

## SUPPLEMENTARY MATERIAL

Table I delineates the detailed structural parameters of our THFGCN method when applied to the PhysioNet dataset. Specifically, the input EEG data dimensions for the PhysioNet dataset are  $32 \times 64 \times 200$ , where 32 represents the batch size, 64 denotes the number of EEG channels, and 200 corresponds to the number of time samples. In contrast, for the LLM-BCImotion dataset, the input data dimensions are set to  $32 \times 32 \times 400$ . The architecture of THFGCN is comprehensively detailed, employing the PyTorch framework.

TABLE I  
THFT-GCN ARCHITECTURE AND NUMBER OF PARAMETERS.

Modual	Layer	Layer type	# filters	Size	Groups	Others	# params
EFTM	Learnable weight	linear	1	(7, 1)	-	-	7
EFTM	GCN_1	gcn	1	(200, 150)	-	-	30000
EFTM	GCN_2	gcn	1	(150, 100)	-	-	15000
HSTM	GCN_1	gcn	1	(200, 150)	-	-	30000
HSTM	GCN_2	gcn	1	(150, 100)	-	-	15000
STCM	Temporal	convolution	24	(1, 1)	1	-	24
STCM	Temporal	batchnorm	24	-	-	-	-
STCM	Temporal	convolution	24	(1, 16)	8	-	1152
STCM	Temporal	batchnorm	24	-	-	-	-
STCM	Temporal	gelu	-	-	-	-	-
STCM	Temporal	dropout	-	p=0.3	-	-	-
STCM	Depth	pooling	-	(1, 485)	-	-	-
STCM	Depth	transpose	-	-	-	-	-
STCM	Depth	convolution	1	(7, 1)	-	padding=3, bias=True	8
STCM	Depth	softmax	-	-	-	-	-
STCM	Depth	transpose	-	-	-	-	-
STCM	Spatial	convolution	8	(1, 1)	1	-	8
STCM	Spatial	batchnorm	8	-	-	-	-
STCM	Spatial	convolution	8	(64, 1)	8	-	512
STCM	Spatial	batchnorm	8	-	-	-	-
STCM	Spatial	gelu	-	-	-	-	-
STCM	Spatial	dropout	-	p=0.3	-	-	-
-	Classifier	linear	1	(5480, 4)	-	-	21924
-	Classifier	softmax	-	-	-	-	-

Tables II and III present detailed within-subject performance for all evaluated methods on the PhysioNet and LLM-BCImotion datasets, respectively. The results demonstrate that THFGCN consistently achieved the highest classification accuracy across nearly all subjects. This consistent superiority across different subjects signifies THFGCN's robustness and adaptability in discerning and classifying MI-related EEG patterns.

TABLE II: THE DETAIL WITHIN-SUBJECT PERFORMANCE OF ALL METHODS ON THE PHYSIONET DATASET.

Subject	FBCSP+SVM	FBCSP+KNN	ShallowNet	EEGNet	LMDA-Net	T3SFNet	THFGCN
<b>S1</b>	62.00%	57.89%	67.67%	53.71%	72.67%	74.33%	81.33%
<b>S2</b>	52.43%	56.15%	66.33%	62.00%	65.33%	71.33%	93.67%
<b>S3</b>	50.14%	62.06%	76.00%	63.14%	79.67%	64.67%	94.67%
<b>S4</b>	50.57%	64.83%	64.67%	55.00%	75.00%	71.33%	96.67%
<b>S5</b>	43.86%	56.15%	73.33%	55.14%	73.33%	66.33%	83.67%
<b>S6</b>	50.57%	51.64%	65.00%	60.14%	66.67%	70.67%	86.33%
<b>S7</b>	50.43%	66.57%	66.33%	70.71%	80.33%	65.00%	93.67%
<b>S8</b>	58.14%	65.18%	58.33%	45.00%	76.00%	65.33%	92.67%
<b>S9</b>	54.57%	48.17%	69.33%	64.86%	75.00%	78.67%	90.00%
<b>S10</b>	53.00%	58.58%	58.67%	58.43%	48.00%	70.33%	83.33%
<b>S11</b>	53.86%	58.93%	53.00%	50.00%	72.67%	55.00%	92.00%
<b>S12</b>	40.86%	57.89%	64.00%	59.00%	74.00%	75.00%	87.00%

