

## SUPPLEMENTARY INFORMATION FILE

### Differential network entropy reveals cancer system hallmarks

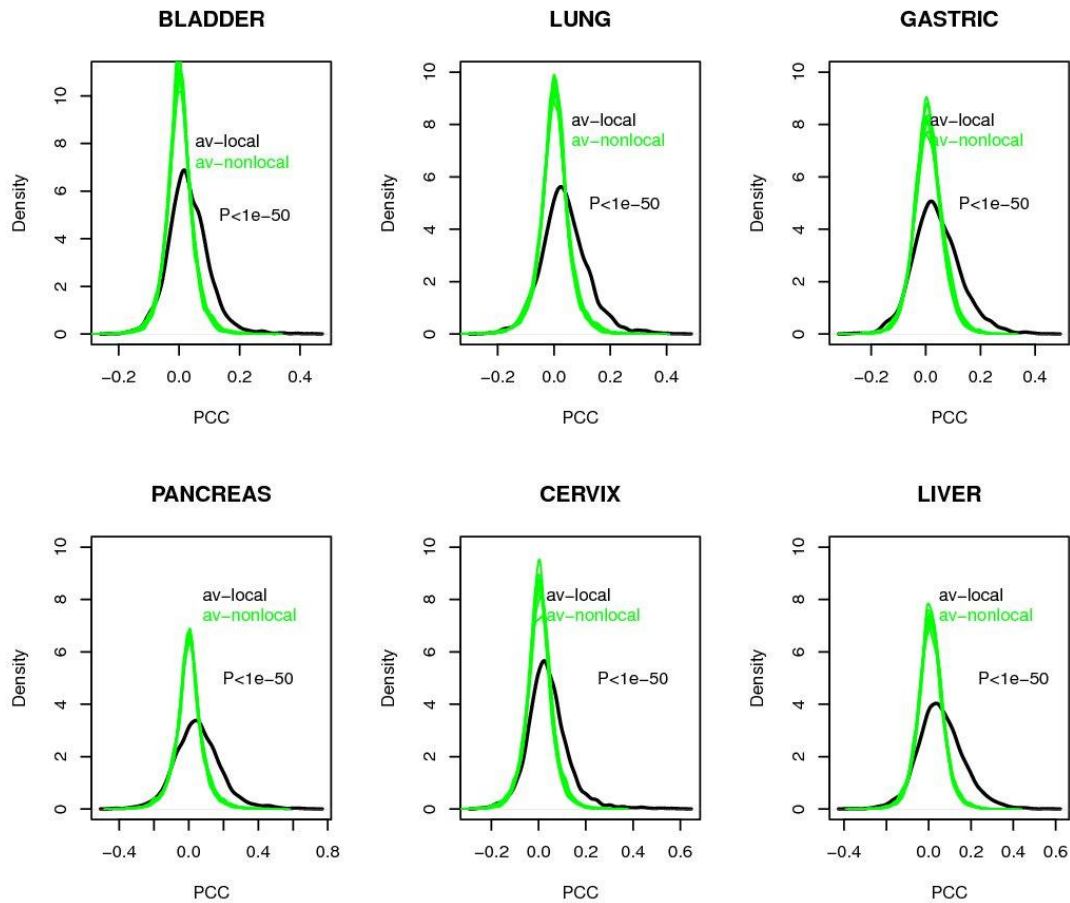
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