Alzheimer's Disease Dementia Classification Through Residual Network and QEEG Image Representations

P1-00

iMediSync

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INTRODUCTION

- **Cognitive functions** are complexly coordinated to allow us carry out daily tasks.
- **Severe deterioration** of cognitive functions, namely **dementia**, adversely affects our life quality.
- **Alzheimer's disease (AD)** is one of the most common causes of dementia, which results from **amyloid plaques** in our brain.
- Positron emission tomography (PET) can be adopted for the screening of amyloid plaques.
- However, it is **expensive** and results in **exposure to harmful ionizing radiation**.
- The present study elaborates on the residual network-based model that successfully differentiates **quantitative electroencephalogram (QEEG)** data of AD dementia (ADD) patients.

METHODS

- **Eyes-closed**, resting state EEG data employed in the present study were recorded at 19 channels defined by the international 10-20 system.
- Figure 1 summarizes the data pre-processing procedures.

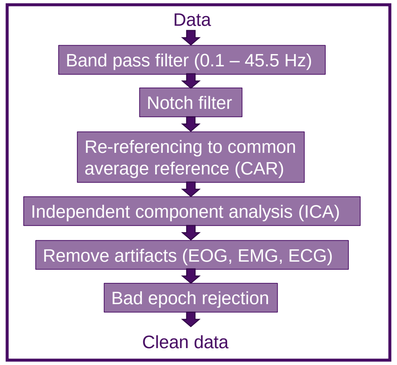

Figure 1. EEG data pre-processing

- Time-series data were converted into frequency domain (1-45Hz) power spectra with 0.25Hz resolution through fast-Fourier transform.
- Age- and sex-standardized Z-scores of the acquired power spectrum were calculated through iMediSync's normative database (N_{Male} = 553, N_{Female} = 736).
- **Gamma** fequency band (30-45Hz) was **excluded** due to its vulnerability to external noises and muscle movements.
- The power spectrum was rearranged into a feature matrix according to spatial locations of EEG channels (Figure 2).

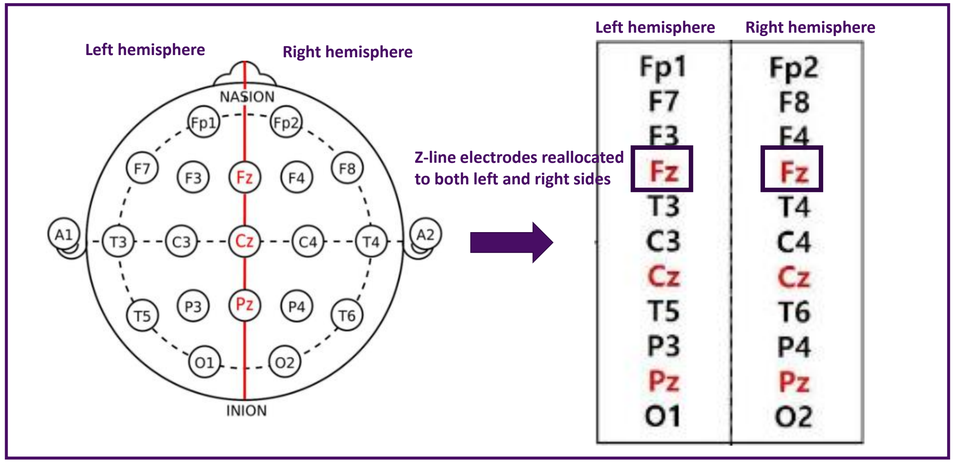

Figure 2. Rearrangement of the channels into a feature matrix

- Initial dataset: N = 732; 137 ADD, 476 non-ADD.
- 75% of the non-ADD data were first excluded as test data due to **data imbalance**.
- The remaining data were split into train and test data, 8:2 ratio.
- Final test dataset: N = 503; 27 ADD; 476 non-ADD.
- Final train dataset: N = 229; 110 ADD; 119 non-ADD.

RESULTS

- Our 18-layer ResNet model showed the following test evaluation performance:
  - 88.5% accuracy
  - 88.9% ADD sensitivity
  - 88.4% ADD specificity

Confusion matrix

	True ADD	True LBD
Pred ADD	24	55
Pred LBD	3	421

Table 1. Confusion matrix

CONCLUSIONS

- The classification results of the established model upholds QEEG utility in the distinguishment of Alzheimer's disease dementia from its pre-clinical stages.
- Continuous refinement will bolster its potential in the diagnosis several other neurological diseases.

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"Conquer dementia through QEEG-based AI"

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