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Subject	FBCSP+SVM	FBCSP+KNN	ShallowNet	EEGNet	LMDA-Net	T3SFNet	THFGCN
S13	51.14%	44.00%	61.33%	57.71%	62.33%	67.67%	92.67%
S14	52.00%	49.56%	60.00%	61.43%	66.00%	72.67%	86.33%
S15	52.71%	50.60%	62.33%	77.29%	71.33%	72.67%	90.33%
S16	46.14%	48.51%	66.33%	45.29%	67.33%	65.33%	86.00%
S17	45.86%	54.76%	66.67%	50.71%	63.00%	62.67%	83.00%
S18	55.00%	47.82%	67.00%	59.71%	65.33%	71.00%	79.67%
S19	45.43%	48.51%	54.00%	61.29%	51.67%	56.00%	83.67%
S20	46.43%	39.14%	65.67%	52.57%	66.33%	76.33%	90.00%
S21	48.14%	54.42%	58.33%	68.14%	64.67%	72.00%	94.33%
S22	43.43%	41.22%	67.00%	70.14%	55.33%	70.00%	87.00%
S23	47.71%	41.22%	63.67%	55.71%	42.67%	66.67%	83.67%
S24	55.57%	62.06%	70.67%	64.57%	60.00%	65.00%	79.67%
S25	47.00%	47.82%	56.00%	50.57%	69.00%	51.00%	93.67%
S26	64.71%	67.26%	77.00%	51.00%	75.00%	68.67%	96.67%
S27	54.57%	53.38%	61.33%	53.43%	64.67%	66.33%	90.00%
S28	52.43%	50.25%	67.00%	49.00%	56.00%	67.00%	78.00%
S29	63.29%	73.51%	64.00%	60.29%	92.00%	76.33%	96.67%
S30	51.14%	49.56%	69.00%	63.29%	53.33%	59.33%	76.33%
S31	48.71%	59.28%	66.00%	60.00%	68.33%	58.67%	85.00%
S32	59.57%	55.11%	78.00%	62.00%	68.00%	69.67%	87.67%
S33	61.14%	65.88%	75.67%	62.29%	81.67%	77.33%	99.67%
S34	52.57%	61.71%	72.33%	56.86%	76.00%	75.00%	93.33%
S35	72.57%	59.63%	63.33%	84.86%	77.33%	71.00%	86.33%
S36	45.29%	53.03%	63.67%	71.29%	51.00%	56.33%	83.00%
S37	51.71%	46.43%	57.00%	51.29%	58.33%	66.67%	87.00%
S38	44.86%	55.81%	60.00%	53.00%	66.67%	69.67%	88.00%
S39	48.29%	36.01%	55.00%	43.86%	53.33%	58.33%	84.67%
S40	48.29%	53.03%	61.67%	51.71%	61.33%	67.33%	97.33%
S41	59.00%	60.67%	72.33%	50.57%	79.00%	66.67%	78.33%
S42	65.57%	60.67%	70.67%	59.00%	64.33%	66.67%	96.33%
S43	50.43%	50.25%	50.00%	61.00%	55.67%	63.67%	87.67%
S44	62.14%	51.99%	66.67%	58.86%	73.67%	71.33%	88.67%
S45	54.71%	72.47%	72.67%	72.14%	68.00%	65.00%	83.00%
S46	57.43%	48.51%	71.33%	54.14%	68.00%	76.33%	79.67%
S47	46.00%	55.46%	65.00%	55.57%	83.33%	61.33%	85.00%
S48	55.71%	60.67%	52.00%	66.00%	64.67%	57.00%	90.67%
S49	53.86%	61.01%	75.33%	67.29%	76.67%	67.67%	98.33%
S50	54.71%	54.42%	76.33%	56.00%	73.67%	73.33%	92.00%
S51	47.14%	55.81%	56.33%	56.14%	50.33%	70.33%	82.33%
S52	44.00%	52.33%	56.33%	45.00%	58.00%	61.00%	95.00%
S53	59.00%	55.11%	81.33%	70.43%	77.00%	68.33%	98.00%
S54	56.29%	58.93%	71.33%	74.00%	68.67%	78.33%	92.33%
S55	48.86%	59.97%	77.33%	66.00%	70.00%	64.00%	90.33%
S56	62.57%	60.32%	62.33%	75.43%	85.33%	75.00%	97.67%
S57	54.00%	50.94%	64.33%	59.71%	52.67%	64.33%	85.33%
S58	62.00%	50.25%	67.67%	67.43%	60.33%	68.00%	96.67%
S59	44.57%	41.92%	51.33%	42.14%	42.67%	78.33%	73.33%
S60	52.71%	53.38%	74.67%	43.86%	74.00%	62.33%	97.33%
S61	57.29%	57.19%	61.67%	57.00%	63.67%	53.00%	90.00%
S62	60.86%	61.01%	60.33%	53.71%	70.33%	73.33%	91.67%
S63	54.14%	57.19%	76.67%	55.57%	69.67%	73.67%	89.67%
S64	42.57%	59.28%	66.33%	62.00%	60.33%	75.00%	80.00%
S65	52.29%	44.00%	59.00%	60.00%	69.33%	68.33%	96.00%
S66	47.86%	49.90%	60.33%	66.86%	57.67%	48.33%	83.00%
S67	48.57%	62.40%	65.67%	64.43%	74.33%	72.67%	89.67%

