

NeuroNetV1: An Adaptive End-to-End Multidomain EEG Classification Network

Supplementary Document

This document offers a comprehensive analysis of the subject-wise results across all EEG datasets. The performance metrics included are accuracy, sensitivity, specificity, precision, $f1$ -score, and Cohen's Kappa coefficient. These results are derived by averaging the 5-fold outcomes for each subject. The detailed results are presented as follows:

Table 1: Classification Performance of NeuroNetV1 on Motor Imagery EEG Dataset MI-I, Averaged Over 5 Folds for Each Subject

Subjects	Accuracy (%)	Sensitivity (%)	Specificity (%)	Precision (%)	F1-score (%)	Kappa (%)
1	98.80	98.80	98.88	98.82	98.80	97.59
2	99.11	99.11	99.11	99.11	99.11	98.21
3	97.62	97.62	97.62	97.73	97.62	95.24
4	98.21	98.21	98.45	98.28	98.22	96.42
5	100.00	100.00	100.00	100.00	100.00	100.00
Mean \pm Std	98.75 \pm 0.90	98.75 \pm 0.90	98.81 \pm 0.87	98.79 \pm 0.86	98.75 \pm 0.90	97.49 \pm 1.81

Table 2: Classification Performance of NeuroNetV1 on Motor Imagery EEG Dataset MI-II, Averaged Over 5 Folds for Each Subject

Subjects	Accuracy (%)	Sensitivity (%)	Specificity (%)	Precision (%)	F1-score (%)	Kappa (%)
1	93.65	93.65	96.58	93.70	93.66	89.85
2	94.20	94.20	96.95	94.23	94.21	90.73
3	94.75	94.75	97.14	94.78	94.76	91.61
4	93.65	93.65	96.21	93.64	93.63	89.80
5	90.06	90.06	95.96	90.77	90.16	84.39
6	94.20	94.20	96.39	94.22	94.20	90.70
7	91.44	91.44	95.29	91.53	91.45	86.33
8	89.23	89.23	94.35	89.56	89.30	82.93
9	94.20	94.20	96.42	94.36	94.21	90.70
10	89.78	89.78	94.52	89.99	89.82	83.74
11	91.44	91.44	95.28	91.60	91.46	86.34
12	94.20	94.20	96.39	94.19	94.20	90.69
13	92.82	92.82	95.56	92.81	92.81	88.47
14	93.92	93.92	97.42	94.19	93.95	90.38
15	95.30	95.30	97.32	95.32	95.31	92.48
16	94.48	94.48	97.99	94.83	94.53	91.26
17	90.88	90.88	96.05	91.33	90.98	85.59
18	90.61	90.61	95.39	90.83	90.66	85.09
19	95.58	95.58	97.78	95.64	95.59	92.95
20	95.86	95.86	98.07	95.92	95.87	93.39

21	91.99	91.99	96.00	92.23	92.03	87.27
22	93.09	93.09	96.02	93.12	93.10	88.96
23	90.33	90.33	95.67	90.76	90.41	84.74
24	93.92	93.92	96.85	94.08	93.94	90.32
25	93.65	93.65	96.77	93.76	93.67	89.88
26	95.30	95.30	97.32	95.33	95.31	92.49
27	91.99	91.99	95.66	92.09	92.02	87.20
28	92.27	92.27	96.12	92.41	92.30	87.69
29	90.61	90.61	95.39	90.89	90.66	85.12
30	95.03	95.03	97.43	95.12	95.05	92.07
31	89.50	89.50	94.65	89.72	89.54	83.34
32	89.23	89.23	95.32	89.85	89.34	83.05
33	92.82	92.82	96.70	93.04	92.86	88.61
34	95.03	95.03	97.04	95.03	95.02	92.02
35	95.58	95.58	98.35	95.77	95.61	92.97
36	94.48	94.48	97.04	94.54	94.49	91.19
37	95.86	95.86	98.07	95.96	95.88	93.40
38	94.20	94.20	96.94	94.23	94.21	90.70
39	95.86	95.86	98.07	95.89	95.87	93.37
40	95.03	95.03	97.97	95.19	95.06	92.10
41	90.06	90.06	95.02	90.35	90.10	84.27
42	94.20	94.20	96.76	94.27	94.21	90.75
43	95.03	95.03	97.79	95.22	95.04	92.12
44	95.03	95.03	96.66	95.02	95.01	91.99
45	95.30	95.30	98.07	95.44	95.34	92.53
46	93.92	93.92	97.80	94.37	93.96	90.43
47	91.99	91.99	95.86	92.11	92.02	87.24
48	90.61	90.61	95.39	90.83	90.66	85.06
49	94.48	94.48	97.05	94.52	94.49	91.17
50	90.33	90.33	94.94	90.50	90.38	84.61
51	89.50	89.50	95.02	89.90	89.57	83.41
52	95.03	95.03	97.60	95.06	95.04	92.04
53	92.54	92.54	96.02	92.70	92.55	88.12
54	92.82	92.82	97.06	93.14	92.87	88.64
55	90.88	90.88	95.11	91.02	90.92	85.46
56	94.75	94.75	97.13	94.80	94.77	91.61
57	91.44	91.44	95.63	91.72	91.49	86.38
58	90.06	90.06	95.01	90.14	90.09	84.10
59	91.16	91.16	95.76	91.50	91.24	85.98
60	94.20	94.20	96.95	94.27	94.22	90.75
61	93.65	93.65	96.95	93.83	93.67	89.92
62	91.44	91.44	96.04	91.77	91.49	86.45
63	89.50	89.50	94.84	89.88	89.58	83.37

