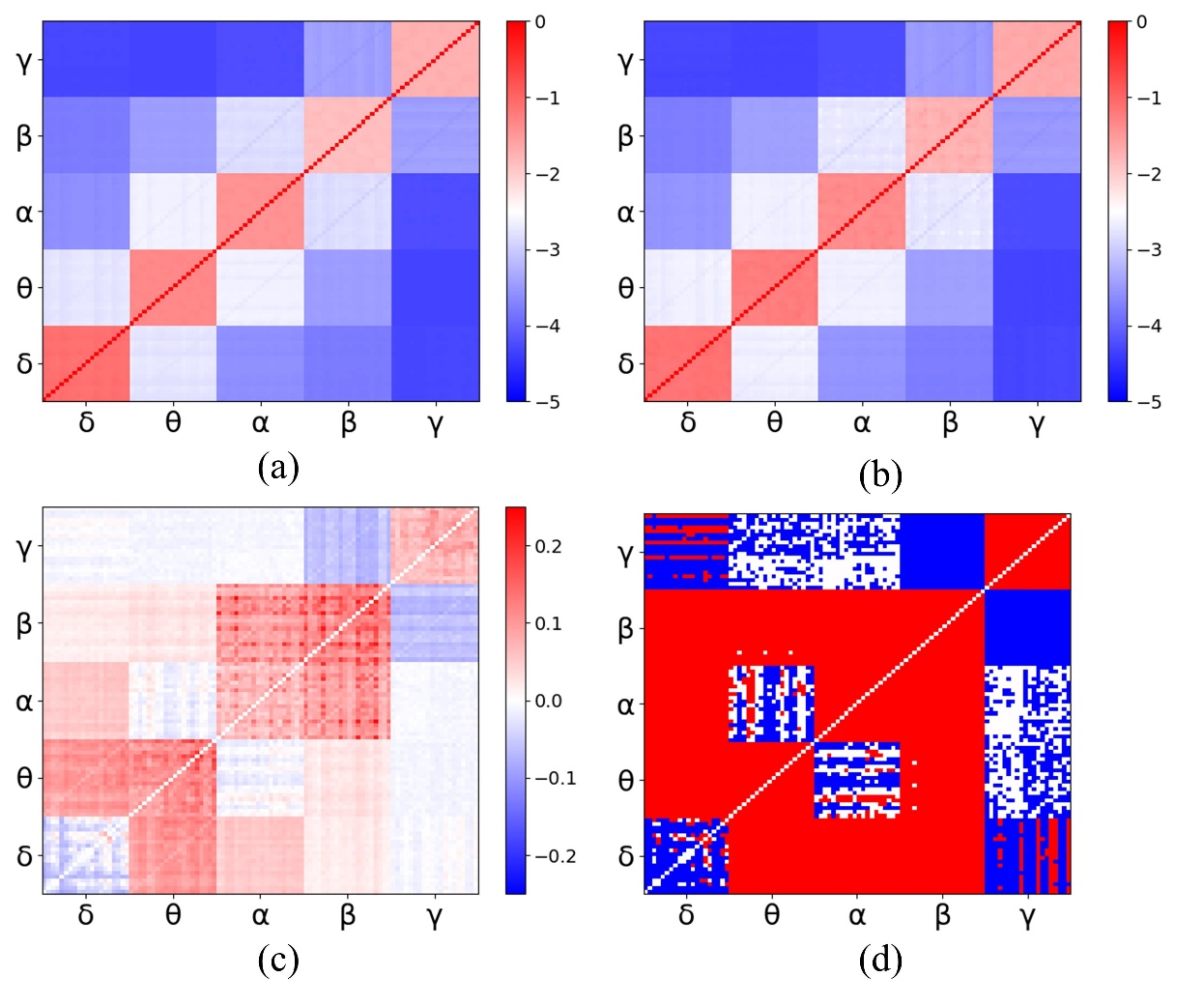
**Compare the Results of PLV and PLI**

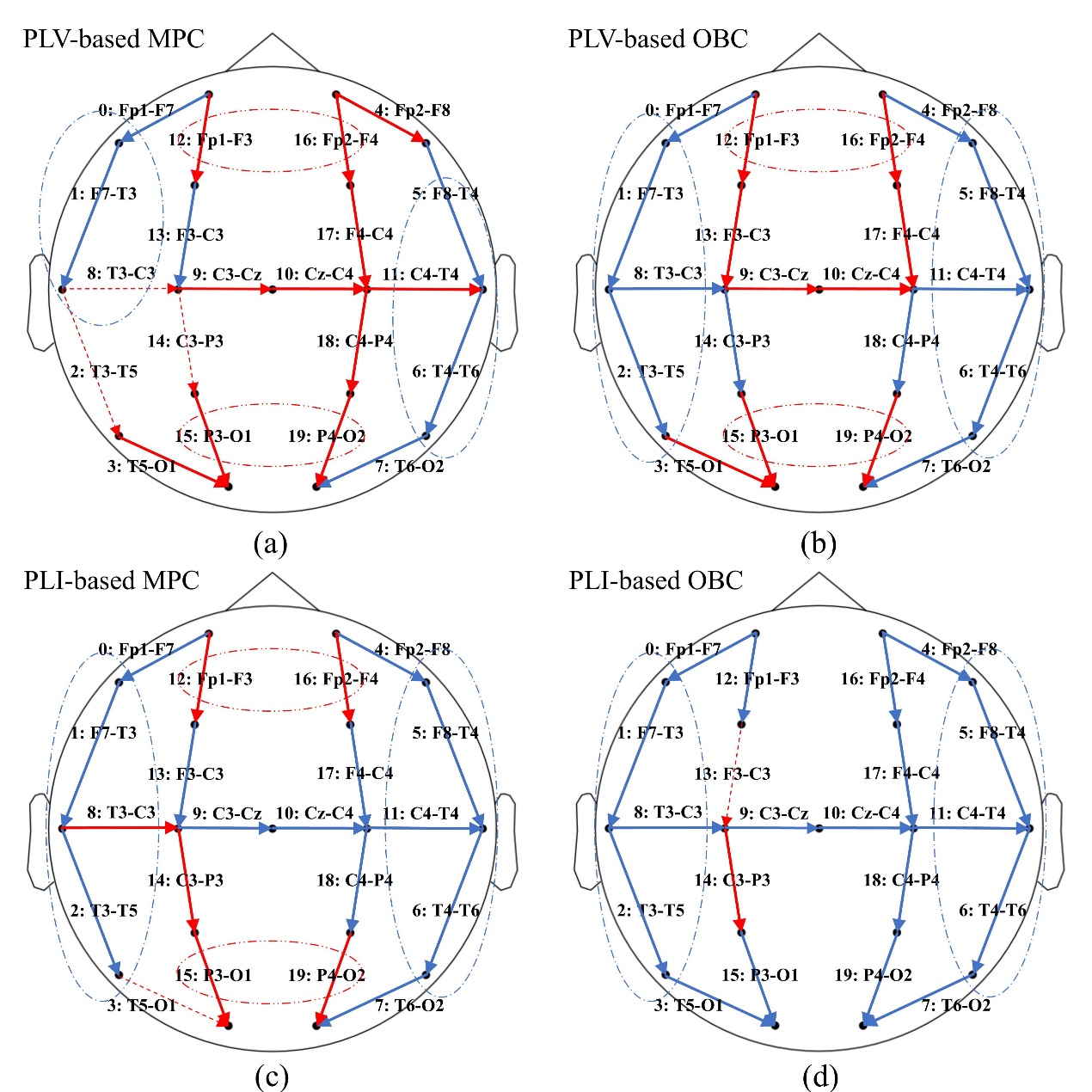
We applied the Phase Lag Index (PLI) to replicate most experiments and verify its consistency with the main findings based on PLV. Fig. S1 shows the average supra-adjacency matrix from PLI, and Tables S1- S12 (first two columns) present p-values and r-effect sizes from PLV and PLI.

