

Supplementary information

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Improving accuracy of protein contact prediction using balanced network
deconvolution

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Table S1. Edge weights in an 8 by 8 constructed symmetric matrix by ND and BND models (Fig.1c in the text).

Node ID	Node ID	Original Edge weight	Edge weight rebuilt by ND noise model	Edge weight rebuilt by BND noise model
1	2	0	2.95E+13	3.69E+12
1	3	0	2.23E+13	1.95E+13
1	4	0	1.67E+14	2.08E+13
1	5	0.369257	7.93E+14	6.94E+14
1	6	0.597762	3.46E+14	3.03E+14
1	7	0	6.87E+14	8.59E+13
1	8	0	2.56E+13	2.24E+13
2	3	0.757482	1.32E+12	1.15E+12
2	4	0	9.83E+12	1.23E+12
2	5	0	4.68E+13	4.09E+13
2	6	0	2.04E+13	1.79E+13
2	7	0	4.05E+13	5.06E+12
2	8	0.490291	1.51E+12	1.32E+12
3	4	0	7.45E+12	6.52E+12
3	5	0	3.54E+13	4.43E+12
3	6	0	1.55E+13	1.93E+12
3	7	0	3.07E+13	2.69E+13
3	8	0	1.15E+12	1.43E+11
4	5	0.086159	2.65E+14	2.31E+14
4	6	0.284088	1.15E+14	1.01E+14
4	7	0	2.29E+14	2.86E+13
4	8	0	8.55E+12	7.48E+12
5	6	0	5.49E+14	6.87E+13
5	7	0.865322	1.09E+15	9.54E+14
5	8	0	4.07E+13	5.08E+12
6	7	0	4.76E+14	4.16E+14
6	8	0	1.77E+13	2.22E+12
7	8	0.016268	3.52E+13	3.08E+13

Table S2. Results for predicting protein residue contact maps on the CASP9

dataset.

Part 1 MI					
Evaluation methods	Predictors	$i-j >23$	$24> i-j >11$	$12> i-j >5$	$i-j >5$
Top $L/10$	MI	10.39%	8.88%	9.45%	11.93%
	MI+ND	21.60%	18.24%	18.15%	25.50%
	MI+BND	26.29%	22.49%	21.15%	31.23%
Top $L/5$	MI	8.41%	7.48%	8.42%	10.32%
	MI+ND	17.73%	14.44%	14.86%	21.95%
	MI+BND	21.58%	17.53%	16.87%	26.99%
Top $L/2$	MI	6.12%	6.37%	7.62%	8.28%
	MI+ND	12.95%	10.47%	11.37%	16.76%
	MI+BND	15.49%	12.21%	12.61%	20.08%
Top L	MI	5.16%	5.41%	6.90%	6.96%
	MI+ND	10.05%	8.18%	9.07%	13.18%
	MI+BND	11.86%	9.32%	9.79%	15.66%

Part 2 MIp					
Evaluation methods	Predictors	$i-j >23$	$24> i-j >11$	$12> i-j >5$	$i-j >5$
Top $L/10$	MIp	10.39%	8.79%	9.57%	11.74%
	MIp+ND	22.22%	17.73%	18.23%	25.30%
	MIp+BND	26.49%	21.93%	21.11%	30.46%
Top $L/5$	MIp	8.46%	7.37%	8.49%	10.26%
	MIp+ND	18.13%	14.39%	15.32%	22.15%
	MIp+BND	21.26%	17.43%	16.55%	26.57%
Top $L/2$	MIp	6.16%	6.41%	7.65%	8.31%
	MIp+ND	13.19%	10.72%	11.60%	16.94%
	MIp+BND	15.81%	12.52%	12.52%	19.86%
Top L	MIp	5.19%	5.38%	6.95%	7.01%
	MIp+ND	10.25%	8.28%	9.21%	13.34%
	MIp+BND	12.38%	9.71%	10.09%	15.72%

Part 3 DCA					
Evaluation methods	Predictors	$i-j >23$	$24> i-j >11$	$12> i-j >5$	$i-j >5$
Top $L/10$	DCA	29.88%	24.76%	20.33%	31.89%
	DCA+ND	29.86%	24.51%	22.72%	32.81%
	DCA+BND	31.34%	25.68%	23.57%	35.00%