64	95.30	95.30	97.51	95.37	95.31	92.52
65	92.54	92.54	95.84	92.64	92.55	88.11
66	95.03	95.03	97.42	95.04	95.03	92.04
67	92.82	92.82	96.49	92.95	92.84	88.56
68	95.58	95.58	97.60	95.60	95.59	92.93
69	91.44	91.44	95.85	91.63	91.49	86.39
70	91.71	91.71	95.19	91.75	91.72	86.76
71	91.44	91.44	95.10	91.58	91.45	86.36
72	95.03	95.03	97.23	95.06	95.03	92.06
73	93.65	93.65	96.96	93.73	93.66	89.87
74	90.06	90.06	94.65	90.19	90.07	84.14
75	91.16	91.16	95.80	91.50	91.24	86.00
76	93.92	93.92	96.49	93.92	93.92	90.25
77	93.65	93.65	97.55	93.98	93.72	89.94
78	90.06	90.06	95.58	90.64	90.14	84.35
79	89.23	89.23	94.19	89.39	89.27	82.86
80	90.33	90.33	94.93	90.56	90.36	84.67
81	94.20	94.20	96.59	94.20	94.20	90.69
82	92.82	92.82	96.50	92.96	92.85	88.57
83	93.92	93.92	97.41	94.21	93.98	90.36
84	89.78	89.78	95.86	90.48	89.90	83.93
85	89.78	89.78	94.74	89.99	89.82	83.76
86	92.82	92.82	95.76	92.93	92.79	88.47
87	95.03	95.03	97.77	95.19	95.06	92.09
88	91.97	91.97	96.29	92.27	92.03	87.28
89	95.77	95.77	98.21	95.92	95.80	93.27
90	91.16	91.16	96.15	91.63	91.24	86.05
91	94.20	94.20	96.40	94.24	94.20	90.71
92	94.04	94.04	97.32	94.19	94.08	90.52
93	91.44	91.44	94.89	91.54	91.39	86.23
94	90.33	90.33	94.74	90.54	90.36	84.64
95	94.48	94.48	97.61	94.59	94.51	91.20
96	92.27	92.27	96.13	92.44	92.31	87.69
97	93.37	93.37	96.86	93.53	93.40	89.46
98	91.44	91.44	95.11	91.62	91.47	86.38
99	93.09	93.09	96.40	93.18	93.12	88.99
100	90.91	90.91	95.30	91.09	90.94	85.53
101	94.48	94.48	97.24	94.57	94.49	91.19
102	95.03	95.03	97.22	95.09	95.05	92.04
103	91.16	91.16	95.00	91.15	91.15	85.82
104	94.13	94.13	96.73	94.19	94.15	90.64
105	93.65	93.65	97.33	94.00	93.67	89.97
106	91.79	91.79	95.69	91.91	91.83	86.89

107	92.54	92.54	96.22	92.65	92.56	88.12
108	92.27	92.27	96.32	92.52	92.29	87.75
109	95.03	95.03	97.61	95.16	95.03	92.11
Mean \pm Std	92.84 \pm 1.95	92.84 \pm 1.95	96.37 \pm 1.04	93.01 \pm 1.87	92.87 \pm 1.93	88.61 \pm 3.08

Table 3: Classification Performance of NeuroNetV1 on Motor Imagery EEG Dataset MI-III, Averaged Over 5 Folds for Each Subject

