UNIVERSITY OF
BIRMINGHAM

Transfer Learning for Alzheimer's Disease Detection: Adapting Video Classification Models for MRI Scans

Rhys W. Alexander (2458177)

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Project supervisor:
Dr Rickson Mesquita

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4.1 Data Acquisition and Characteristics

The Alzheimer's Disease Neuroimaging Initiative (ADNI) database served as the primary data source for this study. ADNI represents a comprehensive, longitudinal dataset specifically designed for Alzheimer's disease research, offering rigorously standardized MRI acquisitions with corresponding clinical diagnoses and metadata.

4.1.1 Dataset Selection and Access

After evaluating potential neuroimaging repositories (including OASIS), ADNI was selected for its comprehensive coverage, standardized acquisition protocols, and expert-validated diagnoses. Access was obtained through a formal application process describing the research objectives. The analysis initially utilized data from ADNI-1, later expanding to incorporate volumes from ADNI-2, ADNI-3, and ADNI-4 to increase sample diversity and size.

4.1.2 Image Acquisition Parameters

All selected scans were T1-weighted Magnetization Prepared Rapid Gradient Echo (MPRAGE) sequences, chosen for their optimal gray/white matter contrast which facilitates hippocampal visualization, standardized acquisition parameters across multiple ADNI sites, high signal-to-noise ratio for structural analysis, and sensitivity to hippocampal atrophy, a primary biomarker for AD progression. Additionally, the widespread clinical availability and established role of MPRAGE in AD assessment made it an ideal choice for this study.

The T1w MPRAGE sequences typically featured field strengths of 1.5T or 3T with approximately $1mm^3$ isotropic resolution. The acquisition matrix was approximately $256\times256\times170$, with TR/TE parameters standardized according to ADNI protocol to ensure consistency across imaging sites.

4.1.3 Subject Demographics and Diagnostic Criteria

Subjects were classified into two distinct diagnostic categories: Alzheimer's Disease (AD) and Cognitively Normal (CN). The AD cohort consisted of subjects meeting NINCDS-ADRDA criteria for probable AD, while the CN cohort comprised control subjects without significant cognitive impairment. The original dataset distribution was approximately 33% AD and 67% CN cases. After initial testing revealed potential overfitting issues (discussed later), additional scans were incorporated. During this expansion phase, all available new AD scans were included, with CN subjects carefully sampled to achieve a balanced 50/50 diagnostic distribution in the final dataset to optimize model training.

4.1.4 Data Distribution Analysis

The final dataset contained 1,300 T1w MRI scans from 408 unique subjects:

- AD cohort: 650 scans from 203 subjects
- CN cohort: 650 scans from 205 subjects

Following subject-level splitting (detailed in Data Splitting Strategy section), the distribution across partitions was:

- Training set: 1,023 scans (512 AD, 511 CN) from 248 subjects (133 AD, 115 CN)
- Validation set: 139 scans (69 AD, 70 CN) from 80 subjects (35 AD, 45 CN)
- Test set: 138 scans (69 AD, 69 CN) from 80 subjects (35 AD, 45 CN)

This distribution ensured each partition contained sufficient samples for robust model training and evaluation while maintaining diagnostic balance. The deliberate focus on AD versus CN classification (excluding Mild Cognitive Impairment) reflects the clearer structural changes observable in established AD, particularly the hippocampal atrophy that serves as a primary biomarker for disease progression.

5 Results

6 Discussion

7 Conclusions

References