

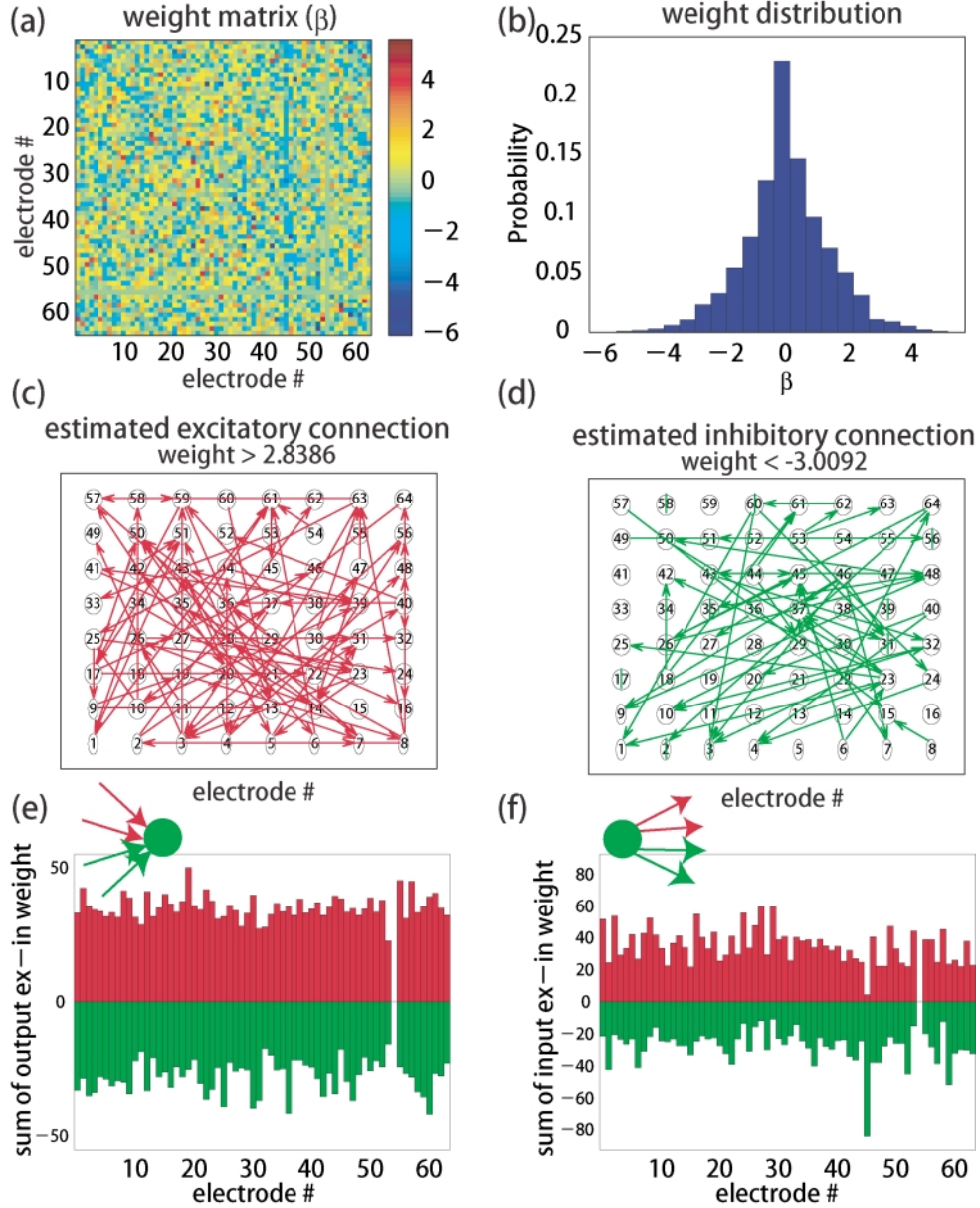


Fig. 5. (a) Estimated values of the parameter $\{\beta_{ij}\}$. (b) The distribution of the parameter β . The estimated network is well balanced in excitation and inhibition. (c) (d) Visualization of excitatory (c) and inhibitory (d) connections that have large coupling weights. (e) (f) Sum of output (e) and input (f) weights of excitatory (red) and inhibitory (green) couplings each. On the 55 th electrode, we observed no spikes. Thus, we did not estimate the parameters of this electrode. See also Fig. 6(b).

Here, the function f means an unnormalized probability distribution, and $\phi(x | \sigma)$ means that the variable x is Gaussian distributed, with mean 0 and variance σ^2 .

4. Analytic Results

Using the data from burst-like population activities shown in Fig. 4, we estimated the firing rate θ and the connection strength β . Using the Markov Chain Monte Carlo method, we sampled the values of these parameters with the posterior distributions Eqs. (10)–(17), and adopted the mean values as the parameter value estimates. The results are given in Figs. 5(a) and 6(b). The network with the estimated parameters displays well balanced excitatory and inhibitory couplings (Fig. 5(b)). In Figs. 5(c) and (d), we illustrated the excitatory and inhibitory connections that have

large coupling weights on the alignment of the electrodes. We see that even distant electrodes are connected with large weights. Figures 5(e) and (f) show the sum of output and input weights in each unit, where we see that excitatory and inhibitory inputs are balanced. In contrast, the outputs are set so that at each site either excitation or inhibition is dominant.

Using the estimated parameters, we evolved the network from an initial condition where all the electrodes are silent. At first, the electrodes fired by themselves according to their intrinsic firing rates. Then, they fired synchronously at times (Fig. 6(a)). We see that the characteristics of these burst-like population activities depend on the excitation-inhibition balance. For example, when the strength of the inhibition was reduced by 5%, the frequency