

# Anatomy-Aware Gating Network for Explainable Alzheimer’s Disease Diagnosis (Supplementary Materials)

Table 1: **Demographic information for the ADNI dataset.** To ensure that there is no data leakage, multiple scans from the same subject which appears in training would not appear in testing and vice versa.

| Label | Sex (M/F) | Age            | Education      | MMSE           |
|-------|-----------|----------------|----------------|----------------|
| CN    | 233 / 253 | $74.1 \pm 5.7$ | $16.4 \pm 2.7$ | $29.1 \pm 1.1$ |
| sMCI  | 204 / 127 | $72.7 \pm 7.6$ | $16.2 \pm 2.8$ | $28.1 \pm 1.6$ |
| pMCI  | 155 / 109 | $73.9 \pm 7.1$ | $15.9 \pm 2.8$ | $26.8 \pm 1.8$ |
| AD    | 184 / 148 | $74.9 \pm 7.8$ | $15.1 \pm 3.0$ | $23.2 \pm 2.1$ |

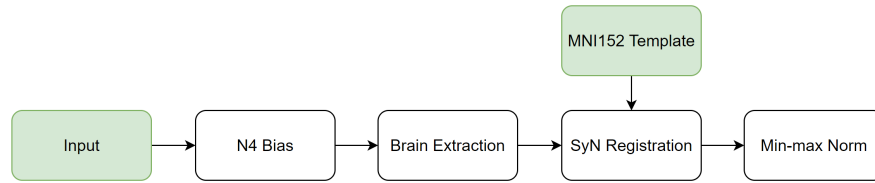


Fig. 1: **Data pre-processing pipeline.** Brain extraction is carried out using a pre-trained U-Net segmentation model from the DeepBrain library (<https://github.com/iitczco/deepbrain>). We register all images to the “MNI152 standard-space T1-weighted average structural template image” from the FreeSurfer library. Affine transformation is first applied to shear and scale the brain to match the template before SyN is used to warp voxels that are not properly aligned.

Table 2: **Ablation on AAGN Components.** (1) Anatomy-Aware Feature Extraction and (2) Anatomy Gating Network. We also compare with an Anatomy Gating Network which uses Gumbel-Softmax. The Gumbel-Softmax formulation although widely used (e.g., Attention-based DMIL) is unsuitable for our task and results in selection behaviour that degrades performance. This is likely due to the softmax saturating importance to a single ROI and ignoring other ROIs.

| Model  | AD vs CN       |                | pMCI vs sMCI   |                |
|--|----------------|----------------|----------------|----------------|
|  | Acc            | AUC            | Acc            | AUC            |
| Anatomy-Aware Feature Extraction             | 89.3 $\pm$ 2.7 | 94.2 $\pm$ 2.1 | 72.3 $\pm$ 4.3 | 77.9 $\pm$ 5.5 |
| + Anatomy Gating Network                     | 90.1 $\pm$ 2.0 | 94.7 $\pm$ 1.5 | 74.8 $\pm$ 4.8 | 81.3 $\pm$ 3.2 |
| + Anatomy Gating Network<br>(Gumbel-Softmax) | 87.8 $\pm$ 2.7 | 91.1 $\pm$ 1.9 | 64.1 $\pm$ 7.0 | 66.2 $\pm$ 3.3 |

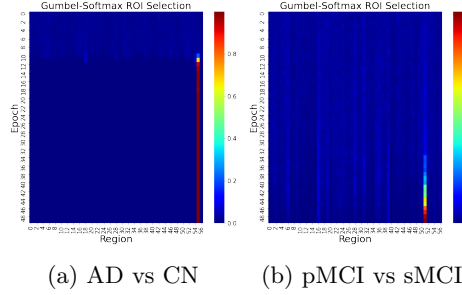


Fig. 2: ROI Selection for Anatomy Gating Network (Gumbel-Softmax). We can see that the network selects only a single ROI. For the pMCI vs sMCI task, it also takes longer for the selection to converge and has lower confidence than AAGN (cf. Fig. 3 of main paper). Best viewed zoomed in.

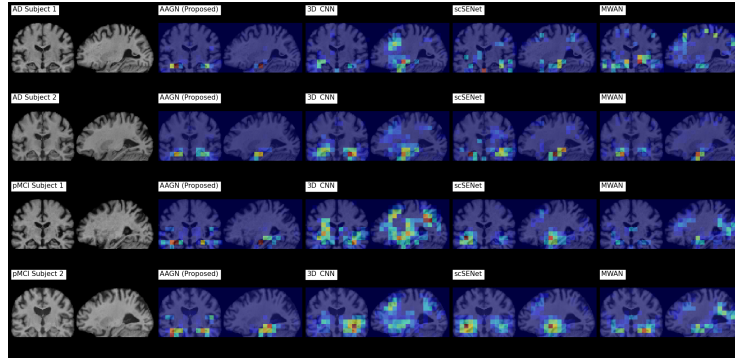


Fig. 3: **Occlusion analysis.** In general, AAGN, scSENet, and MWAN exhibit the ability to focus on specific areas (i.e., sparsely located squares), whereas 3D CNN focuses on a larger neighbourhood. Best viewed zoomed in.