Top $L/5$	DCA	24.93%	18.76%	16.93%	27.11%
	DCA+ND	25.59%	19.52%	18.29%	28.82%
	DCA+BND	26.34%	20.84%	19.53%	31.10%
Top $L/2$	DCA	17.69%	12.65%	12.70%	21.58%
	DCA+ND	17.82%	13.07%	13.33%	22.76%
	DCA+BND	18.87%	14.05%	14.28%	23.96%
Top L	DCA	12.71%	9.19%	9.97%	16.88%
	DCA+ND	13.24%	9.64%	10.60%	17.40%
	DCA+BND	14.00%	10.34%	11.02%	18.72%

Part 4 PSICOV

Evaluation methods	Predictors	$ i-j >23$	$24> i-j >11$	$12> i-j >5$	$ i-j >5$
Top $L/10$	PSICOV	31.94%	23.33%	22.14%	36.18%
	PSICOV+ND	31.57%	22.26%	22.39%	36.22%
	PSICOV+BND	33.70%	24.70%	24.92%	40.07%
Top $L/5$	PSICOV	25.02%	17.88%	17.70%	29.41%
	PSICOV+ND	24.47%	17.16%	17.29%	30.46%
	PSICOV+BND	26.21%	18.89%	18.97%	33.24%
Top $L/2$	PSICOV	17.53%	12.64%	13.09%	21.80%
	PSICOV+ND	16.35%	11.91%	12.69%	21.83%
	PSICOV+BND	17.38%	12.74%	13.51%	23.52%
Top L	PSICOV	13.18%	9.93%	10.60%	16.81%
	PSICOV+ND	12.21%	9.13%	10.10%	16.34%
	PSICOV+BND	12.94%	9.69%	10.51%	17.55%

Part 5 gDCA

Evaluation methods	Predictors	$ i-j >23$	$24> i-j >11$	$12> i-j >5$	$ i-j >5$
Top $L/10$	gDCA	34.29%	25.98%	21.50%	36.36%
	gDCA+ND	35.32%	25.87%	20.89%	34.91%
	gDCA+BND	35.87%	27.06%	22.27%	38.05%
Top $L/5$	gDCA	27.66%	20.75%	18.96%	31.18%
	gDCA+ND	28.57%	20.39%	17.64%	30.30%
	gDCA+BND	29.06%	20.87%	18.17%	32.56%
Top $L/2$	gDCA	20.71%	14.55%	14.32%	23.59%
	gDCA+ND	20.02%	14.25%	13.63%	23.41%
	gDCA+BND	20.10%	13.88%	14.37%	24.36%
Top L	gDCA	15.23%	10.98%	11.24%	18.83%
	gDCA+ND	14.89%	10.49%	10.95%	18.53%
	gDCA+BND	14.68%	10.35%	10.93%	18.75%

Table S3. Results for predicting protein residue contact maps on the CASP10

dataset.

Part 1 MI					
Evaluation methods	Predictors	$i-j >23$	$24> i-j >11$	$12> i-j >5$	$i-j >5$
Top $L/10$	MI	15.82%	17.42%	13.97%	19.36%
	MI+ND	30.63%	33.12%	25.12%	38.60%
	MI+BND	36.78%	37.06%	28.60%	42.75%
Top $L/5$	MI	13.82%	13.33%	11.85%	16.12%
	MI+ND	25.45%	26.72%	19.68%	32.83%
	MI+BND	30.77%	29.83%	22.05%	37.72%
Top $L/2$	MI	9.97%	9.96%	9.97%	13.01%
	MI+ND	18.89%	18.83%	14.55%	25.71%
	MI+BND	22.63%	21.17%	16.14%	29.38%
Top L	MI	7.71%	8.13%	8.20%	10.53%
	MI+ND	14.15%	13.95%	11.14%	20.15%
	MI+BND	16.69%	15.55%	12.07%	23.23%