Comparing Fig. 6 and Fig. S1, it is clear that the overall trends of each subnetwork are consistent. Within the subnetworks, the PLI-based results exhibit smoother patterns. In the δ-γ subnetwork, the key channels highlighted in the main text ("P3-O1", "P4-O2", "Fp1-F3", and "Fp2-F4") exhibited similar local synchronization increases in the PLI results. Furthermore, the channel "T3-C3", corresponding to the left temporal to central region, also demonstrates a similar pattern in the PLI results. In the θ-α subnetwork, the key channels highlighted in the main text are "Fp1-F3", "Fp2-F4", "Fp2-F8", and "F8-T4". Among these, channels "Fp2-F8" and "F8-T4" displayed consistent patterns in PLI, whereas the increases observed in "Fp1-F3" and "Fp2-F4" were not statistically significant in PLI. Therefore, the right temporal lobe region is a suggested area to focus on for further research in this subnetwork. In summary, the results of PLV and PLI are basically the same in the visual analysis of the supra-adjacency matrix.

As seen from meanPLV in Table S1, MCC in Table S3, in Table S11, and algebraic connectivity () in Table S12, the conclusions drawn from PLV and PLI on these four features remain consistent. The effect sizes obtained with PLI are generally slightly lower than those with PLV. Except for MCC, the effect sizes of other node-level features, such as MPC, BC, and OBC, are all very small. This may be due to differences in individualized node-level characteristics during epileptic seizures. For BC of the full-band signals, the trends of PLV and PLI are similar. However, in the BC of specific-band signals, PLI tends to show a greater reduction than PLV. Since OBC is calculated as an aggregate of BC, this trend is also reflected in OBC. We cannot exclude the possibility that the OBC results from PLV may be influenced by spurious synchronization. Therefore, node-level conclusions must be inferred with greater caution. In Section IV.E, the primary conclusions are drawn by integrating analyses of OBC, MPC, and CFC.

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**Figure S1.** Differences of supra-adjacency matrices of multilayer networks between interictal and ictal periods using PLI. (a) The average supra-adjacency matrix in the interictal period (logarithm). (b) The average supra-adjacency matrix in the ictal period (logarithm). (c) Differences between two supra-adjacency matrices. (d) The significance of the differences between the two groups (white represents non-significant results, red represents an increase in the ictal period relative to the interictal period, and blue represents a relative decrease).



**Figure S2.** Trends of average MPC and OBC in PLV- or PLI-based multilayer network between the interictal and ictal periods. Red indicates that the values of the ictal period are higher than the interictal ones, while blue indicates the opposite. The solid line indicates significant differences and dashed line indicates non-significant differences.

**Table S1.** Statistical analysis of meanPLV for each subnetwork: p-value and effect size (Cohen’s *r*)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | subnetwork | PLV (top 30%) | | PLI (top 30%) | | PLV (top 20%) | | PLV (top 40%) | |
| p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r |
| meanPLV | δ | <1e-5\*\*\* | -0.02279 | <1e-5\*\*\* | -0.07522 | <1e-5\*\*\* | -0.02002 | <1e-5\*\*\* | -0.02547 |
| δ-θ | <1e-5\*\*\* | 0.27431 | <1e-5\*\*\* | 0.27095 | <1e-5\*\*\* | 0.27171 | <1e-5\*\*\* | 0.27534 |
| δ-α | <1e-5\*\*\* | 0.18226 | <1e-5\*\*\* | 0.19472 | <1e-5\*\*\* | 0.18108 | <1e-5\*\*\* | 0.18242 |
| δ-β | <1e-5\*\*\* | 0.20279 | <1e-5\*\*\* | 0.15087 | <1e-5\*\*\* | 0.19978 | <1e-5\*\*\* | 0.20419 |
| δ-γ | <1e-5\*\*\* | 0.08013 | <1e-5\*\*\* | 0.11089 | <1e-5\*\*\* | 0.08159 | <1e-5\*\*\* | 0.07854 |
| θ | <1e-5\*\*\* | 0.24238 | <1e-5\*\*\* | 0.22820 | <1e-5\*\*\* | 0.24634 | <1e-5\*\*\* | 0.23869 |
| θ-α | <1e-5\*\*\* | -0.01607 | <1e-5\*\*\* | -0.01217 | <1e-5\*\*\* | -0.01731 | <1e-5\*\*\* | -0.01533 |
| θ-β | <1e-5\*\*\* | 0.13498 | <1e-5\*\*\* | 0.11068 | <1e-5\*\*\* | 0.13228 | <1e-5\*\*\* | 0.13646 |
| θ-γ | <1e-5\*\*\* | -0.01697 | <1e-5\*\*\* | -0.04506 | <1e-5\*\*\* | -0.01431 | <1e-5\*\*\* | -0.01896 |
| α | <1e-5\*\*\* | 0.22878 | <1e-5\*\*\* | 0.14994 | <1e-5\*\*\* | 0.23259 | <1e-5\*\*\* | 0.22468 |
| α-β | <1e-5\*\*\* | 0.21470 | <1e-5\*\*\* | 0.23785 | <1e-5\*\*\* | 0.21099 | <1e-5\*\*\* | 0.21700 |
| α-γ | <1e-5\*\*\* | -0.03848 | <1e-5\*\*\* | -0.02738 | <1e-5\*\*\* | -0.03714 | <1e-5\*\*\* | -0.03925 |
| β | <1e-5\*\*\* | 0.29922 | <1e-5\*\*\* | 0.23962 | <1e-5\*\*\* | 0.29432 | <1e-5\*\*\* | 0.29961 |
| β-γ | <1e-5\*\*\* | -0.26424 | <1e-5\*\*\* | -0.23394 | <1e-5\*\*\* | -0.26079 | <1e-5\*\*\* | -0.26652 |
| γ | <1e-5\*\*\* | 0.19316 | <1e-5\*\*\* | 0.14542 | <1e-5\*\*\* | 0.18150 | <1e-5\*\*\* | 0.19890 |

\*\*\*: < 0.001, \*\*: < 0.01, \*: < 0.05, Red: the data from the ictal phase tends to have higher ranks than the interictal phase.