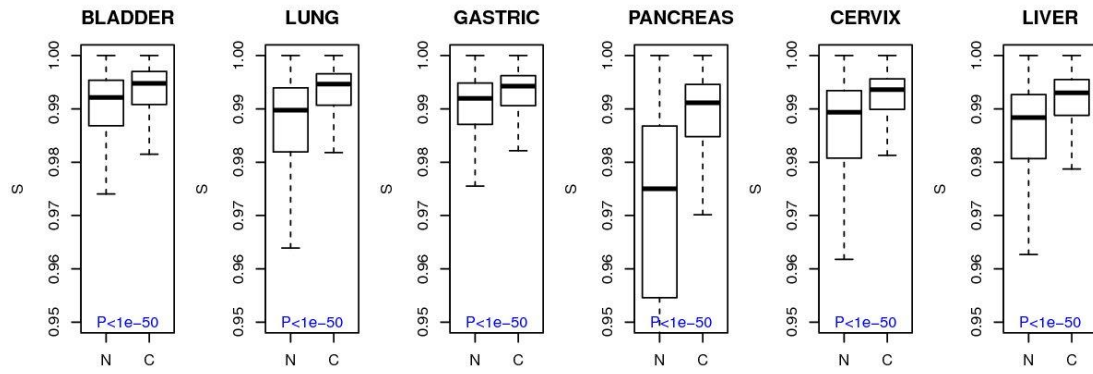
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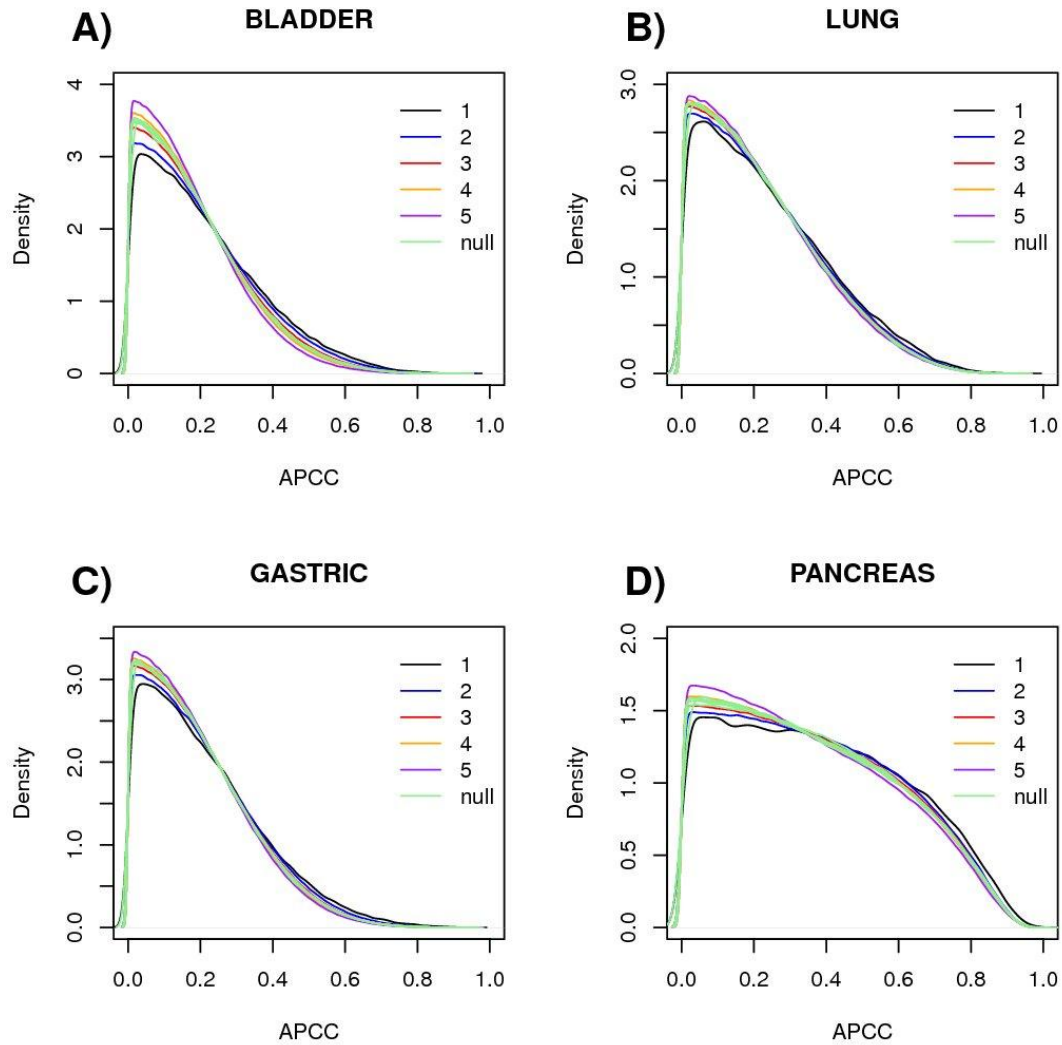
#### SUPPLEMENTARY FIGURES:



