GC Analysis of Big I&F Neuron Network - Several Sparse and Dense Cases with Both Excitatory and Inhibitory Presented

1 Parameter Tables

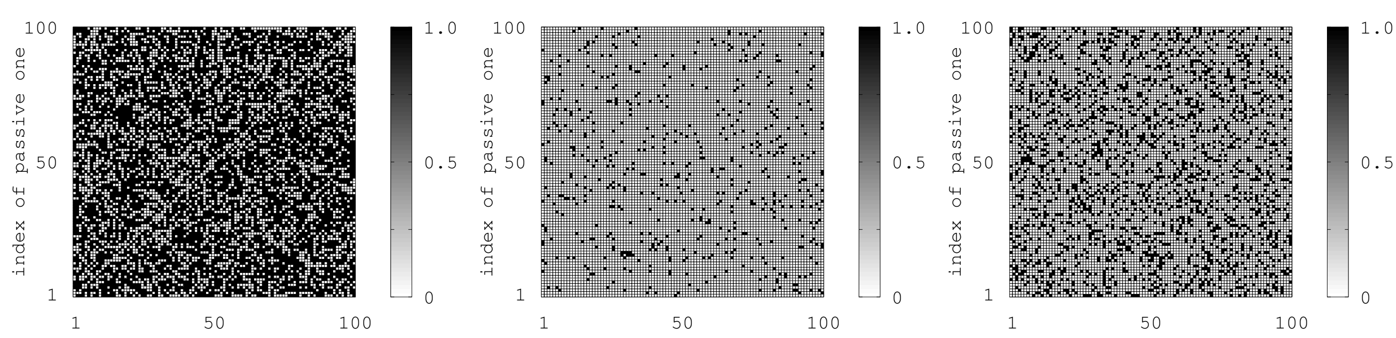
Table 1: Parameters used in IF model. Other parameters (fixed): $f^I = 0$.

Cases	network	n^E	n^I	μ	f^E	S^{E2E}	S^{E2I}	S^{I2E}	S^{I2I}	aveISI/ms	T/sec
C.1	net_100_20	80	20	1.00	0.012	0.005	0.005	0.007	0.007	4.790	1.0×10^3
C.2	net_100_21	up	up	up	up	up	up	up	up	16.01	up
C.3	net_100_01	up	up	0.24	0.020	0.006	0.006	0.006	0.006	71.25	up
C.4	net_100_20	up	up	up	up	up	up	up	up	4.306	up
C.5	net_100_21	up	up	up	up	up	up	up	up	116.53	up

Case C.3 use the same parameters as GCNR.[1] Fig5.F.

Table 2: Network details. Note: high serial number nodes are inhibitory type

name	#node	edges	%edge	type
net_100_20	100	5954	60.1%	random 0/1
net_100_21	100	531	5.4%	random 0/1
net_100_01	100	1941	19.6%	random 0/1



(a) net_100_20 (b) net_100_20 (c) net_100_20

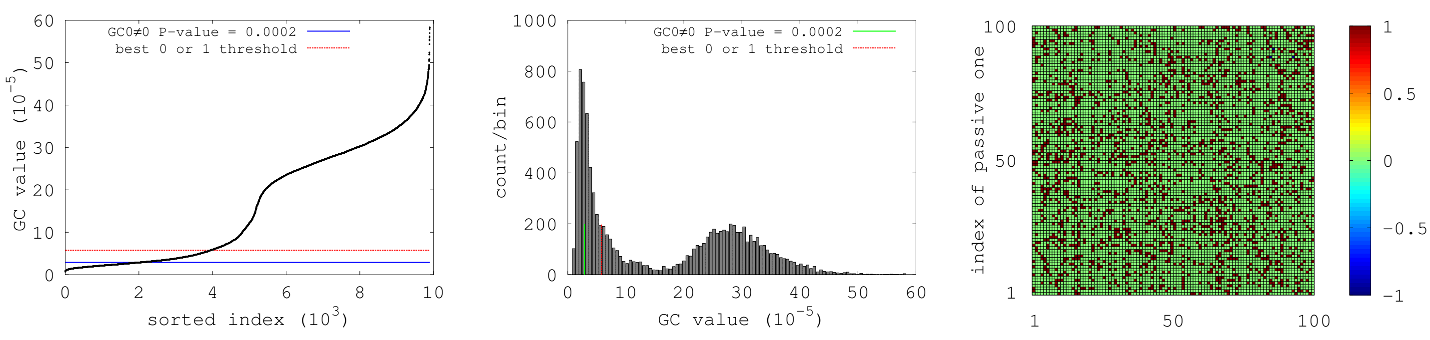
Figure 1: network

[1]Granger Causality Network Reconstruction of Conductance-based Integrate-and-Fire Neuronal Systems (sent: 2013-10-17)