**Table S2.** Statistical analysis of MPC for each node: p-value and effect size (Cohen’s *r*)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | network | PLV (top 30%) | | PLI (top 30%) | | PLV (top 20%) | | PLV (top 40%) | |
| p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r |
| MPC | FP1-F7 | <1e-5\*\*\* | -0.02446 | <1e-5\*\*\* | -0.01966 | <1e-5\*\*\* | -0.04633 | 0.31586 | -0.00180 |
| F7-T3 | <1e-5\*\*\* | -0.08253 | <1e-5\*\*\* | -0.04984 | <1e-5\*\*\* | -0.11400 | <1e-5\*\*\* | -0.05516 |
| T3-T5 | 0.05362 | 0.00355 | <1e-5\*\*\* | -0.01728 | <1e-5\*\*\* | -0.00980 | <1e-5\*\*\* | 0.01889 |
| T5-O1 | <1e-5\*\*\* | 0.02792 | 0.41225 | 0.00147 | <1e-5\*\*\* | 0.01440 | <1e-5\*\*\* | 0.03810 |
| FP2-F8 | <1e-5\*\*\* | 0.02420 | <1e-5\*\*\* | -0.01425 | <1e-5\*\*\* | 0.01058 | <1e-5\*\*\* | 0.03843 |
| F8-T4 | <1e-5\*\*\* | -0.00858 | <1e-5\*\*\* | -0.03513 | <1e-5\*\*\* | -0.03276 | <1e-5\*\*\* | 0.01370 |
| T4-T6 | <1e-5\*\*\* | -0.06522 | <1e-5\*\*\* | -0.02859 | <1e-5\*\*\* | -0.08614 | <1e-5\*\*\* | -0.04323 |
| T6-O2 | <1e-5\*\*\* | -0.03813 | <1e-5\*\*\* | -0.01891 | <1e-5\*\*\* | -0.04851 | <1e-5\*\*\* | -0.02497 |
| T3-C3 | 0.75075 | 0.00057 | <1e-5\*\*\* | 0.01186 | <1e-5\*\*\* | -0.01438 | <1e-5\*\*\* | 0.01312 |
| C3-CZ | <1e-5\*\*\* | 0.01073 | <1e-5\*\*\* | -0.01005 | 0.00215\*\* | 0.00551 | <1e-5\*\*\* | 0.01448 |
| CZ-C4 | <1e-5\*\*\* | 0.07444 | <1e-5\*\*\* | -0.01503 | <1e-5\*\*\* | 0.07960 | <1e-5\*\*\* | 0.06813 |
| C4-T4 | <1e-5\*\*\* | 0.02889 | <1e-5\*\*\* | -0.02012 | <1e-5\*\*\* | 0.01937 | <1e-5\*\*\* | 0.03238 |
| FP1-F3 | <1e-5\*\*\* | 0.05476 | <1e-5\*\*\* | 0.02506 | <1e-5\*\*\* | 0.03918 | <1e-5\*\*\* | 0.06950 |
| F3-C3 | <1e-5\*\*\* | -0.01568 | <1e-5\*\*\* | -0.01002 | <1e-5\*\*\* | -0.03871 | <1e-5\*\*\* | 0.00919 |
| C3-P3 | 0.45496 | 0.00141 | <1e-5\*\*\* | 0.00674 | <1e-5\*\*\* | -0.01459 | <1e-5\*\*\* | 0.01538 |
| P3-O1 | <1e-5\*\*\* | 0.07870 | <1e-5\*\*\* | 0.02632 | <1e-5\*\*\* | 0.06761 | <1e-5\*\*\* | 0.08885 |
| FP2-F4 | <1e-5\*\*\* | 0.06728 | <1e-5\*\*\* | 0.01252 | <1e-5\*\*\* | 0.05609 | <1e-5\*\*\* | 0.08013 |
| F4-C4 | <1e-5\*\*\* | 0.03732 | <1e-5\*\*\* | -0.03367 | <1e-5\*\*\* | 0.02289 | <1e-5\*\*\* | 0.05065 |
| C4-P4 | <1e-5\*\*\* | 0.01933 | <1e-5\*\*\* | -0.03216 | <1e-5\*\*\* | 0.01162 | <1e-5\*\*\* | 0.02507 |
| P4-O2 | <1e-5\*\*\* | 0.06403 | <1e-5\*\*\* | 0.01104 | <1e-5\*\*\* | 0.05443 | <1e-5\*\*\* | 0.07472 |

\*\*\*: < 0.001, \*\*: < 0.01, \*: < 0.05, Red: the data from the ictal phase tends to have higher ranks than the interictal phase.

**Table S3.** Statistical analysis of MCC for each node: p-value and effect size (Cohen’s *r*)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | channel | PLV (top 30%) | | PLI (top 30%) | | PLV (top 20%) | | PLV (top 40%) | |
| p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r |
| MCC | FP1-F7 | <1e-5\*\*\* | 0.18442 | <1e-5\*\*\* | 0.14551 | <1e-5\*\*\* | 0.12307 | <1e-5\*\*\* | 0.22472 |
| F7-T3 | <1e-5\*\*\* | 0.16471 | <1e-5\*\*\* | 0.12604 | <1e-5\*\*\* | 0.10573 | <1e-5\*\*\* | 0.20699 |
| T3-T5 | <1e-5\*\*\* | 0.14539 | <1e-5\*\*\* | 0.10968 | <1e-5\*\*\* | 0.09056 | <1e-5\*\*\* | 0.18466 |
| T5-O1 | <1e-5\*\*\* | 0.18088 | <1e-5\*\*\* | 0.10451 | <1e-5\*\*\* | 0.13224 | <1e-5\*\*\* | 0.20983 |
| FP2-F8 | <1e-5\*\*\* | 0.16578 | <1e-5\*\*\* | 0.14207 | <1e-5\*\*\* | 0.10554 | <1e-5\*\*\* | 0.20822 |
| F8-T4 | <1e-5\*\*\* | 0.15014 | <1e-5\*\*\* | 0.13392 | <1e-5\*\*\* | 0.09377 | <1e-5\*\*\* | 0.19006 |
| T4-T6 | <1e-5\*\*\* | 0.18016 | <1e-5\*\*\* | 0.11889 | <1e-5\*\*\* | 0.12623 | <1e-5\*\*\* | 0.21755 |
| T6-O2 | <1e-5\*\*\* | 0.17637 | <1e-5\*\*\* | 0.10707 | <1e-5\*\*\* | 0.10852 | <1e-5\*\*\* | 0.21232 |
| T3-C3 | <1e-5\*\*\* | 0.21500 | <1e-5\*\*\* | 0.10297 | <1e-5\*\*\* | 0.17134 | <1e-5\*\*\* | 0.24353 |
| C3-CZ | <1e-5\*\*\* | 0.16426 | <1e-5\*\*\* | 0.08670 | <1e-5\*\*\* | 0.11943 | <1e-5\*\*\* | 0.19073 |
| CZ-C4 | <1e-5\*\*\* | 0.13620 | <1e-5\*\*\* | 0.07604 | <1e-5\*\*\* | 0.10582 | <1e-5\*\*\* | 0.16277 |
| C4-T4 | <1e-5\*\*\* | 0.20822 | <1e-5\*\*\* | 0.08931 | <1e-5\*\*\* | 0.16795 | <1e-5\*\*\* | 0.23521 |
| FP1-F3 | <1e-5\*\*\* | 0.20570 | <1e-5\*\*\* | 0.11633 | <1e-5\*\*\* | 0.15830 | <1e-5\*\*\* | 0.23581 |
| F3-C3 | <1e-5\*\*\* | 0.12542 | <1e-5\*\*\* | 0.11382 | <1e-5\*\*\* | 0.07149 | <1e-5\*\*\* | 0.17006 |
| C3-P3 | <1e-5\*\*\* | 0.19378 | <1e-5\*\*\* | 0.10090 | <1e-5\*\*\* | 0.14767 | <1e-5\*\*\* | 0.22370 |
| P3-O1 | <1e-5\*\*\* | 0.23475 | <1e-5\*\*\* | 0.09914 | <1e-5\*\*\* | 0.19567 | <1e-5\*\*\* | 0.25593 |
| FP2-F4 | <1e-5\*\*\* | 0.18713 | <1e-5\*\*\* | 0.11997 | <1e-5\*\*\* | 0.13487 | <1e-5\*\*\* | 0.22424 |
| F4-C4 | <1e-5\*\*\* | 0.15324 | <1e-5\*\*\* | 0.11831 | <1e-5\*\*\* | 0.11136 | <1e-5\*\*\* | 0.18842 |
| C4-P4 | <1e-5\*\*\* | 0.19593 | <1e-5\*\*\* | 0.08708 | <1e-5\*\*\* | 0.15805 | <1e-5\*\*\* | 0.22045 |
| P4-O2 | <1e-5\*\*\* | 0.21848 | <1e-5\*\*\* | 0.09481 | <1e-5\*\*\* | 0.18601 | <1e-5\*\*\* | 0.23971 |