Part 2 MIp					
Evaluation methods	Predictors	$i-j >23$	$24> i-j >11$	$12> i-j >5$	$i-j >5$
Top $L/10$	MIp	15.82%	17.42%	14.06%	19.36%
	MIp+ND	30.81%	33.23%	24.92%	38.70%
	MIp+BND	36.53%	36.69%	28.29%	42.83%
Top $L/5$	MIp	13.82%	13.40%	11.90%	16.31%
	MIp+ND	25.77%	26.88%	19.85%	33.22%
	MIp+BND	30.99%	29.72%	22.11%	37.05%
Top $L/2$	MIp	10.02%	9.97%	10.27%	13.03%
	MIp+ND	19.24%	18.98%	14.62%	25.76%
	MIp+BND	22.88%	21.31%	16.17%	29.38%
Top L	MIp	7.69%	8.05%	8.36%	10.56%
	MIp+ND	14.32%	14.14%	11.27%	20.33%
	MIp+BND	16.98%	15.81%	12.31%	23.31%

Part 3 DCA					
Evaluation methods	Predictors	$i-j >23$	$24> i-j >11$	$12> i-j >5$	$i-j >5$
Top $L/10$	DCA	40.74%	39.56%	29.50%	44.06%
	DCA+ND	38.98%	39.10%	32.00%	46.07%
	DCA+BND	41.42%	40.04%	33.80%	48.94%

Top $L/5$	DCA	34.48%	32.30%	23.88%	39.66%
	DCA+ND	34.24%	33.23%	25.88%	41.83%
	DCA+BND	35.62%	33.83%	27.17%	43.78%
Top $L/2$	DCA	25.94%	22.81%	16.73%	33.00%
	DCA+ND	25.96%	23.11%	17.16%	34.73%
	DCA+BND	26.80%	24.02%	17.74%	36.14%
Top L	DCA	19.13%	16.55%	12.38%	26.71%
	DCA+ND	18.79%	16.83%	12.24%	28.01%
	DCA+BND	19.51%	17.39%	12.62%	29.11%

Part 4 PSICOV

Evaluation methods	Predictors	$ i-j >23$	$24> i-j >11$	$12> i-j >5$	$ i-j >5$
Top $L/10$	PSICOV	41.45%	41.61%	31.57%	51.58%
	PSICOV+ND	39.89%	40.73%	30.80%	50.56%
	PSICOV+BND	41.55%	40.66%	33.48%	51.48%
Top $L/5$	PSICOV	35.87%	32.63%	24.69%	44.82%
	PSICOV+ND	34.75%	31.33%	23.84%	44.48%
	PSICOV+BND	36.50%	32.28%	24.96%	46.47%
Top $L/2$	PSICOV	26.72%	22.55%	17.04%	35.57%
	PSICOV+ND	24.81%	20.91%	16.10%	34.97%
	PSICOV+BND	25.99%	21.87%	16.50%	36.18%
Top L	PSICOV	18.90%	16.63%	12.86%	27.67%
	PSICOV+ND	17.14%	15.06%	11.75%	26.49%
	PSICOV+BND	17.94%	15.99%	12.04%	27.47%

Part 5 gDCA

Evaluation methods	Predictors	$ i-j >23$	$24> i-j >11$	$12> i-j >5$	$ i-j >5$
Top $L/10$	gDCA	45.22%	44.61%	34.05%	51.56%
	gDCA+ND	42.78%	42.89%	33.51%	51.43%
	gDCA+BND	45.13%	44.14%	35.42%	52.72%
Top $L/5$	gDCA	40.11%	36.95%	27.29%	47.07%
	gDCA+ND	38.26%	34.30%	27.00%	47.32%
	gDCA+BND	39.67%	36.23%	27.70%	48.54%
Top $L/2$	gDCA	30.36%	25.53%	18.60%	39.19%
	gDCA+ND	27.57%	23.28%	17.22%	38.52%
	gDCA+BND	29.35%	24.42%	18.20%	40.06%
Top L	gDCA	22.25%	18.38%	13.53%	31.17%
	gDCA+ND	19.16%	16.84%	12.51%	29.47%
	gDCA+BND	20.65%	17.78%	12.99%	31.17%

Table S4. Results for predicting protein residue contact maps on the hard targets

in CASP9 dataset.