Table 3: GC result statistics

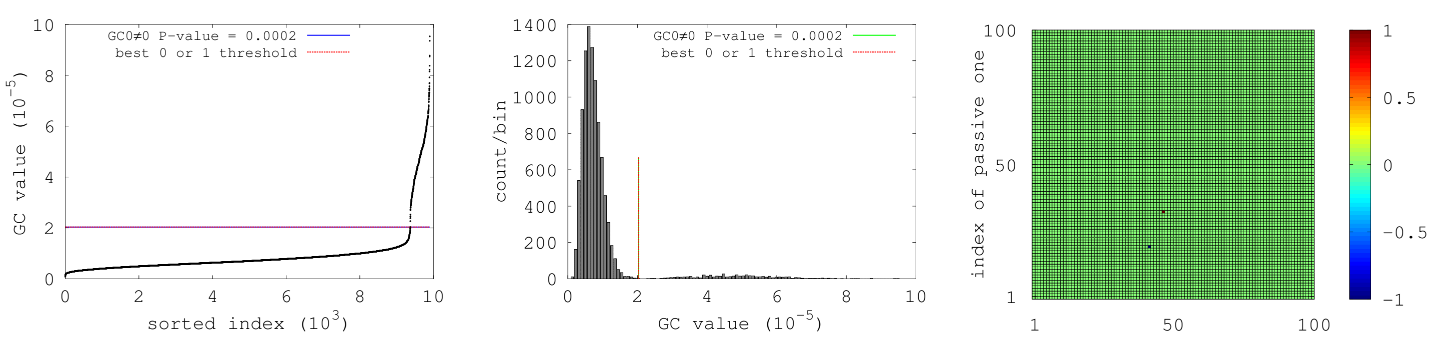
	$\Delta t/\mathrm{ms}$	BIC	$\overline{\mathrm{GC1}}/10^5$	$\overline{\mathrm{GC0}}/10^5$	p-val	$\mathrm{GC}^{\mathrm{thres}}(\text{p-val})/10^5$	OverGuess	LackGuess	best $\mathrm{GC}^{\mathrm{thres}}/10^5$
C.1a	0.5	25	25.03	3.04	2×10^{-4}	2.90	1916	3	5.76
C.1b	1.0	10	42.47	3.40	up	3.38	1756	5	8.14
C.2a	0.5	14	4.85	0.70	up	2.03	1	1	2.04
C.2b	1.0	8	8.31	0.81	up	3.01	0	1	2.89
C.3a	0.5	4	2.75	0.22	up	1.10	5	355	0.80
C.4a	0.5	29	41.45	11.39	up	3.19	3848	0	23.0
C.5a	0.5	4	4.28	0.20	up	1.10	5	65	0.91
C.2c	0.5 ST	23	19.76	1.16	up	2.75	2	0	2.92
C.4c	0.5 ST	32	33.67	7.99	up	3.41	3499	16	18.0
C.5c	0.5 ST	1	0.64	0.05	up	0.69	2	321	0.44