\*\*\*: < 0.001, \*\*: < 0.01, \*: < 0.05, Red: the data from the ictal phase tends to have higher ranks than the interictal phase.

**Table S4.** Statistical analysis of BC for δ-layer network: p-value and effect size (Cohen’s *r*)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | channel | PLV (top 30%) | | PLI (top 30%) | | PLV (top 20%) | | PLV (top 40%) | |
| p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r |
| BC (δ) | FP1-F7 | <1e-5\*\*\* | -0.04684 | <1e-5\*\*\* | -0.01273 | <1e-5\*\*\* | -0.04892 | <1e-5\*\*\* | -0.04272 |
| F7-T3 | <1e-5\*\*\* | -0.03124 | 0.16285 | 0.00249 | <1e-5\*\*\* | -0.03134 | <1e-5\*\*\* | -0.02973 |
| T3-T5 | <1e-5\*\*\* | 0.02134 | 0.06119 | -0.00333 | <1e-5\*\*\* | 0.02292 | <1e-5\*\*\* | 0.01739 |
| T5-O1 | <1e-5\*\*\* | 0.03006 | 0.37349 | -0.00159 | <1e-5\*\*\* | 0.02910 | <1e-5\*\*\* | 0.02623 |
| FP2-F8 | <1e-5\*\*\* | -0.02513 | <1e-5\*\*\* | -0.02786 | <1e-5\*\*\* | -0.02744 | <1e-5\*\*\* | -0.02631 |
| F8-T4 | <1e-5\*\*\* | -0.02725 | <1e-5\*\*\* | -0.01252 | <1e-5\*\*\* | -0.02897 | <1e-5\*\*\* | -0.02180 |
| T4-T6 | <1e-5\*\*\* | -0.02159 | 0.00202\*\* | -0.00547 | <1e-5\*\*\* | -0.02130 | <1e-5\*\*\* | -0.01963 |
| T6-O2 | <1e-5\*\*\* | 0.01925 | 0.06147 | -0.00332 | <1e-5\*\*\* | 0.01731 | <1e-5\*\*\* | 0.01579 |
| T3-C3 | 0.00036\*\*\* | -0.00625 | <1e-5\*\*\* | -0.01305 | 0.94116 | -0.00012 | <1e-5\*\*\* | -0.01080 |
| C3-CZ | <1e-5\*\*\* | 0.02337 | <1e-5\*\*\* | -0.00901 | <1e-5\*\*\* | 0.03027 | <1e-5\*\*\* | 0.01756 |
| CZ-C4 | <1e-5\*\*\* | 0.04117 | 0.00008\*\*\* | -0.00696 | <1e-5\*\*\* | 0.04383 | <1e-5\*\*\* | 0.04091 |
| C4-T4 | <1e-5\*\*\* | 0.00784 | 0.15827 | -0.00250 | <1e-5\*\*\* | 0.01541 | 0.06607 | 0.00330 |
| FP1-F3 | 0.10059 | -0.00292 | 0.00574\*\* | -0.00490 | <1e-5\*\*\* | -0.01186 | 0.18425 | 0.00239 |
| F3-C3 | <1e-5\*\*\* | 0.03138 | 0.00001\*\*\* | 0.00772 | <1e-5\*\*\* | 0.02664 | <1e-5\*\*\* | 0.03022 |
| C3-P3 | <1e-5\*\*\* | 0.02952 | <1e-5\*\*\* | 0.02344 | <1e-5\*\*\* | 0.03406 | <1e-5\*\*\* | 0.02290 |
| P3-O1 | <1e-5\*\*\* | 0.02204 | <1e-5\*\*\* | 0.02462 | <1e-5\*\*\* | 0.02973 | <1e-5\*\*\* | 0.01354 |
| FP2-F4 | <1e-5\*\*\* | -0.00835 | 0.00003\*\*\* | -0.00740 | 0.00001\*\*\* | -0.00735 | 0.00007\*\*\* | -0.00708 |
| F4-C4 | 0.00005\*\*\* | 0.00725 | 0.06082 | -0.00333 | 0.09846 | -0.00288 | <1e-5\*\*\* | 0.01569 |
| C4-P4 | <1e-5\*\*\* | 0.01155 | <1e-5\*\*\* | 0.00918 | <1e-5\*\*\* | 0.01590 | 0.00172\*\* | 0.00565 |
| P4-O2 | <1e-5\*\*\* | 0.04076 | <1e-5\*\*\* | 0.01242 | <1e-5\*\*\* | 0.04782 | <1e-5\*\*\* | 0.03218 |

\*\*\*: < 0.001, \*\*: < 0.01, \*: < 0.05, Red: the data from the ictal phase tends to have higher ranks than the interictal phase.