Subjects	Accuracy (%)	Sensitivity (%)	Specificity (%)	Precision (%)	F1-score (%)	Kappa (%)
1	96.00	96.00	96.00	96.02	96.00	92.00
2	91.50	91.50	91.50	91.50	91.50	83.00
3	96.50	96.50	96.50	96.54	96.50	93.00
4	94.50	94.50	94.50	94.54	94.50	89.00
5	97.00	97.00	97.00	97.00	97.00	94.00
6	95.00	95.00	95.00	95.07	95.00	90.00
7	92.92	92.92	92.92	92.94	92.92	85.83
8	93.50	93.50	93.50	93.54	93.50	87.00
9	94.17	94.17	94.17	94.36	94.16	88.33
10	97.00	97.00	97.00	97.02	97.00	94.00
11	92.50	92.50	92.50	92.50	92.50	85.00
12	96.00	96.00	96.00	96.07	96.00	92.00
13	91.50	91.50	91.50	91.50	91.50	83.00
14	91.50	91.50	91.50	91.54	91.50	83.00
15	95.00	95.00	95.00	95.02	95.00	90.00
16	93.00	93.00	93.00	93.16	92.99	86.00
17	94.50	94.50	94.50	94.54	94.50	89.00
18	96.00	96.00	96.00	96.00	96.00	92.00
19	93.50	93.50	93.50	93.50	93.50	87.00
20	95.00	95.00	95.00	95.00	95.00	90.00
21	92.50	92.50	92.50	92.50	92.50	85.00
22	94.00	94.00	94.00	94.07	94.00	88.00
23	93.00	93.00	93.00	93.07	93.00	86.00
24	92.00	92.00	92.00	92.07	92.00	84.00
25	94.50	94.50	94.50	94.54	94.50	89.00
26	91.50	91.50	91.50	91.50	91.50	83.00
27	96.50	96.50	96.50	96.54	96.50	93.00
28	97.50	97.50	97.50	97.50	97.50	95.00
29	92.00	92.00	92.00	92.02	92.00	84.00
30	94.00	94.00	94.00	94.00	94.00	88.00
31	96.00	96.00	96.00	96.00	96.00	92.00
32	92.50	92.50	92.50	92.50	92.50	85.00
33	92.50	92.50	92.50	92.71	92.49	85.00
34	94.00	94.00	94.00	94.07	94.00	88.00
35	92.00	92.00	92.00	92.27	91.99	84.00

36	93.00	93.00	93.00	93.00	93.00	86.00
37	93.50	93.50	93.50	93.61	93.50	87.00
38	96.50	96.50	96.50	96.62	96.50	93.00
39	96.00	96.00	96.00	96.02	96.00	92.00
40	91.50	91.50	91.50	91.60	91.49	83.00
41	91.50	91.50	91.50	91.50	91.50	83.00
42	93.00	93.00	93.00	93.02	93.00	86.00
43	92.50	92.50	92.50	92.50	92.50	85.00
44	93.00	93.00	93.00	93.02	93.00	86.00
45	92.00	92.00	92.00	92.02	92.00	84.00
46	92.92	92.92	92.92	93.16	92.91	85.83
47	96.50	96.50	96.50	96.50	96.50	93.00
48	97.50	97.50	97.50	97.50	97.50	95.00
49	95.50	95.50	95.50	95.50	95.50	91.00
50	92.00	92.00	92.00	92.00	92.00	84.00
51	92.50	92.50	92.50	92.50	92.50	85.00
52	97.50	97.50	97.50	97.50	97.50	95.00
Mean \pm Std	94.00 \pm 1.90	94.00 \pm 1.90	94.00 \pm 1.90	94.05 \pm 1.89	94.00 \pm 1.90	88.00 \pm 3.81

Table 4: Classification Performance of NeuroNetV1 on Motor Imagery EEG Dataset MI-IV, Averaged Over 5 Folds for Each Subject

Subjects	Accuracy (%)	Sensitivity (%)	Specificity (%)	Precision (%)	F1-score (%)	Kappa (%)
1	94.79	94.79	98.26	94.81	94.78	93.06
2	94.44	94.44	98.15	94.46	94.43	92.59
3	94.10	94.10	98.03	94.18	94.11	92.13
4	97.92	97.92	99.31	97.93	97.92	97.22
5	98.26	98.26	99.42	98.30	98.27	97.69
6	94.44	94.44	98.15	94.47	94.45	92.59
7	97.57	97.57	99.19	97.60	97.57	96.76
8	98.26	98.26	99.42	98.29	98.26	97.69
9	99.31	99.31	99.77	99.31	99.31	99.07
Mean \pm Std	96.57 \pm 2.07	96.57 \pm 2.07	98.86 \pm 0.69	96.59 \pm 2.06	96.57 \pm 2.07	95.42 \pm 2.76

