GG-Lap: Robust EEG Causal Brain Networks Based on Generalized Gaussian Prior and Laplace Noise (Supplement)

I. Confusion Matrix

To provide a more intuitive illustration of the causal connectivity recovery results across the different methods, we employed a confusion matrix $\boldsymbol{e} = e_{kl} \in \mathbb{R}^{3\times 3}$ to analyze the ground truth causal networks that were successfully reconstructed:

$$e_{lk} = \sum_{i=1}^{N}\sum_{j=1}^{N} P(\boldsymbol{D}_{ij} \in l | \boldsymbol{C}_{ij} \in k);\ \ l = 1,2,3; k = 1,2,3 \tag{1}$$

where $\boldsymbol{C}$ and $\boldsymbol{D}$ represent the predefined network and the recovered network. In the confusion matrix, different values of l and k represent the absence of connections, unidirectional connections, and bidirectional connections, respectively. Generally, a higher proportion of diagonal elements in the confusion matrix indicates a more accurate causal network reconstruction.

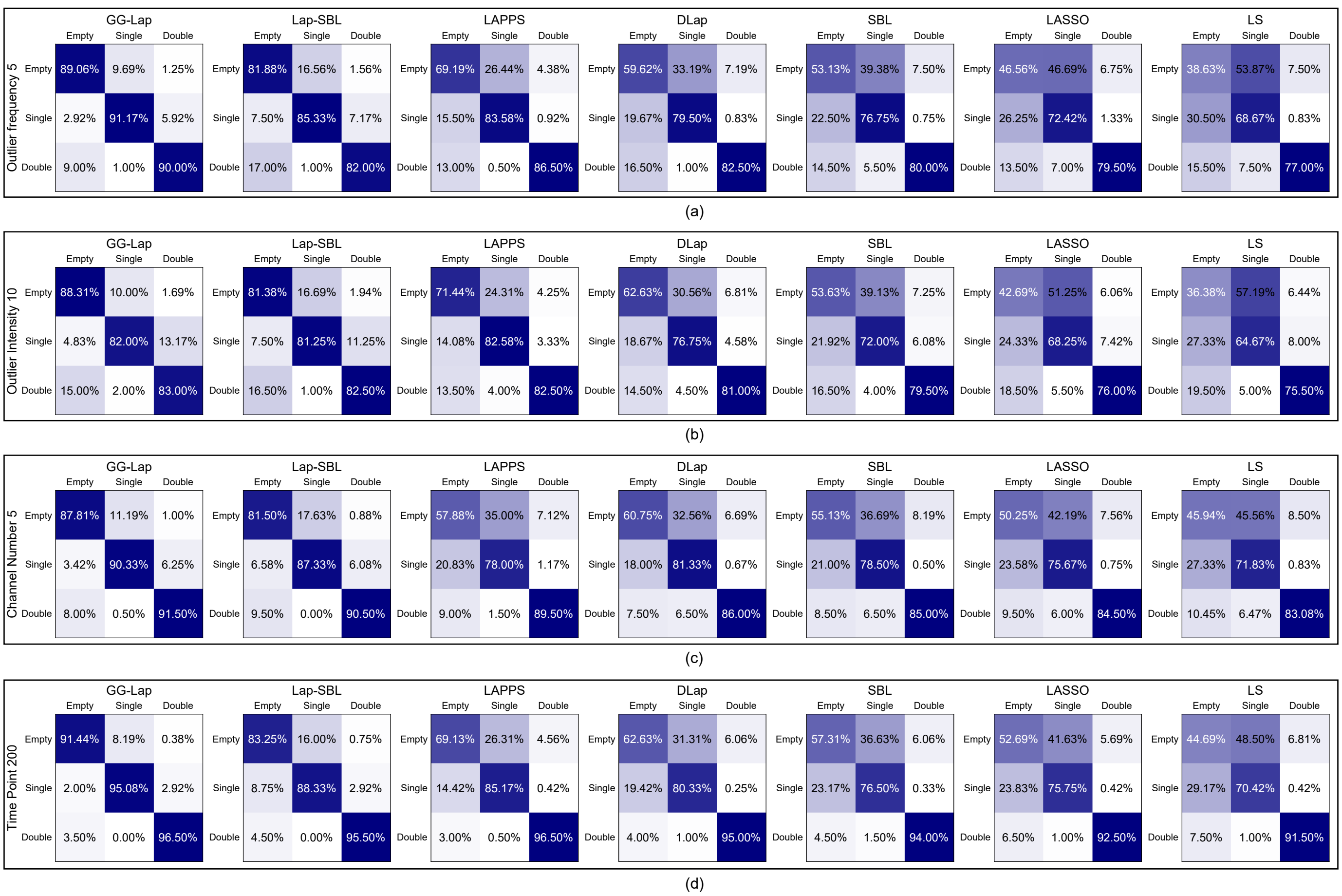

Fig. 1: Confusion matrices of GG-Lap, Lap-SBL, LAPPS, DLap, SBL, LASSO and LS under different outlier settings.

Fig. 1 highlights the topological differences in causal connections constructed by various methods. Clearly, across different conditions, the diagonal elements of the confusion matrices for GG-Lap show a more prominent presence compared to other algorithms. This suggests that GG-Lap more accurately infers inherent network topology, showcasing superior robustness in performance.