

## Appendix A: Full Results of Comparison Experiments

Due to the layout of the text and page limitations, only the experimental results for the ACC metric are presented in the main text. However, to ensure a comprehensive presentation of the results, the full results of the comparison experiments involving all four datasets, HCP, Zhongda Hospital, Xinxiang Hospital and Two-site, are presented in Tables 1 to 4. Four tables are presented detailing the mean and standard deviation values for each evaluation metric. The most exceptional results are shown in bold, while results below the optimal threshold are underlined for clarity and emphasis.

**Analysis.** Based on the results from the four tables, our RH-BrainFS method achieved excellent results in all four datasets. Specifically, we achieved the best results on three metrics in the HCP dataset, four metrics in both the Zhongda and Xinxiang Hospital datasets, and an impressive five metrics in the Two-site dataset. This demonstrates the strong performance of RH-BrainFS in effectively completing the fusion classification task for multimodal brain networks. Furthermore, we observe that on the hospital dataset, our RH-BrainFS method significantly outperforms most other methods in terms of bias in each metric, indicating higher stability. This improved stability contributes to the reliability and robustness of RH-BrainFS in fusion classification tasks.

Table 1: Comparison experiments results on the HCP dataset.

Method	Modality	HCP Dataset				
		ACC	SEN	SPE	F1	AUC
FGDN	FC	67.56±3.02	52.37±12.55	80.54±8.24	59.09±6.98	66.45±3.49
FGDN	SC	63.42±4.79	53.98±20.69	71.43±13.72	55.12±14.65	62.71±5.57
BrainGNN	FC	66.41±6.44	68.92±6.92	63.66±12.30	65.41±5.15	66.29±6.04
BrainGNN	SC	67.37±5.89	68.39±6.07	66.17±8.50	65.88±4.45	67.28±5.80
SVM	SC,FC	74.49±2.97	71.18±4.95	77.32±3.30	71.96±3.49	74.25±3.05
Random Forest	SC,FC	68.24±2.94	54.88±5.78	79.64±4.16	61.31±4.44	67.26±3.04
MGCN	SC,FC	67.94±5.41	<u>74.53±8.20</u>	62.32±7.76	68.10±5.59	68.42±5.41
GBDM	SC,FC	71.02±4.39	61.95±12.37	79.18±8.58	65.76±6.35	70.56±4.32
MMGNN	SC,FC	73.33±2.82	71.17±4.52	75.17±5.67	71.10±2.88	73.17±2.72
AL-NEGAT	SC,FC	<u>75.12±3.66</u>	72.86±7.74	<b>84.46±5.05</b>	<u>76.13±4.70</u>	<b>78.66±3.81</b>
RH-BrainFS (ours)	SC,FC	<b>78.63±4.36</b>	<b>75.59±6.75</b>	<u>81.25±6.04</u>	<b>76.49±4.91</b>	<u>78.42±4.38</u>

Table 2: Comparison experiments results on the Zhongda hospital dataset.

Method	Modality	Zhongda Dataset				
		ACC	SEN	SPE	F1	AUC
FGDN	FC	65.67±3.26	78.31±8.26	49.25±12.11	70.10±4.21	63.78±3.86
FGDN	SC	64.02±3.49	65.67±14.37	61.50±16.65	60.67±8.24	63.58±3.56
BrainGNN	FC	69.18±3.39	73.10±5.23	64.05±5.00	72.05±3.61	68.57±3.46
BrainGNN	SC	70.73±2.07	75.93±3.93	<u>64.10±3.58</u>	73.81±2.33	70.01±2.04
SVM	SC,FC	63.21±2.09	74.17±2.06	49.00±3.22	68.87±2.07	61.58±2.20
Random Forest	SC,FC	61.45±2.80	86.69±2.78	29.00±4.28	71.53±2.17	57.85±2.96
MGCN	SC,FC	<u>75.18±2.34</u>	88.52±3.99	57.10±8.06	<u>80.15±1.91</u>	<u>72.81±2.96</u>
GBDM	SC,FC	74.81±2.44	81.77±5.21	58.14±8.37	74.92±3.20	69.96±3.11
MMGNN	SC,FC	60.69±3.61	70.35±9.19	47.90±9.32	64.45±6.48	59.12±3.50
AL-NEGAT	SC,FC	73.95±3.45	<b>90.71±7.24</b>	52.05±7.69	79.00±4.79	71.38±3.54
RH-BrainFS (ours)	SC,FC	<b>80.64±1.58</b>	<u>90.05±5.58</u>	<b>68.45±9.32</b>	<b>83.96±1.13</b>	<b>79.25±2.24</b>

Table 3: Comparison experiments results on the Xinxiang hospital dataset.