**Table S5.** Statistical analysis of BC for θ-layer network: p-value and effect size (Cohen’s *r*)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | channel | PLV (top 30%) | | PLI (top 30%) | | PLV (top 20%) | | PLV (top 40%) | |
| p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r |
| BC (θ) | FP1-F7 | <1e-5\*\*\* | -0.08464 | <1e-5\*\*\* | -0.04082 | <1e-5\*\*\* | -0.08774 | <1e-5\*\*\* | -0.08044 |
| F7-T3 | <1e-5\*\*\* | -0.06735 | <1e-5\*\*\* | -0.02618 | <1e-5\*\*\* | -0.07957 | <1e-5\*\*\* | -0.06081 |
| T3-T5 | <1e-5\*\*\* | -0.02031 | <1e-5\*\*\* | -0.04012 | <1e-5\*\*\* | -0.02822 | <1e-5\*\*\* | -0.01382 |
| T5-O1 | <1e-5\*\*\* | -0.01766 | <1e-5\*\*\* | -0.03006 | <1e-5\*\*\* | -0.01922 | <1e-5\*\*\* | -0.01081 |
| FP2-F8 | <1e-5\*\*\* | -0.05156 | <1e-5\*\*\* | -0.04120 | <1e-5\*\*\* | -0.05504 | <1e-5\*\*\* | -0.04678 |
| F8-T4 | <1e-5\*\*\* | -0.02769 | <1e-5\*\*\* | -0.03794 | <1e-5\*\*\* | -0.04024 | <1e-5\*\*\* | -0.01797 |
| T4-T6 | <1e-5\*\*\* | -0.07219 | <1e-5\*\*\* | -0.03301 | <1e-5\*\*\* | -0.07304 | <1e-5\*\*\* | -0.06985 |
| T6-O2 | <1e-5\*\*\* | -0.04705 | <1e-5\*\*\* | -0.03308 | <1e-5\*\*\* | -0.05001 | <1e-5\*\*\* | -0.04171 |
| T3-C3 | <1e-5\*\*\* | -0.01841 | <1e-5\*\*\* | -0.04330 | <1e-5\*\*\* | -0.02503 | <1e-5\*\*\* | -0.01491 |
| C3-CZ | 0.03993\* | -0.00367 | <1e-5\*\*\* | -0.03918 | <1e-5\*\*\* | -0.00981 | 0.03849\* | 0.00373 |
| CZ-C4 | <1e-5\*\*\* | 0.01787 | <1e-5\*\*\* | -0.05464 | <1e-5\*\*\* | 0.00952 | <1e-5\*\*\* | 0.02567 |
| C4-T4 | <1e-5\*\*\* | -0.03734 | <1e-5\*\*\* | -0.05157 | <1e-5\*\*\* | -0.04186 | <1e-5\*\*\* | -0.03352 |
| FP1-F3 | <1e-5\*\*\* | -0.01296 | <1e-5\*\*\* | -0.03073 | <1e-5\*\*\* | -0.02469 | 0.00448\*\* | -0.00513 |
| F3-C3 | <1e-5\*\*\* | -0.03830 | <1e-5\*\*\* | -0.02399 | <1e-5\*\*\* | -0.05913 | <1e-5\*\*\* | -0.02468 |
| C3-P3 | <1e-5\*\*\* | -0.01828 | <1e-5\*\*\* | -0.00930 | <1e-5\*\*\* | -0.02610 | <1e-5\*\*\* | -0.01415 |
| P3-O1 | 0.49892 | 0.00121 | 0.05628 | -0.00344 | 0.23533 | -0.00208 | 0.00004\*\*\* | 0.00739 |
| FP2-F4 | <1e-5\*\*\* | -0.01204 | <1e-5\*\*\* | -0.02113 | <1e-5\*\*\* | -0.02155 | 0.00211\*\*\* | -0.00554 |
| F4-C4 | <1e-5\*\*\* | -0.03912 | <1e-5\*\*\* | -0.04828 | <1e-5\*\*\* | -0.05843 | <1e-5\*\*\* | -0.02574 |
| C4-P4 | <1e-5\*\*\* | -0.06103 | <1e-5\*\*\* | -0.03868 | <1e-5\*\*\* | -0.07112 | <1e-5\*\*\* | -0.05514 |
| P4-O2 | <1e-5\*\*\* | -0.02881 | 0.06892 | -0.00326 | <1e-5\*\*\* | -0.03528 | <1e-5\*\*\* | -0.02283 |

\*\*\*: < 0.001, \*\*: < 0.01, \*: < 0.05, Red: the data from the ictal phase tends to have higher ranks than the interictal phase.

**Table S6.** Statistical analysis of BC for α-layer network and OBC for multilayer networks: p-value and effect size (Cohen’s *r*)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | channel | PLV (top 30%) | | PLI (top 30%) | | PLV (top 20%) | | PLV (top 40%) | | |
| p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r | |
| BC (α) | FP1-F7 | <1e-5\*\*\* | -0.07303 | <1e-5\*\*\* | -0.01498 | <1e-5\*\*\* | -0.07984 | <1e-5\*\*\* | | -0.06795 |
| F7-T3 | <1e-5\*\*\* | -0.06771 | <1e-5\*\*\* | -0.02278 | <1e-5\*\*\* | -0.07216 | <1e-5\*\*\* | | -0.06381 |
| T3-T5 | <1e-5\*\*\* | -0.02937 | <1e-5\*\*\* | -0.03382 | <1e-5\*\*\* | -0.04018 | <1e-5\*\*\* | | -0.02344 |
| T5-O1 | 0.00651\*\* | -0.00484 | <1e-5\*\*\* | -0.02085 | <1e-5\*\*\* | -0.01319 | 0.06787 | | 0.00329 |
| FP2-F8 | <1e-5\*\*\* | -0.02183 | 0.00511\*\* | -0.00504 | <1e-5\*\*\* | -0.02782 | <1e-5\*\*\* | | -0.02008 |
| F8-T4 | <1e-5\*\*\* | -0.01789 | <1e-5\*\*\* | -0.02558 | <1e-5\*\*\* | -0.02716 | <1e-5\*\*\* | | -0.01075 |
| T4-T6 | <1e-5\*\*\* | -0.06654 | <1e-5\*\*\* | -0.02326 | <1e-5\*\*\* | -0.07038 | <1e-5\*\*\* | | -0.06525 |
| T6-O2 | <1e-5\*\*\* | -0.05341 | <1e-5\*\*\* | -0.02061 | <1e-5\*\*\* | -0.05628 | <1e-5\*\*\* | | -0.05027 |
| T3-C3 | 0.01236\* | 0.00452 | <1e-5\*\*\* | -0.02253 | <1e-5\*\*\* | -0.01551 | <1e-5\*\*\* | | 0.01126 |
| C3-CZ | <1e-5\*\*\* | -0.01156 | <1e-5\*\*\* | -0.03622 | <1e-5\*\*\* | -0.02314 | 0.38624 | | -0.00157 |
| CZ-C4 | <1e-5\*\*\* | 0.02640 | <1e-5\*\*\* | -0.04282 | <1e-5\*\*\* | 0.00985 | <1e-5\*\*\* | | 0.03560 |
| C4-T4 | <1e-5\*\*\* | -0.01488 | <1e-5\*\*\* | -0.03780 | <1e-5\*\*\* | -0.03514 | 0.02353\* | | -0.00411 |
| FP1-F3 | <1e-5\*\*\* | -0.01114 | <1e-5\*\*\* | -0.00802 | <1e-5\*\*\* | -0.02019 | 0.00096\*\*\* | | -0.00596 |
| F3-C3 | <1e-5\*\*\* | -0.02721 | <1e-5\*\*\* | -0.01118 | <1e-5\*\*\* | -0.04570 | <1e-5\*\*\* | | -0.01824 |
| C3-P3 | <1e-5\*\*\* | -0.03195 | <1e-5\*\*\* | -0.02192 | <1e-5\*\*\* | -0.04691 | <1e-5\*\*\* | | -0.02869 |
| P3-O1 | <1e-5\*\*\* | 0.01279 | <1e-5\*\*\* | -0.02783 | 0.02115\* | 0.00409 | <1e-5\*\*\* | | 0.01327 |
| FP2-F4 | 0.07987 | -0.00315 | <1e-5\*\*\* | -0.01443 | <1e-5\*\*\* | -0.01284 | 0.34397 | | -0.00172 |
| F4-C4 | <1e-5\*\*\* | -0.01669 | <1e-5\*\*\* | -0.03873 | <1e-5\*\*\* | -0.03610 | 0.07963 | | -0.00318 |
| C4-P4 | <1e-5\*\*\* | -0.06116 | <1e-5\*\*\* | -0.03763 | <1e-5\*\*\* | -0.06729 | <1e-5\*\*\* | | -0.05836 |
| P4-O2 | <1e-5\*\*\* | -0.01530 | <1e-5\*\*\* | -0.02984 | <1e-5\*\*\* | -0.02737 | 0.000289\*\*\* | | -0.00657 |

\*\*\*: < 0.001, \*\*: < 0.01, \*: < 0.05, Red: the data from the ictal phase tends to have higher ranks than the interictal phase.