Table 5: Classification Performance of NeuroNetV1 on Mental Imagery EEG Dataset MeI-V, Averaged Over 5 Folds for Each Subject

Subjects	Accuracy (%)	Sensitivity (%)	Specificity (%)	Precision (%)	F1-score (%)	Kappa (%)
1	98.60	98.60	99.37	98.63	98.61	97.89
2	97.76	97.76	98.94	97.78	97.76	96.61
3	98.17	98.17	99.08	98.18	98.17	97.26
Mean \pm Std	98.18 \pm 0.42	98.18 \pm 0.42	99.13 \pm 0.22	98.19 \pm 0.43	98.18 \pm 0.42	97.25 \pm 0.64

Table 6: Classification Performance of NeuroNetV1 on P300 EEG Dataset P300-VI, Averaged Over 5 Folds for Each Subject

Subjects	Accuracy (%)	Sensitivity (%)	Specificity (%)	Precision (%)	F1-score (%)	Kappa (%)
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1	95.88	95.88	96.62	96.05	95.91	91.12
2	95.29	95.29	95.79	96.91	95.77	71.75
3	96.18	96.18	94.18	96.85	96.38	80.55
4	96.76	96.76	97.50	96.90	96.79	92.88
5	97.35	97.35	97.09	97.36	97.35	94.63
6	96.76	96.76	96.78	96.77	96.77	93.52
7	95.29	95.29	95.25	95.35	95.31	89.95
8	97.94	97.94	97.84	97.95	97.94	95.63
9	96.47	96.47	95.61	96.47	96.47	92.08
10	96.76	96.76	96.37	96.89	96.80	91.13
11	95.59	95.59	95.90	95.76	95.63	89.80
12	95.29	95.29	99.58	97.01	95.76	75.29
13	97.06	97.06	96.36	97.66	97.23	82.28
14	97.06	97.06	96.09	97.05	97.05	93.51
15	96.18	96.18	97.24	96.42	96.22	91.07
16	97.35	97.35	97.06	97.43	97.35	94.67
Mean \pm Std	96.45 \pm 0.82	96.45 \pm 0.82	96.58 \pm 1.22	96.80 \pm 0.68	96.54 \pm 0.74	88.74 \pm 7.25

Table 7: Classification Performance of NeuroNetV1 on Slow Cortical Potential EEG Dataset SCP-VII, Averaged Over 5 Folds for Each Subject

Subjects	Accuracy (%)	Sensitivity (%)	Specificity (%)	Precision (%)	F1-score (%)	Kappa (%)
1	95.90	95.90	95.87	95.96	95.89	91.79
2	92.50	92.50	92.50	92.50	92.50	85.00
Mean \pm Std	94.20 \pm 2.40	94.20 \pm 2.40	94.18 \pm 2.38	94.23 \pm 2.44	94.20 \pm 2.40	88.39 \pm 4.80

Table 8: Classification Performance of NeuroNetV1 on Emotions EEG Dataset Emot-VIII, Averaged Over 5 Folds for Each Subject

Subjects	Accuracy (%)	Sensitivity (%)	Specificity (%)	Precision (%)	F1-score (%)	Kappa (%)
1	97.99	97.99	99.00	97.99	97.99	96.98
2	94.31	94.31	97.16	94.31	94.31	91.45
3	93.72	93.72	96.89	93.79	93.72	90.57
4	96.81	96.81	98.39	96.81	96.81	95.21
5	97.35	97.35	98.67	97.35	97.35	96.02
6	98.09	98.09	99.04	98.09	98.09	97.13
7	95.14	95.14	97.58	95.14	95.14	92.71
8	93.86	93.86	96.90	93.89	93.86	90.79
9	92.73	92.73	96.36	92.73	92.73	89.10
10	93.27	93.27	96.65	93.28	93.28	89.91
11	94.55	94.55	97.25	94.56	94.55	91.82
12	95.24	95.24	97.62	95.25	95.24	92.85
13	93.47	93.47	96.74	93.47	93.47	90.20
14	98.23	98.23	99.11	98.24	98.23	97.35
15	98.87	98.87	99.44	98.88	98.87	98.31