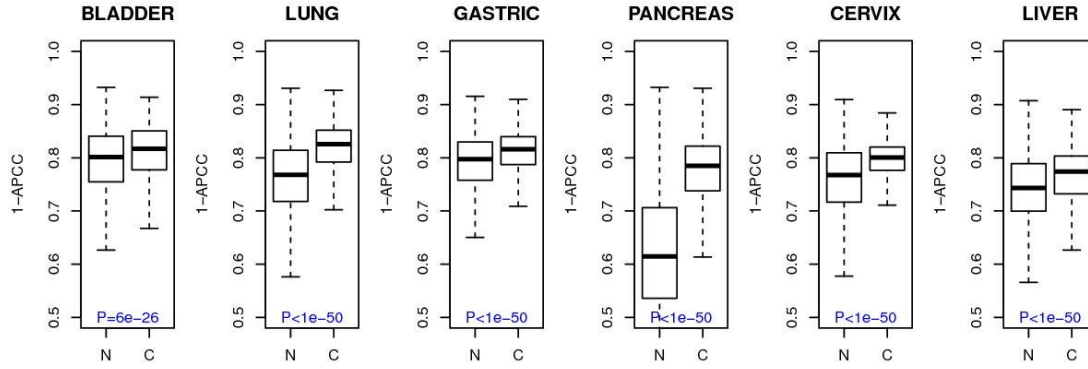
**Supp.Fig.1:** Densities of average local and non-local Pearson Correlation Coefficients (PCC), for each tissue type, where correlations were estimated only over normal samples. Wilcoxon rank sum test P-value between the local and non-local distributions is given. In the local case, averages are taken over the correlations with neighbors of a given node, in the non-local case, the average is taken over a randomly selected number of nodes.



**Supp.Fig.2:** Local network entropy boxplots for normal (N) and cancer (C) tissue, using all nodes of degree at least 2. Wilcoxon rank sum test P-values are given.



**Supp.Fig.3:** Densities of the average of absolute Pearson Correlation Coefficients (APCC) for nodes at path length distances 1,2,3,4,5 and for the case of randomly selected nodes (NULL). Averages are taken over nodes in a shell with path length distance “d” away from a given node. Observe that the strength of correlations is not stronger than random at distances beyond path length distance 3.



**Supp.Fig.4:** Boxplots of 1-APCC comparing normal (N) and cancer (C) tissue, where APCC is the average of Absolute Pearson Correlation Coefficients over the neighbors of a given node. Wilcoxon-rank sum test P-values are given.

**SUPPLEMENTARY TABLES:**

	BLADDER	LUNG	GASTRIC	PANCREAS	CERVIX	LIVER
PCC: $z(dS) \sim k$	0.048	0.076	0.169	0.077	0.078	0.077
Pval: $z(dS) \sim k$	0.54	0.101	0.085	0.01	0.302	0.339
PCC: $z(dS) \sim t(dE)$	-0.34	-0.026	-0.26	-0.129	-0.201	-0.14
Pval: $z(dS) \sim t(dE)$	7.2E-06	0.568	0.007	0.000013	0.007	0.083
PCC: $z(dS) \sim t(dE) \mid k$	-0.351	-0.042	-0.288	-0.138	-0.203	-0.155
Pval: $z(dS) \sim t(dE) \mid k$	1.7E-06	0.363	0.002	0.0000027	0.006	0.054

**Supp.Table.1:** Analysis results of the Pearson Correlation Coefficient (PCC) and associated P-value (Pval) between the z-statistics of differential entropy ( $z(dS)$ ), and node degree ( $k$ ), between  $z(dS)$  and the t-statistics of differential expression ( $t(dE)$ ), as well as their partial correlation analysis after adjustment for node degree (last two rows). These results were estimated over all nodes of degree at least 2 in the network.