2 Plots



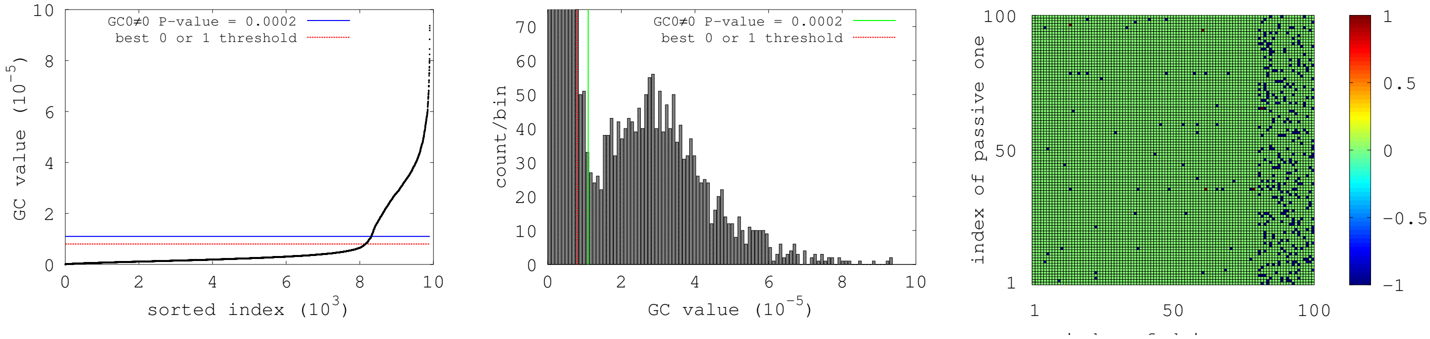
(a) GC sort (b) GC hist (c) GC cmp

Figure 2: C.1a



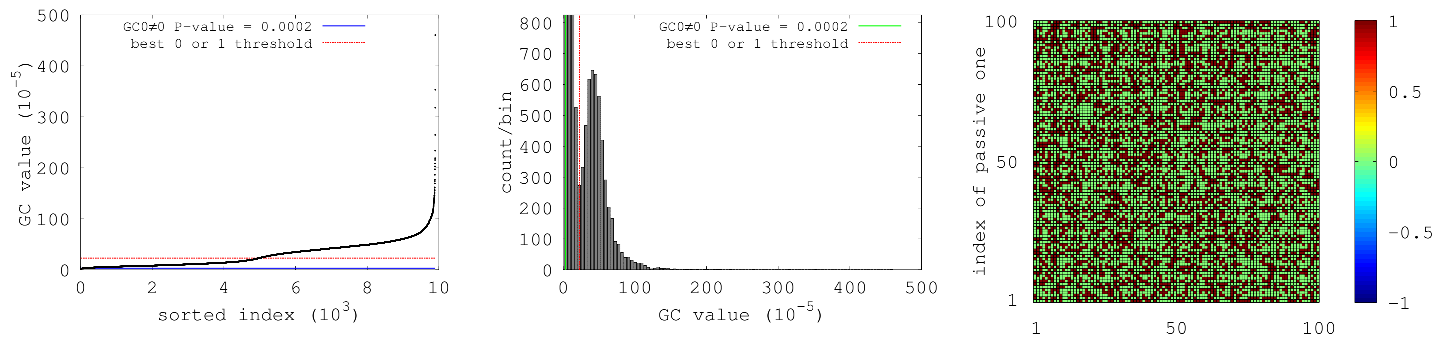
(a) GC sort (b) GC hist (c) GC cmp

Figure 3: C.2a



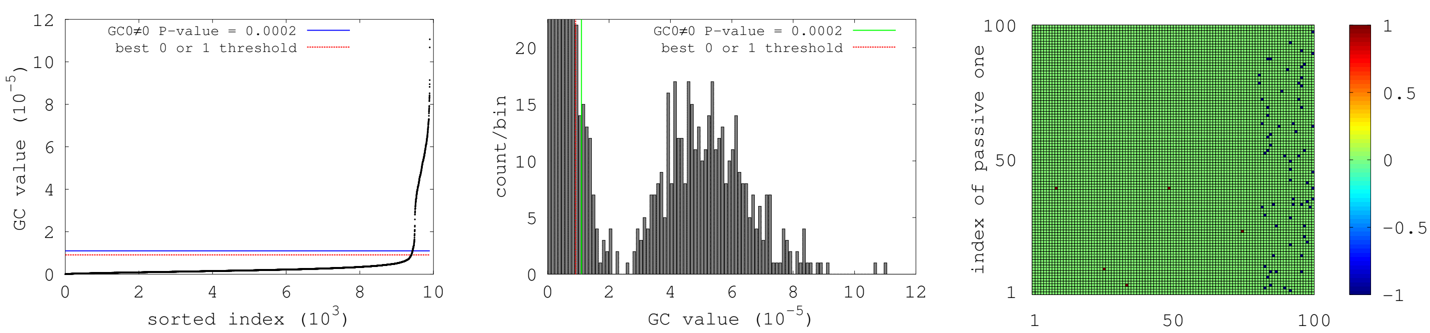
(a) GC sort (b) GC hist (c) GC cmp

Figure 4: C.3a. (Note this graph is different from GCNR. Fig5.F, because here $T = 10^3$ sec, instead of $T = 10^4$ sec)



(a) GC sort (b) GC hist (c) GC cmp

Figure 5: C.4a.