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Subject	FBCSP+SVM	FBCSP+KNN	ShallowNet	EEGNet	LMDA-Net	T3SFNet	THFGCN
S68	54.14%	65.53%	68.00%	43.57%	67.67%	73.67%	89.00%
S69	48.14%	53.72%	58.33%	59.43%	50.00%	43.67%	88.00%
S70	53.86%	70.39%	65.67%	69.29%	68.33%	64.33%	84.33%
S71	49.71%	60.67%	60.67%	50.71%	56.67%	64.00%	88.33%
S72	72.71%	74.56%	73.67%	48.43%	76.00%	73.67%	91.67%
S73	51.57%	53.38%	61.33%	54.43%	44.33%	73.33%	90.67%
S74	52.29%	50.25%	63.33%	55.14%	53.67%	64.00%	75.33%
S75	45.29%	47.13%	56.33%	56.14%	65.00%	63.67%	79.00%
S76	43.29%	59.97%	49.67%	55.71%	58.33%	55.67%	79.00%
S77	48.00%	44.00%	57.67%	56.00%	59.00%	59.67%	89.00%
S78	53.14%	54.42%	69.00%	51.43%	68.33%	59.33%	83.00%
S79	55.00%	51.29%	70.00%	50.57%	55.67%	65.33%	89.00%
S80	58.29%	48.17%	64.00%	60.00%	73.00%	69.67%	89.00%
S81	45.86%	48.86%	58.33%	66.14%	60.33%	79.00%	86.00%
S82	51.29%	59.97%	57.00%	50.57%	58.67%	74.33%	96.33%
S83	55.29%	47.47%	63.00%	51.43%	53.33%	54.67%	73.00%
S84	57.14%	50.94%	57.33%	41.29%	58.33%	80.67%	87.33%
S85	60.71%	56.85%	62.67%	53.43%	66.00%	60.33%	94.33%
S86	59.29%	49.21%	68.67%	60.43%	76.00%	60.33%	94.00%
S87	47.86%	51.99%	61.33%	49.57%	65.00%	68.00%	96.00%
S88	58.00%	48.86%	68.67%	68.86%	71.33%	62.67%	86.00%
S89	61.14%	61.36%	65.33%	77.00%	75.00%	78.67%	95.33%
S90	58.29%	59.97%	67.00%	56.00%	61.33%	61.00%	88.00%
S91	52.57%	50.60%	65.00%	60.86%	63.00%	57.67%	92.00%
S92	60.00%	63.10%	70.33%	53.86%	61.67%	65.00%	86.67%
S93	47.86%	42.26%	48.67%	70.29%	67.00%	65.67%	88.00%
S94	50.29%	49.21%	67.33%	66.71%	56.33%	65.67%	90.67%
S95	58.00%	70.04%	64.00%	60.57%	72.00%	68.67%	93.67%
S96	46.43%	59.28%	58.33%	60.71%	59.67%	79.33%	85.00%
S97	58.14%	59.28%	64.67%	70.29%	74.00%	60.67%	87.67%
S98	51.14%	51.99%	54.67%	60.14%	65.00%	71.00%	90.67%
S99	52.71%	48.51%	72.00%	43.00%	69.33%	60.33%	92.00%
S100	49.00%	42.26%	54.33%	65.29%	56.00%	65.00%	84.33%
S101	45.29%	41.22%	55.67%	47.29%	64.67%	66.33%	92.00%
S102	46.14%	41.22%	51.00%	42.71%	50.00%	70.00%	82.33%
S103	60.00%	42.96%	51.67%	48.29%	51.67%	69.67%	81.67%
S104	54.43%	51.99%	54.00%	66.71%	53.33%	63.33%	94.00%
ACC	<b>52.91%</b>	<b>54.45%</b>	<b>64.01%</b>	<b>58.36%</b>	<b>65.22%</b>	<b>66.98%</b>	<b>88.41%</b>
STD	<b>0.0623</b>	<b>0.0784</b>	<b>0.0717</b>	<b>0.0872</b>	<b>0.0962</b>	<b>0.0712</b>	<b>0.0594</b>

