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A Comparison of Convolutional Neural Network Architectures for the Classification of Alzheimer's Disease Patients Using MRI Scans

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Abstract : In this study, we investigate the impact of various convolutional neural network (CNN) architectures on the accuracy of diagnosing Alzheimer's disease (AD) using patient MRI scans. Alzheimer's disease is a debilitating neurodegenerative disorder that affects millions worldwide. Early, accurate, and non-invasive diagnostic methods are required for providing optimal care and symptom management. Deep learning techniques, particularly CNNs, have shown great promise in enhancing this diagnostic process. We aim to contribute to the ongoing research in this field by comparing the effectiveness of different CNN architectures and providing insights for future studies. Our methodology involved preprocessing MRI data, implementing multiple CNN architectures, and evaluating the performance of each model. We employed intensity normalization, linear registration, and skull stripping for our preprocessing. The selected architectures included VGG, ResNet, and DenseNet models, all implemented using the Keras library. We employed transfer learning and trained models from scratch to compare their effectiveness. Our findings demonstrated significant differences in performance among the tested architectures, with DenseNet201 achieving the highest accuracy of 86.4%. Transfer learning proved to be helpful in improving model performance. We also identified potential areas for future research, such as experimenting with other architectures, optimizing hyperparameters, and employing fine-tuning strategies. By providing a comprehensive analysis of the selected CNN architectures, we offer a solid foundation for future research in Alzheimer's disease diagnosis using deep learning techniques. Our study highlights the potential of CNNs as a valuable diagnostic tool and emphasizes the importance of ongoing research to develop more accurate and effective models.

Keywords : Alzheimer's disease, convolutional neural networks, deep learning, medical imaging, MRI
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