**Table S7.** Statistical analysis of BC for β-layer network and OBC for multilayer networks: p-value and effect size (Cohen’s *r*)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | channel | PLV (top 30%) | | PLI (top 30%) | | PLV (top 20%) | | PLV (top 40%) | |
| p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r |
| BC (β) | FP1-F7 | <1e-5\*\*\* | -0.07051 | <1e-5\*\*\* | -0.02328 | <1e-5\*\*\* | -0.07896 | <1e-5\*\*\* | -0.06700 |
| F7-T3 | <1e-5\*\*\* | -0.10036 | <1e-5\*\*\* | -0.05159 | <1e-5\*\*\* | -0.10157 | <1e-5\*\*\* | -0.10150 |
| T3-T5 | <1e-5\*\*\* | -0.03758 | <1e-5\*\*\* | -0.05188 | <1e-5\*\*\* | -0.03964 | <1e-5\*\*\* | -0.03571 |
| T5-O1 | <1e-5\*\*\* | -0.01435 | <1e-5\*\*\* | -0.03435 | <1e-5\*\*\* | -0.02070 | 0.00003\*\*\* | -0.00743 |
| FP2-F8 | <1e-5\*\*\* | -0.03209 | <1e-5\*\*\* | -0.00828 | <1e-5\*\*\* | -0.03642 | <1e-5\*\*\* | -0.02965 |
| F8-T4 | <1e-5\*\*\* | -0.04530 | <1e-5\*\*\* | -0.05423 | <1e-5\*\*\* | -0.05242 | <1e-5\*\*\* | -0.04151 |
| T4-T6 | <1e-5\*\*\* | -0.10250 | <1e-5\*\*\* | -0.04747 | <1e-5\*\*\* | -0.10367 | <1e-5\*\*\* | -0.10333 |
| T6-O2 | <1e-5\*\*\* | -0.07073 | <1e-5\*\*\* | -0.03787 | <1e-5\*\*\* | -0.06830 | <1e-5\*\*\* | -0.06825 |
| T3-C3 | <1e-5\*\*\* | -0.01714 | <1e-5\*\*\* | -0.02639 | <1e-5\*\*\* | -0.03621 | <1e-5\*\*\* | -0.01779 |
| C3-CZ | 0.14288 | 0.00265 | <1e-5\*\*\* | -0.02766 | <1e-5\*\*\* | -0.01256 | <1e-5\*\*\* | 0.01284 |
| CZ-C4 | <1e-5\*\*\* | 0.02370 | <1e-5\*\*\* | -0.03929 | <1e-5\*\*\* | 0.00863 | <1e-5\*\*\* | 0.03003 |
| C4-T4 | <1e-5\*\*\* | -0.03092 | <1e-5\*\*\* | -0.04760 | <1e-5\*\*\* | -0.05142 | <1e-5\*\*\* | -0.02092 |
| FP1-F3 | <1e-5\*\*\* | -0.02104 | <1e-5\*\*\* | -0.01212 | <1e-5\*\*\* | -0.03586 | <1e-5\*\*\* | -0.01745 |
| F3-C3 | <1e-5\*\*\* | -0.01230 | <1e-5\*\*\* | -0.03299 | <1e-5\*\*\* | -0.02780 | 0.00011\*\*\* | -0.00700 |
| C3-P3 | <1e-5\*\*\* | -0.02533 | <1e-5\*\*\* | -0.02245 | <1e-5\*\*\* | -0.03132 | <1e-5\*\*\* | -0.03094 |
| P3-O1 | <1e-5\*\*\* | 0.02714 | <1e-5\*\*\* | -0.03998 | <1e-5\*\*\* | 0.01550 | <1e-5\*\*\* | 0.03120 |
| FP2-F4 | <1e-5\*\*\* | -0.01138 | <1e-5\*\*\* | -0.01513 | <1e-5\*\*\* | -0.02293 | <1e-5\*\*\* | -0.00832 |
| F4-C4 | <1e-5\*\*\* | -0.01088 | <1e-5\*\*\* | -0.03883 | <1e-5\*\*\* | -0.03042 | 0.59170 | -0.00097 |
| C4-P4 | <1e-5\*\*\* | -0.05633 | <1e-5\*\*\* | -0.04469 | <1e-5\*\*\* | -0.06043 | <1e-5\*\*\* | -0.06002 |
| P4-O2 | 0.42724 | -0.00145 | <1e-5\*\*\* | -0.04621 | <1e-5\*\*\* | -0.01620 | <1e-5\*\*\* | 0.00897 |

\*\*\*: < 0.001, \*\*: < 0.01, \*: < 0.05, Red: the data from the ictal phase tends to have higher ranks than the interictal phase.