Part 1 MI					
Evaluation methods	Predictors	$i-j >23$	$24> i-j >11$	$12> i-j >5$	$i-j >5$
Top $L/10$	MI	7.62%	5.46%	7.32%	10.08%
	MI+ND	14.47%	13.07%	13.99%	18.37%
	MI+BND	20.53%	18.13%	19.20%	27.02%
Top $L/5$	MI	6.59%	4.45%	6.62%	8.17%
	MI+ND	13.04%	9.25%	12.37%	15.27%
	MI+BND	16.41%	13.31%	14.54%	23.25%
Top $L/2$	MI	4.81%	4.51%	6.14%	5.72%
	MI+ND	9.68%	7.31%	9.68%	12.02%
	MI+BND	12.10%	9.35%	10.80%	16.80%
Top L	MI	4.04%	4.51%	6.05%	5.05%
	MI+ND	7.45%	6.37%	7.84%	9.73%
	MI+BND	9.01%	7.46%	8.48%	12.43%

Part 2 MIp					
Evaluation methods	Predictors	$i-j >23$	$24> i-j >11$	$12> i-j >5$	$i-j >5$
Top $L/10$	MIp	7.62%	5.46%	7.32%	10.25%
	MIp+ND	15.38%	12.26%	15.37%	18.63%
	MIp+BND	20.88%	17.66%	20.01%	26.77%
Top $L/5$	MIp	6.59%	4.45%	6.62%	8.17%
	MIp+ND	13.33%	9.29%	13.16%	15.22%
	MIp+BND	15.75%	13.67%	14.83%	22.76%
Top $L/2$	MIp	4.81%	4.56%	6.22%	5.72%
	MIp+ND	9.93%	7.54%	10.22%	12.27%
	MIp+BND	12.14%	9.65%	10.85%	16.49%
Top L	MIp	4.04%	4.43%	6.15%	5.10%
	MIp+ND	7.44%	6.39%	7.94%	10.00%
	MIp+BND	9.23%	7.91%	8.74%	12.68%

Part 3 DCA					
Evaluation methods	Predictors	$i-j >23$	$24> i-j >11$	$12> i-j >5$	$i-j >5$
Top $L/10$	DCA	25.61%	17.61%	19.23%	28.14%
	DCA+ND	26.04%	16.79%	21.49%	27.49%
	DCA+BND	24.56%	16.58%	21.32%	27.51%

Top $L/5$	DCA	19.96%	12.94%	14.54%	22.77%
	DCA+ND	19.75%	13.12%	15.92%	23.50%
	DCA+BND	19.88%	14.48%	16.33%	25.37%
Top $L/2$	DCA	12.43%	8.39%	10.47%	17.30%
	DCA+ND	12.60%	9.16%	10.55%	17.49%
	DCA+BND	13.26%	10.24%	11.91%	18.60%
Top L	DCA	8.62%	6.64%	8.22%	12.51%
	DCA+ND	9.37%	7.25%	8.78%	12.75%
	DCA+BND	10.09%	8.02%	9.24%	13.88%

Part 4 PSICOV

Evaluation methods	Predictors	$ i-j >23$	$24> i-j >11$	$12> i-j >5$	$ i-j >5$
Top $L/10$	PSICOV	23.43%	17.73%	18.14%	29.78%
	PSICOV+ND	22.63%	16.54%	17.68%	29.00%
	PSICOV+BND	24.44%	17.33%	18.14%	30.63%
Top $L/5$	PSICOV	17.35%	13.86%	14.14%	22.95%
	PSICOV+ND	16.61%	12.53%	13.15%	22.44%
	PSICOV+BND	17.19%	12.85%	13.79%	24.25%
Top $L/2$	PSICOV	12.72%	9.47%	10.95%	15.79%
	PSICOV+ND	11.74%	9.19%	9.92%	15.60%
	PSICOV+BND	12.91%	10.13%	11.30%	16.18%
Top L	PSICOV	9.59%	8.21%	8.81%	12.99%
	PSICOV+ND	9.20%	7.59%	8.45%	12.13%
	PSICOV+BND	9.32%	8.06%	9.08%	13.20%