Method	Modality	Xinxiang Dataset				
		ACC	SEN	SPE	F1	AUC
FGDN	FC	67.91±3.27	43.58±8.18	84.50±8.30	42.03±6.59	64.04±2.88
FGDN	SC	65.89±5.15	61.83±14.81	68.85±15.06	53.03±8.16	65.34±3.82
BrainGNN	FC	73.46±4.33	54.92±10.57	86.25±6.10	55.72±9.30	70.58±4.88
BrainGNN	SC	73.66±3.60	56.83±10.76	85.35±8.26	57.39±8.58	71.09±3.76
SVM	SC,FC	71.73±1.99	49.92±4.35	86.55±3.42	54.52±4.72	68.23±2.19
Random Forest	SC,FC	62.78±1.63	12.08±4.81	<b>97.20±1.96</b>	17.03±6.61	54.64±2.11
MGCN	SC,FC	<u>82.24±3.71</u>	<u>74.16±6.62</u>	87.45±3.45	<u>76.15±5.88</u>	<u>80.80±4.15</u>
GBDM	SC,FC	80.71±2.83	60.20±10.03	88.43±5.86	63.46±9.11	73.31±5.83
MMGNN	SC,FC	68.21±4.44	57.33±6.35	75.10±8.12	55.48±6.03	66.21±4.06
AL-NEGAT	SC,FC	75.75±3.81	56.42±14.80	88.50±6.35	61.19±10.80	72.46±5.34
RH-BrainFS (ours)	SC,FC	<b>90.27±2.00</b>	<b>80.75±5.86</b>	<u>96.65±2.34</u>	<b>85.43±3.90</b>	<b>88.70±2.48</b>

Table 4: Comparison experiments results on the Two-site dataset.

Method	Modality	Two-site Dataset				
		ACC	SEN	SPE	F1	AUC
FGDN	FC	59.34±2.78	54.70±10.82	63.79±8.83	49.96±8.04	59.24±2.85
FGDN	SC	68.91±2.53	70.02±12.42	67.83±9.78	66.31±7.03	68.93±2.52
BrainGNN	FC	69.55±3.23	69.62±5.23	68.36±6.67	67.54±3.34	68.99±3.22
BrainGNN	SC	69.51±2.58	68.12±5.41	69.24±6.66	66.76±3.42	68.68±3.03
SVM	SC,FC	66.06±1.56	58.01±2.49	<u>74.04±1.77</u>	62.03±2.27	66.03±1.56
Random Forest	SC,FC	62.43±2.19	56.17±2.87	68.60±3.48	59.04±2.73	62.38±2.20
MGCN	SC,FC	<u>72.98±2.17</u>	74.02±7.03	73.74±4.05	<u>72.45±4.48</u>	<u>73.88±2.22</u>
GBDM	SC,FC	72.48±1.91	71.53±7.55	65.97±5.61	68.74±4.92	68.75±2.90
MMGNN	SC,FC	59.72±3.18	65.10±4.83	54.42±4.42	59.96±4.02	59.76±3.15
AL-NEGAT	SC,FC	71.86±2.49	<u>75.26±3.62</u>	68.12±6.19	72.16±2.24	71.69±2.56
RH-BrainFS (ours)	SC,FC	<b>78.48±1.43</b>	<b>76.20±4.06</b>	<b>80.72±3.60</b>	<b>77.35±1.97</b>	<b>78.46±1.43</b>

## Appendix B: Full Results of Hyperparameter Experiments

In the main text, our hyperparameter experiments are performed on the HCP dataset and the Two-site dataset. We explore two key hyperparameters in RH-BrainFS: the number of bottlenecks and the number of subgraph sampling hops  $k$ . However, in the main text we have only presented visualisations of the results of the hyperparameter experiments without giving specific numerical values. Hence, we present here the complete experimental results in Tables 5 to 8.

