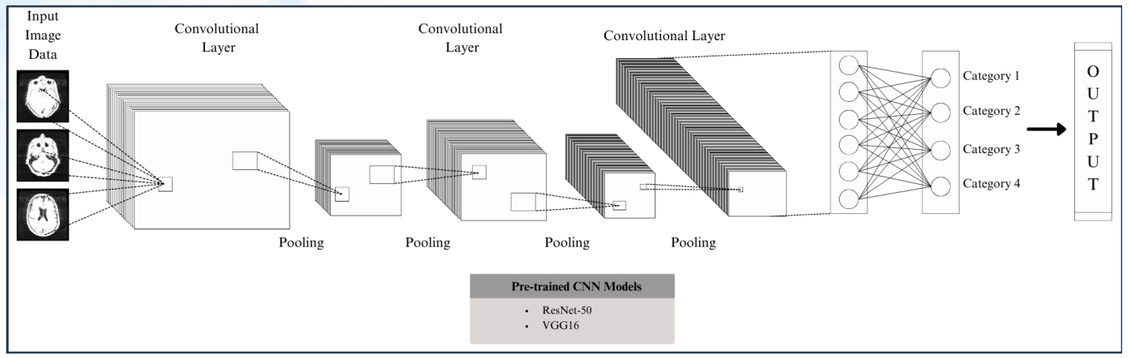


Fig.1 Diagram of disease detection model using CNN

In our CNN model, the functional layers is based on following algorithms:

- Functional layer 1: VGG16
- Functional layer 2: ResNet50

In average layer, an ensemble model often emerges by combining the strengths of ResNet-50 and VGG-16 algorithms. The optimization of model attributes, such as weights and le acilitated by the Adam optimizer. To prevent overfitting, we implement th g callbacks function from Keras. After training, we save the model so th ater to make predictions in the future.

Result Analysis:

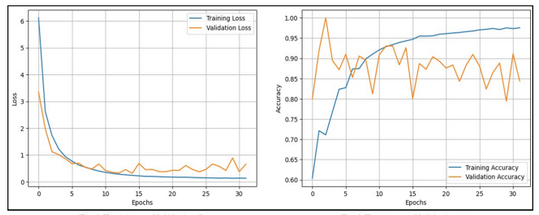


Fig.2 Training vs Validation Loss

Fig.3 Training vs Validation Accuracy

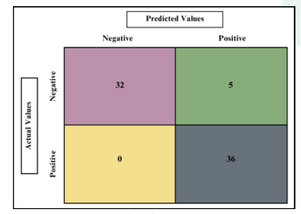
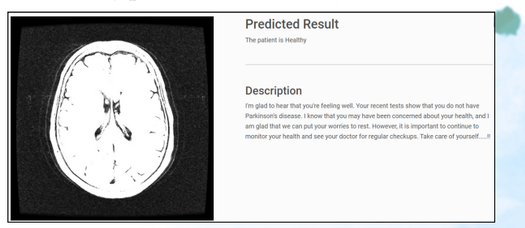


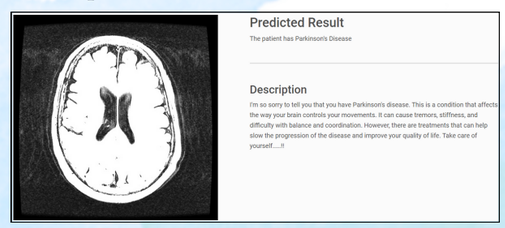
Fig.4 Confusion Matrix

These models collectively achieved an outstanding accuracy rate of 97%.The input image uploading is possible on the system, and the system gives an appropriate output.

For Healthy patient



For PD patient



Future Work:

One key future scope is to extend the model's capabilities by incorporating multi-modal data, including not only brain MRI images but also patient clinical data, genetic information, and vocal features. By integrating these diverse data sources, the model can provide a more comprehensive and accurate diagnosis, potentially revolutionizing early PD detection. Continuous monitoring of disease progression is an intriguing future scope. Extending the model's capabilities to track PD progression over time can assist in personalized treatment planning and optimize patient care.

Conclusion:

In conclusion, our system demonstrates a remarkable capability to predict Parkinson's illness in its earlier stages, addressing a critical need in medical diagnostics. This Deep Learning-based approach opens up exciting opportunities for medical image analysis, empowering researchers and medical teams to engage in feature selection and classification.

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