Part 5 gDCA

Evaluation methods	Predictors	$ i-j >23$	$24> i-j >11$	$12> i-j >5$	$ i-j >5$
Top $L/10$	gDCA	29.30%	20.52%	18.57%	31.13%
	gDCA+ND	29.55%	16.61%	17.68%	29.02%
	gDCA+BND	29.53%	18.99%	18.91%	32.01%
Top $L/5$	gDCA	21.75%	15.75%	16.54%	26.98%
	gDCA+ND	22.11%	13.74%	15.72%	24.63%
	gDCA+BND	21.84%	14.79%	15.33%	25.81%
Top $L/2$	gDCA	15.16%	11.10%	11.68%	19.22%
	gDCA+ND	13.97%	10.83%	11.41%	19.01%
	gDCA+BND	13.57%	10.23%	12.09%	18.65%
Top L	gDCA	11.32%	8.14%	9.76%	15.24%
	gDCA+ND	10.78%	7.64%	9.49%	14.56%
	gDCA+BND	10.58%	7.82%	9.71%	14.11%

Table S5. Results for predicting protein residue contact maps on the hard targets

in CASP10 dataset.

Part 1 MI					
Evaluation methods	Predictors	$i-j >23$	$24> i-j >11$	$12> i-j >5$	$i-j >5$
Top $L/10$	MI	9.48%	12.60%	7.71%	10.88%
	MI+ND	13.89%	21.72%	13.35%	19.99%
	MI+BND	18.61%	23.47%	17.55%	24.09%
Top $L/5$	MI	8.27%	9.78%	7.05%	8.83%
	MI+ND	12.04%	17.81%	10.48%	16.84%
	MI+BND	15.72%	19.66%	13.21%	20.91%
Top $L/2$	MI	6.54%	6.98%	6.34%	7.33%
	MI+ND	9.09%	12.63%	8.87%	13.12%
	MI+BND	11.28%	14.61%	10.31%	15.25%
Top L	MI	5.35%	5.81%	5.69%	6.29%
	MI+ND	7.07%	10.47%	7.84%	10.35%
	MI+BND	8.82%	11.79%	8.74%	12.04%

Part 2 MIp					
Evaluation methods	Predictors	$i-j >23$	$24> i-j >11$	$12> i-j >5$	$i-j >5$
Top $L/10$	MIp	9.48%	12.60%	7.71%	10.88%
	MIp+ND	13.99%	21.26%	13.66%	20.70%
	MIp+BND	17.83%	22.62%	17.16%	24.09%
Top $L/5$	MIp	8.27%	10.18%	7.05%	9.33%
	MIp+ND	12.04%	18.10%	11.08%	17.08%
	MIp+BND	16.59%	19.89%	13.47%	20.51%
Top $L/2$	MIp	6.70%	6.93%	7.28%	7.36%
	MIp+ND	9.61%	12.79%	9.03%	13.20%
	MIp+BND	11.76%	14.87%	10.71%	15.41%
Top L	MIp	5.30%	5.70%	6.22%	6.40%
	MIp+ND	7.32%	10.57%	7.71%	10.55%
	MIp+BND	9.22%	12.00%	8.56%	12.44%

Part 3 DCA					
Evaluation methods	Predictors	$i-j >23$	$24> i-j >11$	$12> i-j >5$	$i-j >5$
Top $L/10$	DCA	19.08%	22.89%	17.09%	22.94%
	DCA+ND	16.61%	21.07%	17.25%	24.28%
	DCA+BND	20.30%	23.74%	18.71%	28.53%

Top $L/5$	DCA	14.34%	18.87%	12.93%	20.77%
	DCA+ND	14.61%	19.12%	13.96%	21.51%
	DCA+BND	15.67%	19.61%	15.45%	23.85%
Top $L/2$	DCA	11.44%	14.74%	9.51%	16.57%
	DCA+ND	11.13%	15.58%	10.45%	17.51%
	DCA+BND	11.74%	16.19%	10.87%	18.72%
Top L	DCA	9.16%	11.88%	7.94%	13.06%
	DCA+ND	8.46%	12.58%	8.43%	14.03%
	DCA+BND	8.75%	13.28%	8.97%	14.78%

