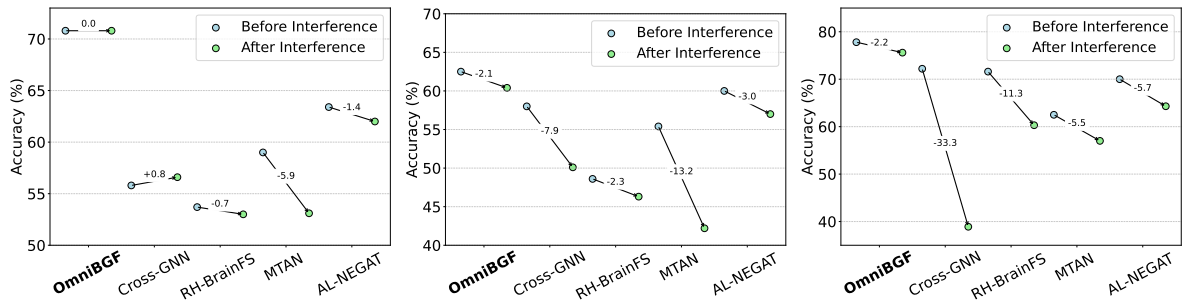
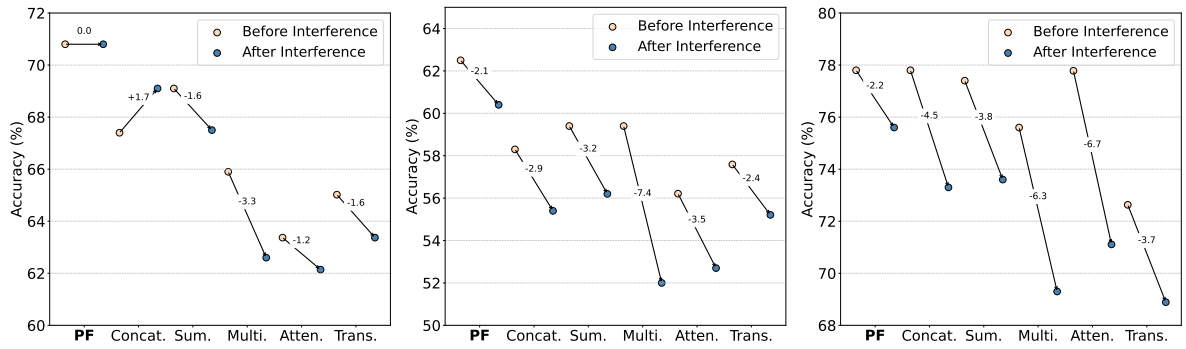


(a) ADNI (b) PPMI (c) 4RTNI

Figure 1: Accuracy changes of OmniBGF and other multimodal brain graph learning models under noise interference.

Table 1: Comparison of model performance between OmniBGF and other multimodal brain graph learning models before and after noise interference on the ADNI dataset (%).

Method	ADNI				
	ACC	F1	AUC	Sen.	Spe.
Cross-GNN	55.8±5.5	40.2±5.4	62.6±4.5	40.4±7.5	72.9±3.7
Cross-GNN (+Noise)	56.6±3.4	41.4±5.6	37.4±1.8	40.4±2.5	66.1±5.2
RH-BrainFS	53.7±9.1	40.3±7.3	70.1±6.4	42.2±7.3	73.4±5.1
RH-BrainFS (+Noise)	53.0±6.1	40.0±5.3	69.2±7.1	42.5±5.3	73.3±4.0
MTAN	59.0±6.8	49.8±6.2	48.3±6.4	46.2±6.9	63.1±8.2
MTAN (+Noise)	53.1±4.3	41.6±4.4	41.2±4.6	42.6±5.0	61.5±7.4
AL-NEGAT	63.4±2.8	48.4±4.3	72.8±3.3	50.7±3.2	79.5±1.7
AL-NEGAT (+Noise)	62.0±2.0	48.3±3.3	72.1±1.1	49.2±3.7	78.0±1.7
OmniBGF	70.8±0.6	49.9±0.3	77.2±0.9	46.8±0.4	81.7±0.8
OmniBGF (+Noise)	70.8±0.6	49.8±0.5	77.1±0.2	46.5±0.1	81.6±0.1



(a) ADNI (b) PPMI (c) 4RTNI

Figure 2: Accuracy changes of models using different fusion methods before and after noise interference on three datasets.

Table 2: Comparison of model performance between OmniBGF and other multimodal brain graph learning models before and after noise interference on the PPMI dataset (%).