TABLE III  
THE DETAIL WITHIN-SUBJECT PERFORMANCE OF ALL METHODS ON THE LLM-BCIMOTION DATASET.

Subject	FBCSP+SVM	FBCSP+KNN	ShallowNet	EEGNet	LMDA-Net	T3SFTNet	THFGCN
S1	51.85%	55.56%	62.96%	50.00%	71.30%	77.78%	<b>87.96%</b>
S2	62.50%	61.11%	58.80%	66.67%	56.48%	83.33%	<b>78.70%</b>
S3	70.83%	63.89%	57.87%	72.22%	60.19%	77.77%	<b>75.00%</b>
S4	45.37%	48.61%	56.02%	61.11%	67.59%	77.78%	<b>82.41%</b>
S5	49.07%	47.69%	54.17%	61.11%	54.63%	66.67%	<b>82.87%</b>
S6	54.17%	56.48%	75.93%	77.78%	67.13%	77.78%	<b>89.81%</b>
S7	64.35%	61.11%	59.72%	83.33%	60.65%	83.33%	<b>79.63%</b>
S8	55.56%	61.11%	61.57%	66.67%	45.83%	77.78%	<b>84.72%</b>
S9	55.09%	50.46%	50.46%	72.22%	64.81%	72.22%	<b>85.65%</b>
S10	57.41%	53.24%	56.02%	61.11%	70.37%	66.67%	<b>81.48%</b>
ACC	<b>56.62%</b>	<b>55.93%</b>	<b>59.35%</b>	<b>67.22%</b>	<b>61.90%</b>	<b>76.11%</b>	<b>82.82%</b>
STD	<b>0.0683</b>	<b>0.0525</b>	<b>0.0620</b>	<b>0.0869</b>	<b>0.0722</b>	<b>0.0532</b>	<b>0.0401</b>