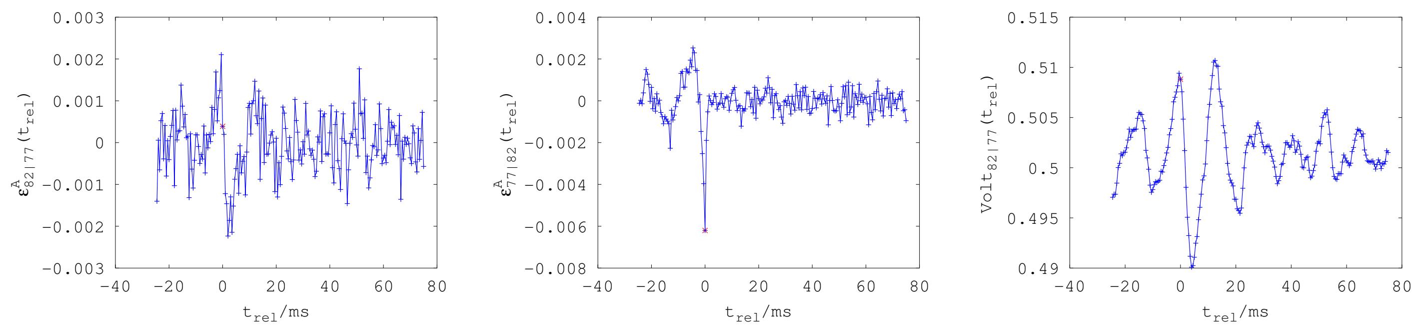


(a) GC sort (b) GC hist (c) GC cmp

Figure 6: C.5a.

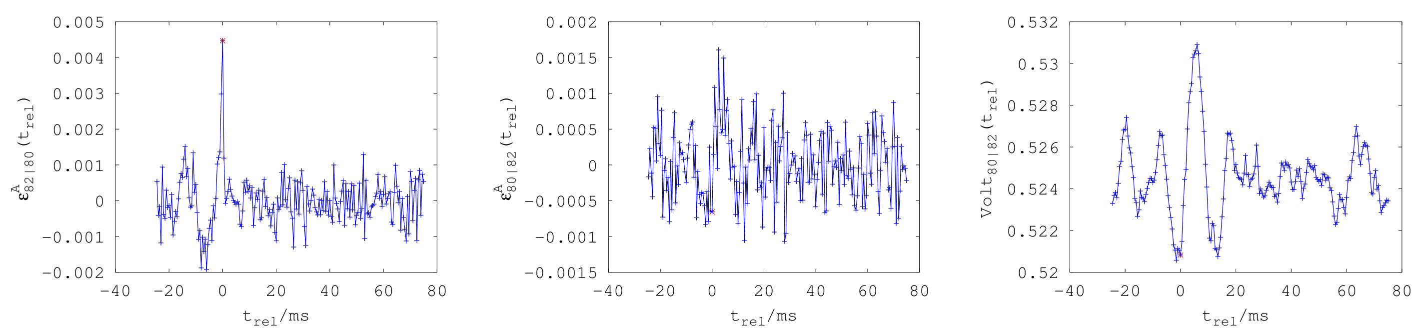
3 Excitatory or Inhibitory

3.1 C.2a



(a) 77 → 82 (excitatory) (b) 82 → 77 (no direct arc) (c) Volt 77 → 82 (excitatory)

Figure 7: node(neuron) pair 77 and 82. (GC(77 → 82) $= 5.87\times10^{-5}$, GC(82 → 77) $= 0.43\times10^{-5}$)