EntrezID	Symbol	dS	$z(dS)$	Pval(dS)	k	t	Pval(t)
9212	AURKB	-0.00817	-4.86765	1.13E-06	149	9.057115247	1.62E-15
7083	TK1	-0.00793	-4.60117	4.2E-06	73	9.409416085	2.2E-16
991	CDC20	-0.00787	-4.51719	6.27E-06	50	13.01819497	2.18E-25
55143	CDCA8	-0.01623	-4.06792	4.74E-05	26	10.29751892	1.37E-18
4605	MYBL2	-0.00938	-3.71224	0.000205	39	6.320989653	3.75E-09
9368	SLC9A3R1	-0.00687	-3.43271	0.000598	111	7.060170278	8.71E-11
3833	KIFC1	-0.00804	-3.42213	0.000621	48	9.197113437	7.34E-16
9470	EIF4E2	-0.00664	-3.41819	0.00063	114	2.674718246	0.008431
2584	GALK1	-0.00646	-3.4059	0.000659	85	3.763568175	0.000252
891	CCNB1	-0.00756	-3.31125	0.000929	93	10.59157164	2.53E-19
9055	PRC1	-0.02509	-3.30762	0.000941	10	11.09346785	1.4E-20
4171	MCM2	-0.0055	-3.29924	0.000969	84	11.18909017	8.08E-21
6790	AURKA	-0.00538	-3.20844	0.001335	170	11.95116679	9.97E-23
6712	SPTBN2	-0.00787	-3.17602	0.001493	55	6.490703789	1.61E-09

9133	CCNB2	-0.00847	-3.15285	0.001617	56	12.54615189	3.26E-24
3619	INCENP	-0.00806	-3.12461	0.00178	25	3.204347762	0.0017
5058	PAK1	-0.00415	-3.10923	0.001876	140	0.03973053	0.968368
1457	CSNK2A1	-0.00309	-3.10518	0.001902	335	6.708130371	5.35E-10
9136	RRP9	-0.00887	-3.10413	0.001908	40	1.197651363	0.233212
3007	HIST1H1D	-0.00467	-2.9859	0.002827	76	0.559287628	0.576919
54821	ERCC6L	-0.00701	-2.89831	0.003752	22	5.56733345	1.4E-07
1468	SLC25A10	-0.0085	-2.89238	0.003823	57	6.051434387	1.41E-08
51203	NUSAP1	-0.01353	-2.85238	0.004339	12	8.258984683	1.39E-13
4288	MKI67	-0.00991	-2.8428	0.004472	42	10.74021532	1.08E-19
55379	LRRC59	-0.00523	-2.81197	0.004924	151	5.707930826	7.27E-08
55388	MCM10	-0.00595	-2.73769	0.006187	25	7.654668699	3.73E-12
54472	TOLLIP	-0.01066	-2.70455	0.00684	14	3.748152238	0.000266
3014	H2AFX	-0.00462	-2.70379	0.006855	125	3.739550202	0.000274
3337	DNAJB1	-0.00445	-2.7001	0.006932	63	2.222799962	0.027942
9111	NMI	-0.01127	-2.69927	0.006949	16	4.155352214	5.82E-05
1063	CENPF	-0.00546	-2.65616	0.007904	59	11.01365715	2.22E-20
990	CDC6	-0.00691	-2.63315	0.00846	23	9.907525167	1.29E-17
55720	TSR1	-0.00373	-2.57361	0.010064	48	3.995260524	0.000107

**Supp.Table.2:** We list the top ranked genes showing the largest reductions in network entropy in bladder cancer compared to normal tissue. We provide the EntrezID, Gene Symbol, the differential entropy change, the associated z-statistic and P-value, the node degree, the t-statistic and associated P-value of differential expression.