Table 5: Hyperparameter experiments of varying bottlenecks number on HCP dataset.

# bottlenecks	HCP Dataset				
	ACC	SEN	SPE	F1	AUC
2	76.26 $\pm$ 3.58	69.70 $\pm$ 11.51	80.00 $\pm$ 5.46	71.74 $\pm$ 6.13	74.85 $\pm$ 4.06
4	<b>78.63<math>\pm</math>4.36</b>	<b>75.59<math>\pm</math>6.75</b>	<b>81.25<math>\pm</math>6.04</b>	<b>76.49<math>\pm</math>4.91</b>	<b>78.42<math>\pm</math>4.38</b>
6	76.85 $\pm$ 3.41	69.72 $\pm$ 8.32	80.54 $\pm$ 7.38	72.29 $\pm$ 4.26	75.13 $\pm$ 3.46
8	76.51 $\pm$ 3.05	71.16 $\pm$ 9.82	81.25 $\pm$ 8.11	73.45 $\pm$ 4.42	76.20 $\pm$ 3.18

Table 6: Hyperparameter experiments of varying bottlenecks number on Two-site dataset.

# bottlenecks	Two-site Dataset				
	ACC	SEN	SPE	F1	AUC
2	76.21 $\pm$ 1.17	68.88 $\pm$ 4.98	<b>83.61<math>\pm</math>4.56</b>	73.21 $\pm$ 2.33	76.24 $\pm$ 1.15
4	<b>78.48<math>\pm</math>1.43</b>	<b>76.20<math>\pm</math>4.06</b>	80.72 $\pm$ 3.60	<b>77.35<math>\pm</math>1.97</b>	<b>78.46<math>\pm</math>1.43</b>
6	76.35 $\pm$ 1.43	70.39 $\pm$ 3.82	82.10 $\pm$ 4.18	73.80 $\pm$ 2.06	76.24 $\pm$ 1.48
8	76.71 $\pm$ 1.32	73.68 $\pm$ 5.34	79.71 $\pm$ 4.83	74.97 $\pm$ 2.28	76.69 $\pm$ 1.31

Table 7: Hyperparameter experiments of varying subgraph sampling hops on HCP dataset.

$k$	HCP Dataset				
	ACC	SEN	SPE	F1	AUC
1	<b>78.63<math>\pm</math>4.36</b>	<b>75.59<math>\pm</math>6.75</b>	81.25 $\pm$ 6.04	<b>76.49<math>\pm</math>4.91</b>	<b>78.42<math>\pm</math>4.38</b>
2	77.09 $\pm$ 3.53	71.35 $\pm$ 12.30	81.96 $\pm$ 9.40	73.72 $\pm$ 5.73	76.66 $\pm$ 3.81
3	77.47 $\pm$ 3.31	74.73 $\pm$ 6.83	79.82 $\pm$ 5.36	75.27 $\pm$ 4.00	77.28 $\pm$ 3.39
4	76.61 $\pm$ 4.00	69.07 $\pm$ 11.44	<b>83.04<math>\pm</math>4.01</b>	72.63 $\pm$ 6.79	76.05 $\pm$ 4.50
5	73.92 $\pm$ 2.94	64.50 $\pm$ 6.03	81.96 $\pm$ 6.41	69.44 $\pm$ 3.56	73.23 $\pm$ 2.88

Table 8: Hyperparameter experiments of varying subgraph sampling hops on Two-site dataset.

k	Two-site Dataset				
	ACC	SEN	SPE	F1	AUC
1	<b>78.48±1.43</b>	<b>76.20±4.06</b>	<b>80.72±3.60</b>	<b>77.35±1.97</b>	<b>78.46±1.43</b>
2	73.99±1.32	69.49±2.88	78.42±3.04	71.53±2.04	73.96±1.32
3	74.37±1.81	72.47±5.79	76.26±3.42	72.66±3.37	74.36±1.79
4	74.55±1.64	73.13±6.88	75.92±6.98	72.96±2.68	74.53±1.63
5	74.14±1.25	70.41±5.73	77.79±4.62	71.70±3.15	74.10±1.28