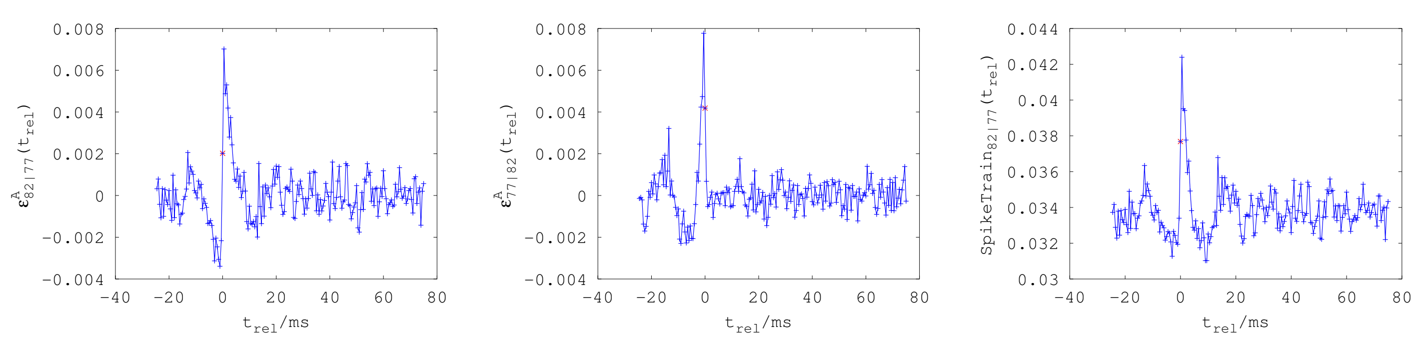


(a) 80 → 82(no direct arc) (b) 82 → 80 (inhibitory) (c) Volt 82 → 80 (inhibitory)

Figure 8: node(neuron) pair 80 and 82. (GC(80 → 82) $= 0.32\times10^{-5}$, GC(82 → 80) $= 2.46\times10^{-5}$)

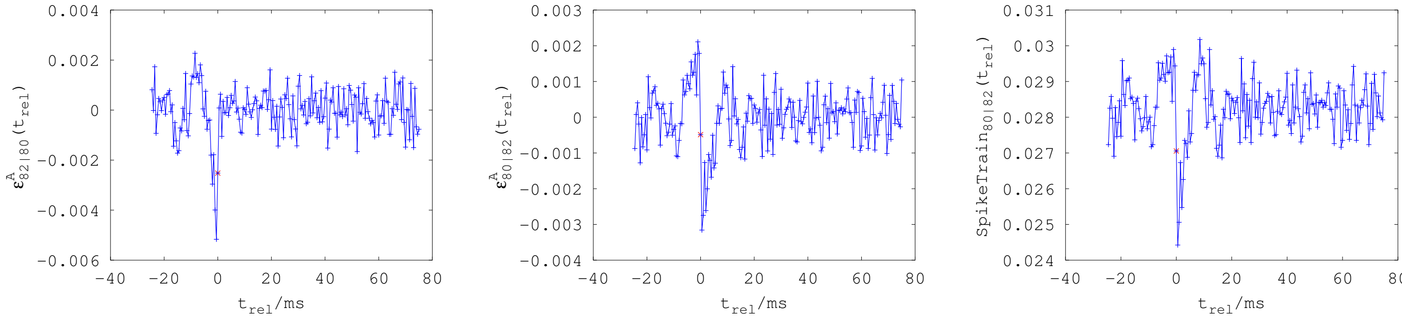
I thank it's may decrease or increase just after $t_{rel} = 0$. Because an EPSP may cause the neuron spike or form a positive plump (depends on dynamic region). May be in case of spike train, this information can be captured easier.

Case of spike trains (see C.2c in Table 3):



(a) 77 → 82 (excitatory) (b) 82 → 77 (no direct arc) (c) Volt 77 → 82 (excitatory)

Figure 9: node(neuron) pair 77 and 82. (GC(77 → 82) $= 23.61\times10^{-5}$, GC(82 → 77) $= 0.66\times10^{-5}$)



(a) 80 $\rightarrow$ 82(no direct arc)

(b) 82 $\rightarrow$ 80 (inhibitory)

(c) Volt 82 $\rightarrow$ 80 (inhibitory)

Figure 10: node(neuron) pair 80 and 82. ($\mathrm{GC}(80 \rightarrow 82) = 0.70 \times 10^{-5}$, $\mathrm{GC}(82 \rightarrow 80) = 9.78 \times 10^{-5}$)