Neural Architecture Search for Optimization of Spatial-temporal Brain Network Decomposition

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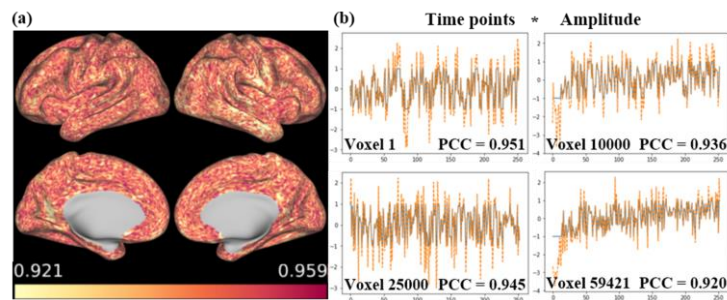
Fig. 1. Performance of NAS-DSRAE in reconstructing the gambling task fMRI signals. (a) The Pearson correlation coefficients (PCCs) between the reconstructed signals by NAS-DSRAE and the original signals in spatial dimension. (b) Temporal fluctuation comparison of the reconstructed voxels and original voxels. Blue curves are the reconstruction time series. Orange curves are the time series of original fMRI data.
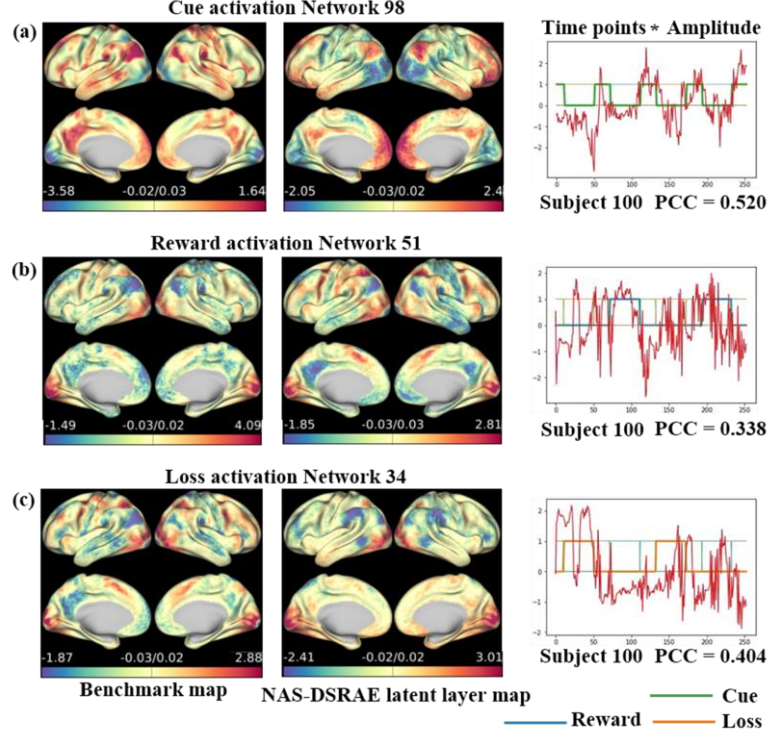
Fig. 2. Comparison between NAS-DSRAE and benchmark outputs of gambling task. (a) The spatial benchmark activation map, the spatial activation map predicted by NAS-DSRAE, and corresponding temporal fluctuations and ground truth of cue stimulus. Here, we showed the comparison results of one randomly selected subject. The correlation coefficients between the network #73 (the most cue-related) and he benchmark in spatial and temporal dimensions are 0.944 and 0.520, respectively. (b) The spatial activation maps and corresponding temporal fluctuations of reward stimulus. The reward stimulus benchmark and network #51 (the most reward-related) are correlated with 0.762 and 0.338 spatially and temporally. (c) The spatial activation maps and corresponding temporal fluctuations of loss stimulus. The network #34 (the most loss-related) has the correlation coefficients with 0.661 and 0.404 in spatial and temporal dimensions with the benchmark.

Table 1. Learned architectures by NAS of Gambling task.

Encoder Dense Layer	Encoder Recurrent Layer	Decoder Recurrent Layer	Decoder Dense Layer
59421→113	113→84	84→113	113→59421
59421→163	163→10→10→10	10→10→10→163	163→59421
59421→170	170→32→16	16→32→170	170→59421
59421→124	124→36→10	10→36→124	124→59421
59421→161	161→61→23	23→61→161	161→59421
59421→138	138→95	95→138	138→59421
59421→200	200→16→11→10→10→10→10	10→10→10→10→11→16→200	200→59421

59421→182	182→80→35	35→80→182	182→59421
59421→138	138→126	126→138	138→59421
59421→182	182→119→78→51	51→78→119→182	182→59421
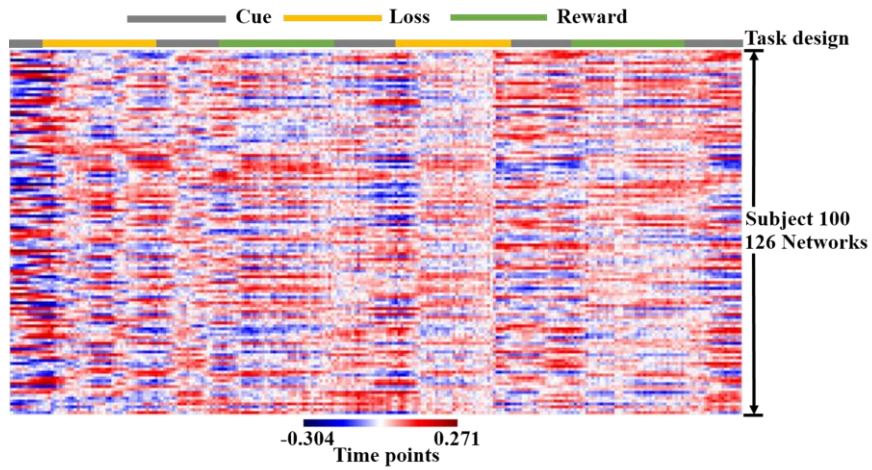
Fig. 3. The correlation matrix of the networks derived by NAS-DSRAE and the fMRI volumes for gambling task.