Part 4 PSICOV

Evaluation methods	Predictors	$ i-j >23$	$24> i-j >11$	$12> i-j >5$	$ i-j >5$
Top $L/10$	PSICOV	17.58%	24.89%	15.62%	27.20%
	PSICOV+ND	16.10%	24.12%	13.96%	27.49%
	PSICOV+BND	19.09%	23.33%	15.82%	29.83%
Top $L/5$	PSICOV	15.39%	18.77%	11.14%	21.90%
	PSICOV+ND	14.11%	18.68%	11.45%	22.24%
	PSICOV+BND	16.10%	18.81%	11.60%	24.37%
Top $L/2$	PSICOV	11.34%	14.65%	9.74%	16.89%
	PSICOV+ND	10.66%	14.28%	9.49%	16.95%
	PSICOV+BND	11.11%	15.38%	9.54%	17.38%
Top L	PSICOV	8.62%	12.01%	9.66%	13.13%
	PSICOV+ND	7.93%	11.67%	9.10%	13.05%
	PSICOV+BND	8.15%	11.94%	9.27%	13.94%

Part 5 gDCA

Evaluation methods	Predictors	$ i-j >23$	$24> i-j >11$	$12> i-j >5$	$ i-j >5$
Top $L/10$	gDCA	20.86%	27.05%	17.10%	27.90%
	gDCA+ND	19.28%	22.49%	16.23%	27.39%
	gDCA+BND	21.82%	25.23%	16.80%	28.65%
Top $L/5$	gDCA	18.04%	21.73%	14.69%	23.79%
	gDCA+ND	16.56%	19.99%	14.00%	24.35%
	gDCA+BND	17.66%	21.35%	12.98%	25.67%
Top $L/2$	gDCA	13.31%	16.74%	10.73%	19.11%
	gDCA+ND	11.42%	15.62%	10.69%	19.24%
	gDCA+BND	12.48%	16.42%	10.73%	20.22%
Top L	gDCA	10.24%	13.22%	9.46%	15.10%
	gDCA+ND	8.68%	12.96%	9.03%	15.38%
	gDCA+BND	9.36%	13.70%	9.02%	15.95%

Table S6. Results for predicting protein residue contact maps on the PSICOV

dataset.

Part 1 MI					
Evaluation methods	Predictors	$i-j >23$	$24> i-j >11$	$12> i-j >5$	$i-j >5$
Top $L/10$	MI	29.12%	22.26%	19.83%	30.28%
	MI+ND	55.04%	45.59%	39.74%	61.93%
	MI+BND	60.76%	50.03%	43.11%	66.36%
Top $L/5$	MI	23.15%	16.95%	16.17%	25.08%
	MI+ND	46.89%	35.47%	30.37%	53.90%
	MI+BND	52.23%	39.96%	33.28%	58.84%
Top $L/2$	MI	16.33%	12.39%	11.94%	18.71%
	MI+ND	33.58%	22.41%	19.70%	42.11%
	MI+BND	38.61%	25.77%	21.34%	46.19%
Top L	MI	12.42%	9.32%	9.84%	15.50%
	MI+ND	24.18%	15.15%	13.81%	31.83%
	MI+BND	27.99%	17.19%	14.81%	35.57%

Part 2 MIp					
Evaluation methods	Predictors	$i-j >23$	$24> i-j >11$	$12> i-j >5$	$i-j >5$
Top $L/10$	MIp	29.12%	22.26%	19.83%	30.28%
	MIp+ND	55.15%	45.68%	39.66%	62.07%
	MIp+BND	60.20%	50.12%	43.29%	65.83%
Top $L/5$	MIp	23.15%	16.95%	16.17%	25.08%
	MIp+ND	46.96%	35.53%	30.60%	53.96%
	MIp+BND	52.29%	40.03%	33.26%	58.87%
Top $L/2$	MIp	16.33%	12.39%	11.94%	18.71%
	MIp+ND	33.86%	22.60%	19.94%	42.21%
	MIp+BND	38.73%	25.96%	21.57%	46.11%
Top L	MIp	12.42%	9.32%	9.84%	15.50%
	MIp+ND	24.35%	15.36%	13.88%	31.90%
	MIp+BND	28.11%	17.25%	14.92%	35.59%