Method	PPMI				
	ACC	F1	AUC	Sen.	Spe.
Cross-GNN	58.0±3.4	57.9±8.5	65.9±7.5	44.7±9.0	76.6±8.7
Cross-GNN (+Noise)	50.1±4.5	43.5±1.8	64.9±2.8	47.2±10.6	73.8±4.5
RH-BrainFS	48.6±8.0	47.7±9.7	66.3±9.2	48.5±10.2	73.1±5.2
RH-BrainFS (+Noise)	46.3±1.4	45.5±11.0	62.7±9.2	46.2±14.2	72.4±7.6
MTAN	55.4±8.0	51.8±6.5	42.4±7.1	54.2±10.1	66.0±9.4
MTAN (+Noise)	42.2±6.1	29.8±11.2	34.4±1.0	40.2±7.4	52.3±8.4
AL-NEGAT	60.0±4.5	53.6±5.9	65.8±6.7	43.4±5.1	77.6±2.6
AL-NEGAT (+Noise)	57.0±5.6	51.5±6.4	67.2±6.2	51.9±4.3	76.8±2.7
OmniBGF	62.5±0.1	58.8±1.9	64.7±1.2	45.2±0.8	78.0±0.1
OmniBGF (+Noise)	60.4±1.5	58.3±2.6	64.9±0.1	44.1±0.3	77.8±0.1

Table 3: Comparison of model performance between OmniBGF and other multimodal brain graph learning models before and after noise interference on the 4RTNI dataset (%).

Method	4RTNI				
	ACC	F1	AUC	Sen.	Spe.
Cross-GNN	72.2±5.6	69.9±5.0	72.2±12.5	86.2±5.0	50.0±3.0
Cross-GNN (+Noise)	38.9±5.6	38.5±6.0	35.0±15.0	50.0±4.0	30.0±7.5
RH-BrainFS	71.6±12.3	52.1±9.8	69.5±14.3	70.6±11.5	57.9±12.8
RH-BrainFS (+Noise)	60.3±13.2	54.4±10.0	58.9±17.1	60.4±18.5	40.2±17.3
MTAN	62.5±22.4	70.1±20.7	56.0±15.1	86.0±19.6	58.0±16.0
MTAN (+Noise)	57.0±21.1	65.4±20.9	49.3±18.2	82.3±22.5	54.5±10.2
AL-NEGAT	70.0±10.0	51.8±29.7	66.7±20.2	60.0±38.8	56.0±19.6
AL-NEGAT (+Noise)	64.3±15.0	45.6±15.3	65.8±16.4	70.8±17.3	64.5±15.4
OmniBGF	77.8±3.1	77.7±0.6	77.4±0.4	86.9±0.5	53.8±5.2
OmniBGF (+Noise)	75.6±3.0	77.4±0.4	76.0±2.7	85.2±1.1	52.8±1.3

Table 4: Performance of models using different fusion methods before and after noise interference on the ADNI dataset (%).

Method	ADNI				
	ACC	F1	AUC	Sen.	Spe.
Atten.	63.3±4.1	47.3±4.8	68.9±0.6	41.9±1.0	78.4±0.7
Atten. (+Noise)	62.1±3.2	47.2±3.8	68.4±0.7	40.9±0.9	77.9±0.8
Trans.	65.0±2.5	47.9±2.2	67.8±1.1	38.5±1.3	77.2±0.4
Trans. (+Noise)	63.4±4.8	47.4±1.5	69.1±1.2	40.7±0.5	78.0±0.3
PF	70.8±0.6	49.9±0.3	77.2±0.9	46.8±0.4	81.7±0.8
PF (+Noise)	70.8±0.6	49.8±0.5	77.1±0.2	46.5±0.1	81.6±0.1

Table 5: Performance of models using different fusion methods before and after noise interference on the PPMI dataset (%).

Method	PPMI				
	ACC	F1	AUC	Sen.	Spe.
Atten.	56.2±1.5	53.8±3.0	67.2±0.3	41.5±0.8	77.4±0.4
Atten. (+Noise)	52.7±2.9	52.5±1.3	66.9±0.4	41.7±0.8	76.6±0.5
Trans.	57.6±2.9	53.7±3.6	65.6±1.9	49.2±1.6	75.9±1.2
Trans. (+Noise)	55.2±3.9	55.8±4.5	65.5±1.9	47.0±1.7	75.9±1.3
PF	62.5±0.1	58.8±1.9	64.7±1.2	45.2±0.8	78.0±0.1
PF (+Noise)	60.4±1.5	58.3±2.6	64.9±0.1	44.1±0.3	77.8±0.1

Table 6: Performance of models using different fusion methods before and after noise interference on the 4RTNI dataset (%).