Mean \pm Std	95.58 \pm 2.10	95.58 \pm 2.10	97.79 \pm 1.05	95.59 \pm 2.10	95.58 \pm 2.10	93.36 \pm 3.15
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Table 9: Classification Performance of NeuroNetV1 on Sleep Stage Dataset Sleep-IX, Averaged Over 5 Folds for Each Subject

Subjects	Accuracy (%)	Sensitivity (%)	Specificity (%)	Precision (%)	F1-score (%)	Kappa (%)
1	95.86	95.86	98.92	95.94	95.88	94.58
2	96.69	96.69	99.31	96.81	96.72	95.02
3	91.78	91.78	98.08	92.23	91.88	88.58
4	99.16	99.16	99.78	99.17	99.16	98.78
5	98.30	98.30	99.53	98.36	98.31	97.58
6	95.83	95.83	98.93	95.94	95.85	94.24
7	97.08	97.08	99.36	97.18	97.10	95.96
8	94.09	94.09	98.45	94.19	94.11	92.23
9	95.23	95.23	98.87	95.48	95.30	93.78
10	98.02	98.02	99.65	98.10	98.04	97.13
11	94.93	94.93	98.65	95.42	95.06	91.73
12	97.69	97.69	99.56	97.74	97.71	96.50
13	95.07	95.07	98.58	95.17	95.09	93.40
14	83.45	83.45	96.02	85.23	83.92	76.82
15	90.80	90.80	97.77	91.84	91.10	87.47
16	98.79	98.79	99.68	98.80	98.79	98.35
17	94.87	94.87	98.84	95.16	94.94	92.96
18	98.71	98.71	99.64	98.73	98.72	98.22
19	93.78	93.78	98.46	93.98	93.81	91.77
20	94.15	94.15	98.72	94.63	94.26	91.75
Mean \pm Std	95.21 \pm 3.59	95.21 \pm 3.59	98.84 \pm 0.87	95.51 \pm 3.20	95.29 \pm 3.49	93.34 \pm 4.99

Table 10: Classification Performance of NeuroNetV1 on Schizophrenia EEG Dataset SZ-XI, Averaged Over 5 Folds for Each Subject. The data for all 81 subjects was combined to form the training and testing set. Here we present the classification accuracies for three different cases.

Cases	Accuracy (%)	Sensitivity (%)	Specificity (%)	Precision (%)	F1-score (%)	Kappa (%)
1	98.51	98.51	98.58	98.52	98.51	96.91
2	99.13	99.13	99.15	99.13	99.13	98.21
3	99.33	99.33	99.34	99.33	99.33	98.62
Mean \pm Std	98.99 \pm 0.43	98.99 \pm 0.43	99.02 \pm 0.40	98.99 \pm 0.43	98.99 \pm 0.43	97.91 \pm 0.89

Table 11: Classification Performance of NeuroNetV1 on Alcoholism EEG Dataset AC-XI, Averaged Over 5 Folds for Each Subject. The data for all 122 subjects was combined to form the training and testing set.

Subjects	Accuracy (%)	Sensitivity (%)	Specificity (%)	Precision (%)	F1-score (%)	Kappa (%)
1-122 combined	98.29	98.29	98.27	98.30	98.29	96.34

Table 12: Classification Performance of NeuroNetV1 on Alzheimer EEG Dataset AD-XI, Averaged Over 5 Folds for Each Subject. The data for all 88 subjects was combined to form the training and testing set.

Subjects	Accuracy (%)	Sensitivity (%)	Specificity (%)	Precision (%)	F1-score (%)	Kappa (%)
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1-88 combined	89.18	89.18	89.13	89.28	89.21	77.88
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Table 13: Classification Performance of NeuroNetV1 on Epilepsy EEG Dataset EP-XI, Averaged Over 5 Folds for Each Subject

Subjects	Accuracy (%)	Sensitivity (%)	Specificity (%)	Precision (%)	F1-score (%)	Kappa (%)
1	98.82	98.82	98.82	98.82	98.82	97.63
2	98.72	98.72	98.72	98.72	98.72	97.43
3	99.15	99.15	99.15	99.15	99.15	98.30
4	98.78	98.78	98.78	98.78	98.78	97.57
5	99.38	99.38	99.38	99.38	99.38	98.77
Mean ± Std	98.97 ± 0.29	98.97 ± 0.29	98.97 ± 0.29	98.97 ± 0.29	98.97 ± 0.29	97.94 ± 0.57