**Table S8.** Statistical analysis of BC for γ-layer network and OBC for multilayer networks: p-value and effect size (Cohen’s *r*)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | channel | PLV (top 30%) | | PLI (top 30%) | | PLV (top 20%) | | PLV (top 40%) | |
| p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r |
| BC (γ) | FP1-F7 | <1e-5\*\*\* | -0.03956 | <1e-5\*\*\* | -0.01220 | <1e-5\*\*\* | -0.04231 | <1e-5\*\*\* | -0.03733 |
| F7-T3 | <1e-5\*\*\* | -0.06254 | <1e-5\*\*\* | -0.02642 | <1e-5\*\*\* | -0.06261 | <1e-5\*\*\* | -0.06324 |
| T3-T5 | <1e-5\*\*\* | -0.02399 | <1e-5\*\*\* | -0.01733 | <1e-5\*\*\* | -0.02636 | <1e-5\*\*\* | -0.02200 |
| T5-O1 | <1e-5\*\*\* | -0.02755 | <1e-5\*\*\* | -0.01484 | <1e-5\*\*\* | -0.03188 | <1e-5\*\*\* | -0.02649 |
| FP2-F8 | <1e-5\*\*\* | -0.04250 | <1e-5\*\*\* | -0.02288 | <1e-5\*\*\* | -0.04000 | <1e-5\*\*\* | -0.04124 |
| F8-T4 | <1e-5\*\*\* | -0.02381 | <1e-5\*\*\* | -0.02223 | <1e-5\*\*\* | -0.02513 | <1e-5\*\*\* | -0.02187 |
| T4-T6 | <1e-5\*\*\* | -0.06254 | <1e-5\*\*\* | -0.01540 | <1e-5\*\*\* | -0.06002 | <1e-5\*\*\* | -0.06264 |
| T6-O2 | <1e-5\*\*\* | -0.03871 | <1e-5\*\*\* | -0.01470 | <1e-5\*\*\* | -0.04092 | <1e-5\*\*\* | -0.03334 |
| T3-C3 | 0.00293\*\* | -0.00539 | 0.00143\*\* | -0.00575 | <1e-5\*\*\* | -0.01854 | 0.01202\* | -0.00456 |
| C3-CZ | <1e-5\*\*\* | 0.02378 | <1e-5\*\*\* | 0.01008 | <1e-5\*\*\* | 0.00796 | <1e-5\*\*\* | 0.02668 |
| CZ-C4 | <1e-5\*\*\* | 0.01686 | <1e-5\*\*\* | -0.01611 | 0.01137\* | 0.00450 | <1e-5\*\*\* | 0.02093 |
| C4-T4 | <1e-5\*\*\* | -0.02334 | <1e-5\*\*\* | -0.02869 | <1e-5\*\*\* | -0.03349 | <1e-5\*\*\* | -0.01997 |
| FP1-F3 | 0.00002\*\*\* | 0.00777 | 0.62971 | -0.00087 | 0.01458\* | -0.00433 | <1e-5\*\*\* | 0.00934 |
| F3-C3 | 0.02627\* | 0.00402 | 0.66189 | 0.00078 | 0.00807\*\* | -0.00470 | 0.01125\* | 0.00459 |
| C3-P3 | <1e-5\*\*\* | -0.01587 | 0.02818\* | -0.00398 | <1e-5\*\*\* | -0.01737 | <1e-5\*\*\* | -0.01688 |
| P3-O1 | <1e-5\*\*\* | 0.01045 | <1e-5\*\*\* | -0.01069 | 0.36108 | 0.00163 | <1e-5\*\*\* | 0.01274 |
| FP2-F4 | <1e-5\*\*\* | 0.02018 | <1e-5\*\*\* | -0.00966 | <1e-5\*\*\* | 0.01275 | <1e-5\*\*\* | 0.02093 |
| F4-C4 | 0.44386 | 0.00138 | <1e-5\*\*\* | -0.03318 | <1e-5\*\*\* | -0.01101 | 0.09983 | 0.00298 |
| C4-P4 | <1e-5\*\*\* | -0.02522 | <1e-5\*\*\* | -0.03716 | <1e-5\*\*\* | -0.02783 | <1e-5\*\*\* | -0.02799 |
| P4-O2 | <1e-5\*\*\* | 0.02746 | <1e-5\*\*\* | -0.02220 | <1e-5\*\*\* | 0.01585 | <1e-5\*\*\* | 0.03248 |

\*\*\*: < 0.001, \*\*: < 0.01, \*: < 0.05, Red: the data from the ictal phase tends to have higher ranks than the interictal phase.

**Table S9.** Statistical analysis of BC for full-band single-layer network and OBC for multilayer networks: p-value and effect size (Cohen’s *r*)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | channel | PLV (top 30%) | | PLI (top 30%) | | PLV (top 20%) | | PLV (top 40%) | |
| p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r |
| BC (Full) | FP1-F7 | <1e-5\*\*\* | -0.03222 | <1e-5\*\*\* | -0.01874 | <1e-5\*\*\* | -0.03228 | <1e-5\*\*\* | -0.03569 |
| F7-T3 | <1e-5\*\*\* | -0.01591 | <1e-5\*\*\* | 0.01902 | <1e-5\*\*\* | -0.01954 | <1e-5\*\*\* | -0.01664 |
| T3-T5 | <1e-5\*\*\* | 0.05382 | <1e-5\*\*\* | 0.03692 | <1e-5\*\*\* | 0.04914 | <1e-5\*\*\* | 0.05137 |
| T5-O1 | <1e-5\*\*\* | 0.05068 | <1e-5\*\*\* | 0.02684 | <1e-5\*\*\* | 0.04822 | <1e-5\*\*\* | 0.04870 |
| FP2-F8 | 0.35671 | 0.00164 | <1e-5\*\*\* | -0.01981 | 0.09963 | 0.00279 | 0.00034\*\*\* | -0.00640 |
| F8-T4 | 0.14288 | 0.00255 | 0.49891 | -0.00119 | <1e-5\*\*\* | -0.00539 | 0.63075 | -0.00084 |
| T4-T6 | <1e-5\*\*\* | -0.01855 | <1e-5\*\*\* | 0.02321 | <1e-5\*\*\* | -0.02350 | <1e-5\*\*\* | -0.02343 |
| T6-O2 | <1e-5\*\*\* | 0.03428 | <1e-5\*\*\* | 0.01910 | <1e-5\*\*\* | 0.03153 | <1e-5\*\*\* | 0.03082 |
| T3-C3 | <1e-5\*\*\* | 0.04187 | <1e-5\*\*\* | 0.03592 | <1e-5\*\*\* | 0.04904 | <1e-5\*\*\* | 0.03428 |
| C3-CZ | <1e-5\*\*\* | 0.07590 | <1e-5\*\*\* | 0.04038 | <1e-5\*\*\* | 0.07236 | <1e-5\*\*\* | 0.07215 |
| CZ-C4 | <1e-5\*\*\* | 0.10999 | <1e-5\*\*\* | 0.03244 | <1e-5\*\*\* | 0.09807 | <1e-5\*\*\* | 0.11045 |
| C4-T4 | <1e-5\*\*\* | 0.05152 | <1e-5\*\*\* | 0.03968 | <1e-5\*\*\* | 0.05808 | <1e-5\*\*\* | 0.04641 |
| FP1-F3 | <1e-5\*\*\* | 0.05197 | <1e-5\*\*\* | 0.01813 | <1e-5\*\*\* | 0.04355 | <1e-5\*\*\* | 0.05422 |
| F3-C3 | <1e-5\*\*\* | 0.09976 | <1e-5\*\*\* | 0.05618 | <1e-5\*\*\* | 0.08394 | <1e-5\*\*\* | 0.09866 |
| C3-P3 | <1e-5\*\*\* | 0.06456 | <1e-5\*\*\* | 0.07635 | <1e-5\*\*\* | 0.06945 | <1e-5\*\*\* | 0.05583 |
| P3-O1 | <1e-5\*\*\* | 0.06161 | <1e-5\*\*\* | 0.06331 | <1e-5\*\*\* | 0.07103 | <1e-5\*\*\* | 0.04596 |
| FP2-F4 | <1e-5\*\*\* | 0.04767 | <1e-5\*\*\* | 0.02093 | <1e-5\*\*\* | 0.04306 | <1e-5\*\*\* | 0.04464 |
| F4-C4 | <1e-5\*\*\* | 0.07591 | <1e-5\*\*\* | 0.04594 | <1e-5\*\*\* | 0.05636 | <1e-5\*\*\* | 0.08557 |
| C4-P4 | <1e-5\*\*\* | 0.04856 | <1e-5\*\*\* | 0.03691 | <1e-5\*\*\* | 0.04545 | <1e-5\*\*\* | 0.04349 |
| P4-O2 | <1e-5\*\*\* | 0.07003 | <1e-5\*\*\* | 0.04295 | <1e-5\*\*\* | 0.07706 | <1e-5\*\*\* | 0.06114 |

\*\*\*: < 0.001, \*\*: < 0.01, \*: < 0.05, Red: the data from the ictal phase tends to have higher ranks than the interictal phase.

