Supplementary: Fine-Grained and Multiple Classification for Alzheimer's Disease with Wavelet Convolution Unit Network

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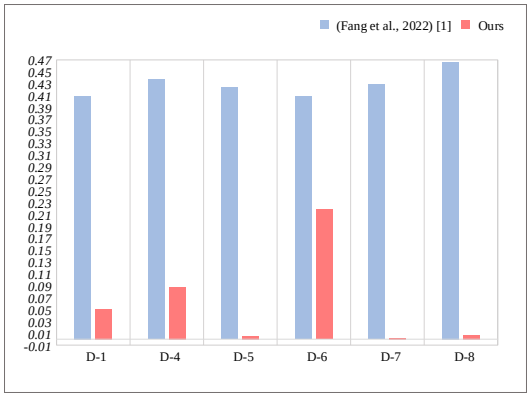

Fig. 1: The standard deviation histogram for five groups of ablated methods (without uS_iS, without uM_uS, without uC_o, without uA_mD, without uC_oMS), and our complete method. Obviously, our method has a comparative advantage.

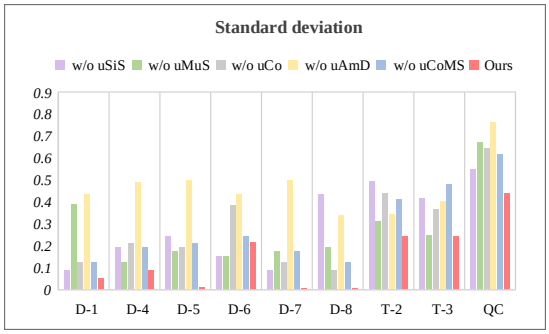

Fig. 2: The standard deviation histogram of method [1] and our complete method in this paper. Obviously, our complete method has a comparative advantage.

TABLE I: The statistical test of standard deviation and p-value.

Statistical Tests	D-1	D-2	D-3	D-4	D-5	D-6
Standard Deviation	0.0510	0.1937	0.1937	0.0880	0.0050	0.2179
P-Value	0.0241	0.0225	0.0444	0.0074	0.0285	0.0407
Statistical Tests	D-7	D-8	T-1	T-2	T-3	QC
Standard Deviation	0.0003	0.0067	0.1761	0.2421	0.2421	0.4372
P-Value	0.039	0.0192	0.0112	0.0324	0.0232	0.0136

I. Statistical Test

A. Standard Deviation

The standard deviation is a measure of the dispersion of the average value of a group of data. We used a group of test data and their predict result to calculate the standard deviation to verify whether our method has statistical significance. The calculation results are shown in Fig. 1 and Fig. 2. Generally speaking, the smaller the standard deviation, the more stable the method. In two figures, D-1, D-4, D-5, D-6, D-7, D-8, T-2, T-3 and QC correspond to AD vs. NC, AD vs. EMCI, AD vs. LMCI, NC vs. EMCI, NC vs. LMCI, EMCI vs. LMCI, AD vs. EMCI vs. LMCI, NC vs. EMCI vs. LMCI, and AD vs. NC vs. EMCI vs. LMCI. Fig. 1 shows the results of standard deviation of six kinds of combination compared with those of the reference [1]. In this figure, the red bars and the blue bars respectively correspond to our method and the reference [1]. For our method, the standard deviation values of the other five combination classifications are all less than 0.1 except the combination classification D-6 (NC and EMCI). Obviously, the standard deviation of our method is significantly smaller than that in reference [1]. This figure also shows that the standard deviation is proportional to the distribution of accuracy.

Fig. 2 shows the result of standard deviation of five methods (without uS_iS, without uM_uS, without uC_o, without uA_mD, without uC_oMS), and our approach. According to the standard deviation results of our method, the classification of two combinations is relatively small, the classification of three combinations is second, and the classification standard deviation of four combinations is the largest. The classification accuracy of two combinations is higher, the difficulty of three combinations is increased, the accuracy is smaller, and the accuracy of four combinations is more difficult. This also shows that the standard deviation is proportional to the distribution of accuracy. We can find that the value of standard deviation of our approach in Fig. 2 is relatively small.

B. P-Value

In order to verify whether the new method proposed in this paper has statistical significance, we also used a group of test data and their predict result to calculate the p-value. The calculation results are shown in Table I. In Table I, we can find that no matter which combination it belongs to, the p-value is relatively small and less than 0.05, which can indicate that it is statistically significant. By the way, the standard deviation values of all twelve kinds of combination classifications of our method are listed in this table for reference.

References

[1] M. Fang, Z. Jin, F. Qin, Y. Peng, C. Jiang, and Z. Pan, "Re-transfer learning and multi-modal learning assisted early diagnosis of Alzheimer's disease," *Multimedia Tools and Applications*, vol. 81, no. 20, pp. 29 159–29 175, 2022.