Method	4RTNI				
	ACC	F1	AUC	Sen.	Spe.
Atten.	77.8±3.1	73.0±1.3	72.1±11.9	86.7±2.0	30.7±8.4
Atten. (+Noise)	71.1±8.3	72.8±2.1	70.4±11.7	84.2±1.2	31.9±7.8
Trans.	72.6±6.3	70.6±0.2	66.6±2.5	89.6±5.6	16.4±12.9
Trans. (+Noise)	68.9±6.3	69.7±1.2	65.7±5.9	89.0±5.3	14.9±8.3
PF	77.8±3.1	77.7±0.6	77.4±0.4	86.9±0.5	53.8±5.2
PF (+Noise)	75.6±3.0	77.4±0.4	76.0±2.7	85.2±1.1	52.8±1.3

Table 7: Additional experimental results on three datasets (%).

Method		ADNI				
		ACC	AUC	F1	Sen.	Spe.
Unimodal (FBG)	Differmer	58.5±5.6	68.5±3.3	42.8±4.8	45.1±4.0	75.7±2.8
	DDM	58.5±7.1	76.2±3.9	40.6±5.3	43.6±5.6	74.8±4.3
Multimodal	Differmer	59.0±4.3	68.9±4.0	46.1±6.4	**47.1±4.9**	75.9±2.8
	DDM	58.5±3.7	76.2±3.1	43.7±5.1	45.3±3.9	75.5±2.3
OmniBGF (ours)		**70.8±0.6**	**77.2±0.9**	**49.9±0.3**	46.8±0.4	**81.7±0.8**
Method		PPMI				
		ACC	AUC	F1	Sen.	Spe.
Unimodal (FBG)	Differmer	46.5±6.8	57.8±6.3	42.4±7.3	44.3±5.9	72.2±2.5
	DDM	54.5±7.6	60.9±6.8	47.2±12.8	49.0±10.2	74.3±4.7
Multimodal	Differmer	49.0±8.4	59.4±10.5	43.3±5.5	43.3±5.5	72.4±3.6
	DDM	53.7±12.2	61.8±9.3	48.5±13.8	**51.4±12.3**	74.9±6.6
OmniBGF (ours)		**62.5±0.1**	**64.7±1.2**	**58.8±1.9**	45.2±0.8	**78.0±0.1**
Method		4RTNI				
		ACC	AUC	F1	Sen.	Spe.
Unimodal (FBG)	Differmer	49.0±6.5	45.9±14.7	38.9±3.5	43.8±5.1	43.8±5.1
	DDM	60.4±10.0	51.3±20.2	46.9±15.3	86.5±13.6	19.2±26.4
Multimodal	Differmer	61.0±10.8	53.1±12.9	49.2±12.4	54.0±11.2	**54.0±11.2**
	DDM	60.5±13.9	45.1±19.7	50.9±17.6	83.5±17.6	26.7±24.9
OmniBGF (ours)		**77.8±3.1**	**77.4±0.4**	**77.7±0.6**	**86.9±0.5**	53.8±5.2

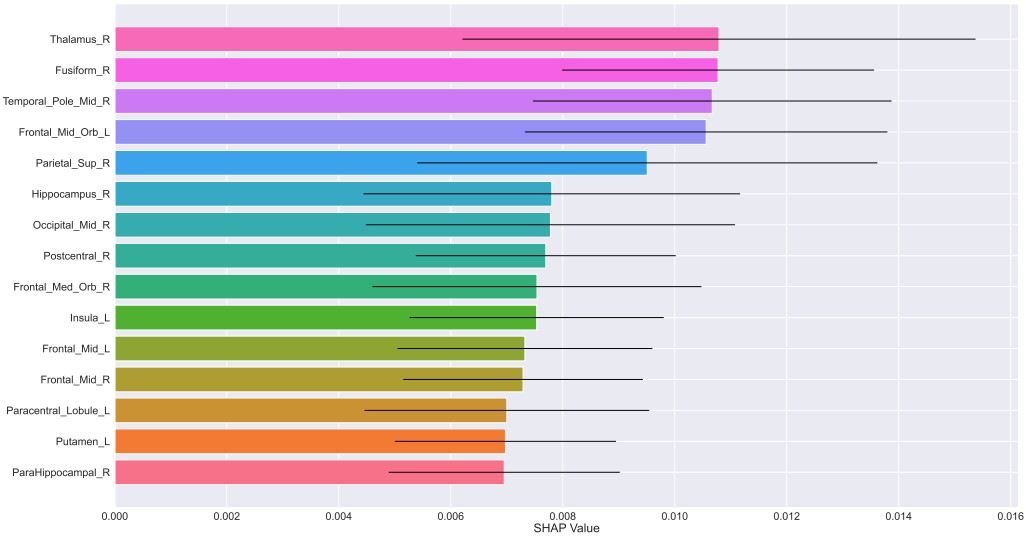


Figure 3: Visualization of the top 15 ROIs with the highest SHAP values for ADNI dataset.