**Table S10.** Statistical analysis of OBC for multilayer networks: p-value and effect size (Cohen’s *r*)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | channel | PLV (top 30%) | | | PLI (top 30%) | | PLV (top 20%) | | PLV (top 40%) | |
| p-value | Cohen's r | | p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r |
| OBC | FP1-F7 | <1e-5\*\*\* | | -0.09340 | 0.00002\*\*\* | -0.00772 | <1e-5\*\*\* | -0.11436 | <1e-5\*\*\* | -0.08520 |
| F7-T3 | <1e-5\*\*\* | | -0.09482 | <1e-5\*\*\* | -0.01182 | <1e-5\*\*\* | -0.11532 | <1e-5\*\*\* | -0.09312 |
| T3-T5 | <1e-5\*\*\* | | -0.01209 | <1e-5\*\*\* | -0.03630 | <1e-5\*\*\* | -0.03418 | 0.00251\*\* | -0.00550 |
| T5-O1 | <1e-5\*\*\* | | 0.01190 | <1e-5\*\*\* | -0.01915 | <1e-5\*\*\* | -0.01289 | <1e-5\*\*\* | 0.02218 |
| FP2-F8 | <1e-5\*\*\* | | -0.04259 | <1e-5\*\*\* | -0.01387 | <1e-5\*\*\* | -0.06426 | <1e-5\*\*\* | -0.03801 |
| F8-T4 | <1e-5\*\*\* | | -0.02586 | <1e-5\*\*\* | -0.02918 | <1e-5\*\*\* | -0.04929 | <1e-5\*\*\* | -0.01579 |
| T4-T6 | <1e-5\*\*\* | | -0.09749 | <1e-5\*\*\* | -0.01756 | <1e-5\*\*\* | -0.11292 | <1e-5\*\*\* | -0.09640 |
| T6-O2 | <1e-5\*\*\* | | -0.04249 | <1e-5\*\*\* | -0.01457 | <1e-5\*\*\* | -0.06087 | <1e-5\*\*\* | -0.03704 |
| T3-C3 | 0.63737 | | -0.00085 | <1e-5\*\*\* | -0.03078 | <1e-5\*\*\* | -0.03111 | 0.43127 | 0.00143 |
| C3-CZ | <1e-5\*\*\* | | 0.04337 | <1e-5\*\*\* | -0.01620 | <1e-5\*\*\* | 0.01308 | <1e-5\*\*\* | 0.05218 |
| CZ-C4 | <1e-5\*\*\* | | 0.07283 | <1e-5\*\*\* | -0.04522 | <1e-5\*\*\* | 0.03811 | <1e-5\*\*\* | 0.08252 |
| C4-T4 | <1e-5\*\*\* | | -0.01602 | <1e-5\*\*\* | -0.04838 | <1e-5\*\*\* | -0.04800 | 0.01033\* | -0.00467 |
| FP1-F3 | <1e-5\*\*\* | | 0.00873 | 0.03652\* | -0.00382 | <1e-5\*\*\* | -0.02451 | <1e-5\*\*\* | 0.01841 |
| F3-C3 | 0.00006\*\*\* | | 0.00726 | 0.44645 | 0.00140 | <1e-5\*\*\* | -0.02796 | <1e-5\*\*\* | 0.01638 |
| C3-P3 | 0.00004\*\*\* | | -0.00745 | 0.00825\*\* | 0.00481 | <1e-5\*\*\* | -0.02648 | <1e-5\*\*\* | -0.01066 |
| P3-O1 | <1e-5\*\*\* | | 0.04162 | <1e-5\*\*\* | -0.01059 | <1e-5\*\*\* | 0.02393 | <1e-5\*\*\* | 0.04378 |
| FP2-F4 | <1e-5\*\*\* | | 0.01775 | 0.00019\*\*\* | -0.00677 | 0.00018\*\*\* | -0.00677 | <1e-5\*\*\* | 0.02283 |
| F4-C4 | <1e-5\*\*\* | | 0.01155 | <1e-5\*\*\* | -0.03729 | <1e-5\*\*\* | -0.02817 | <1e-5\*\*\* | 0.02652 |
| C4-P4 | <1e-5\*\*\* | | -0.05144 | <1e-5\*\*\* | -0.03387 | <1e-5\*\*\* | -0.06914 | <1e-5\*\*\* | -0.05215 |
| P4-O2 | <1e-5\*\*\* | | 0.02561 | <1e-5\*\*\* | -0.01967 | 0.21766 | 0.00224 | <1e-5\*\*\* | 0.03432 |

\*\*\*: < 0.001, \*\*: < 0.01, \*: < 0.05, Red: the data from the ictal phase tends to have higher ranks than the interictal phase.

**Table S11.** Statistical analysis of  for full multilayer network and specific-layer removed networks: p-value and effect size (Cohen’s *r*)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | channel | PLV (top 30%) | | PLI (top 30%) | | PLV (top 20%) | | PLV (top 40%) | |
| p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r |
| GEmulti | Full | <1e-5\*\*\* | 0.12673 | <1e-5\*\*\* | 0.11228 | <1e-5\*\*\* | 0.12225 | <1e-5\*\*\* | 0.11998 |
| ~δ | <1e-5\*\*\* | 0.26549 | <1e-5\*\*\* | 0.26565 | <1e-5\*\*\* | 0.24771 | <1e-5\*\*\* | 0.26611 |
| ~θ | <1e-5\*\*\* | 0.09623 | <1e-5\*\*\* | 0.03802 | <1e-5\*\*\* | 0.10385 | <1e-5\*\*\* | 0.08273 |
| ~α | <1e-5\*\*\* | 0.13321 | <1e-5\*\*\* | 0.09963 | <1e-5\*\*\* | 0.14040 | <1e-5\*\*\* | 0.12066 |
| ~β | <1e-5\*\*\* | 0.11046 | <1e-5\*\*\* | 0.09786 | <1e-5\*\*\* | 0.10142 | <1e-5\*\*\* | 0.10658 |
| ~γ | <1e-5\*\*\* | 0.12019 | <1e-5\*\*\* | 0.10197 | <1e-5\*\*\* | 0.11197 | <1e-5\*\*\* | 0.11511 |

\*\*\*: < 0.001, \*\*: < 0.01, \*: < 0.05, Red: the data from the ictal phase tends to have higher ranks than the interictal phase.

**Table S12.** Statistical analysis of algebraic connectivity for multilayer network: p-value and effect size (Cohen’s *r*)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | PLV (top 30%) | | PLI (top 30%) | | PLV (top 20%) | | PLV (top 40%) | |
| p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r | p-value | Cohen's r |
| Algebraic Connectivity | <1e-5\*\*\* | -0.13932 | <1e-5\*\*\* | -0.11479 | <1e-5\*\*\* | -0.12371 | <1e-5\*\*\* | -0.13579 |

\*\*\*: < 0.001, \*\*: < 0.01, \*: < 0.05, Red: the data from the ictal phase tends to have higher ranks than the interictal phase.