Classification of Alzheimer's Disease based on MRI Image using Convolutional Neural Network

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Abstract

Alzheimer's disease is a medical condition that manifests as memory loss. It can lead to dementia and general cognitive decline due to the death of brain cells over time. Doctors can visualize brain images with magnetic resonance imaging (MRI) technology to assess Alzheimer's disease. A classification system of these MRI images is needed to assist doctors in detecting this disease, and the CNN approach is the most appropriate for this case. The domain classification task in the medical field encounters significant challenges due to imbalanced data distribution, where certain conditions are overrepresented while others are underrepresented. To mitigate these issues and enhance performance, fine-tuning strategies are essential. These include adjusting class weights to counteract data skewness, applying data augmentation techniques to expand the dataset artificially, selecting optimizers to improve convergence, and choosing appropriate models and batch sizes to ensure efficient training. This study exploits ResNet architecture for the model as it has been proven in previous research to work well for MRI. The best model from this research is the ResNet18 model with batch size 24, using AUC as an auxiliary metric and adjusted class weight formula values, no spatial augmentation but using intensity augmentation, namely brightness with max delta 0.15 and contrast range 0.8-1.2, using SGD optimizer and learning rate 0.01. Tested on testing data, the best model achieved an accuracy of 0.9737, AUC of 0.9955, and F1 Score of 0.9821. These results show that the proposed model achieves a high performance on the Alzheimer's disease classification task..

Kata kunci: *Alzheimer's disease, magnetic resonance imaging (MRI), ResNet architecture, fine-tuning strategies*