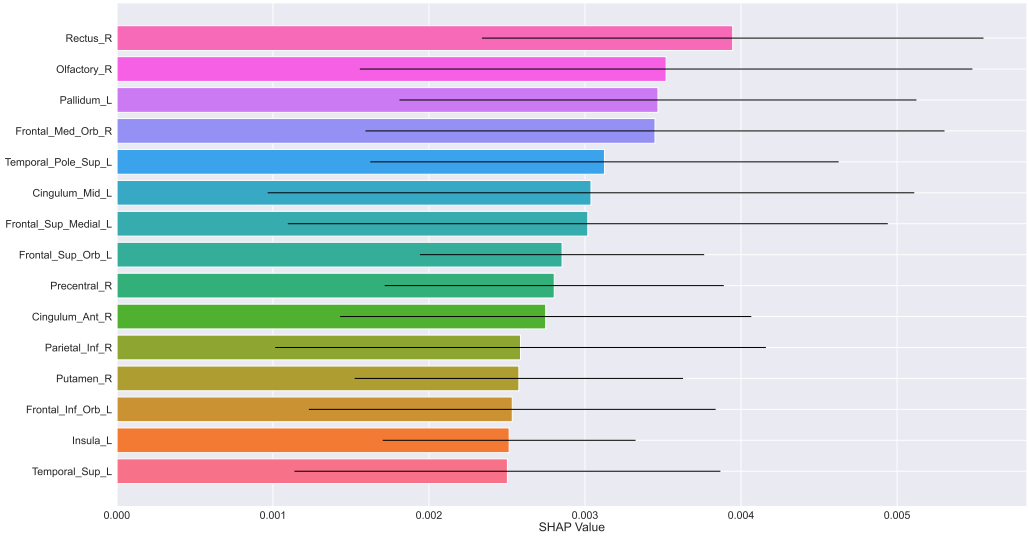


Figure 4: Visualization of the top 15 ROIs with the highest SHAP values for PPMI dataset.

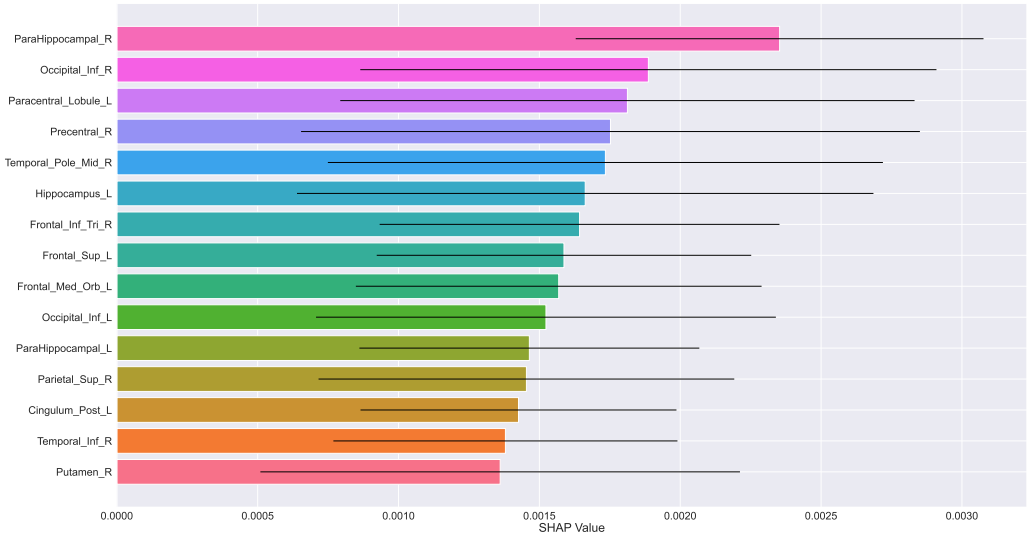


Figure 5: Visualization of the top 15 ROIs with the highest SHAP values for 4RTNI dataset.