Part 3 DCA					
Evaluation methods	Predictors	$i-j >23$	$24> i-j >11$	$12> i-j >5$	$i-j >5$
Top $L/10$	DCA	54.92%	53.45%	43.33%	60.14%
	DCA+ND	56.06%	54.89%	46.37%	63.57%
	DCA+BND	58.03%	56.86%	48.73%	65.96%

Top $L/5$	DCA	50.55%	42.81%	35.22%	56.45%
	DCA+ND	51.42%	44.30%	36.86%	58.66%
	DCA+BND	53.44%	45.49%	37.61%	60.92%
Top $L/2$	DCA	40.00%	26.58%	22.51%	47.98%
	DCA+ND	40.81%	27.04%	22.61%	49.92%
	DCA+BND	42.39%	28.24%	23.34%	51.66%
Top L	DCA	29.18%	17.02%	15.18%	38.35%
	DCA+ND	29.58%	17.00%	14.60%	39.81%
	DCA+BND	30.72%	17.69%	15.14%	41.11%

Part 4 PSICOV

Evaluation methods	Predictors	$ i-j >23$	$24> i-j >11$	$12> i-j >5$	$ i-j >5$
Top $L/10$	PSICOV	71.77%	58.11%	50.95%	77.11%
	PSICOV+ND	70.53%	56.97%	49.72%	76.66%
	PSICOV+BND	71.22%	57.60%	51.25%	77.03%
Top $L/5$	PSICOV	62.56%	45.87%	38.62%	71.19%
	PSICOV+ND	60.69%	43.27%	36.77%	70.28%
	PSICOV+BND	62.42%	44.82%	38.06%	70.65%
Top $L/2$	PSICOV	44.74%	27.81%	23.94%	56.22%
	PSICOV+ND	42.10%	25.09%	21.68%	54.63%
	PSICOV+BND	44.05%	26.29%	22.71%	56.39%
Top L	PSICOV	31.48%	17.96%	16.12%	42.55%
	PSICOV+ND	28.60%	15.87%	14.16%	39.87%
	PSICOV+BND	29.91%	16.35%	14.82%	41.42%

Part 5 gDCA

Evaluation methods	Predictors	$ i-j >23$	$24> i-j >11$	$12> i-j >5$	$ i-j >5$
Top $L/10$	gDCA	72.86%	60.79%	54.59%	76.56%
	gDCA+ND	72.86%	61.51%	54.04%	78.73%
	gDCA+BND	73.62%	62.96%	56.63%	78.52%
Top $L/5$	gDCA	64.70%	50.28%	42.15%	71.81%
	gDCA+ND	64.31%	47.48%	40.33%	72.11%
	gDCA+BND	66.38%	50.16%	42.44%	73.86%
Top $L/2$	gDCA	50.61%	31.81%	26.32%	59.94%
	gDCA+ND	47.27%	28.24%	23.85%	59.04%
	gDCA+BND	50.39%	30.19%	25.41%	61.59%
Top L	gDCA	36.90%	20.51%	17.37%	47.72%
	gDCA+ND	32.24%	17.71%	15.56%	44.25%
	gDCA+BND	35.19%	19.02%	16.55%	47.42%

Table S7. Results for predicting protein residue contact maps on the CASP9

dataset at different cutoff values of long-range contacts.

Part 1 MI					
Evaluation methods	Predictors	$i-j >23$	$i-j >20$	$i-j >15$	$i-j >8$
Top $L/10$	MI	10.39%	10.68%	10.68%	11.59%
	MI+ND	21.60%	22.26%	23.28%	25.19%
	MI+BND	26.29%	27.66%	28.81%	31.44%
Top $L/5$	MI	8.41%	8.58%	9.09%	10.03%
	MI+ND	17.73%	18.68%	19.65%	21.50%
	MI+BND	21.58%	22.40%	23.49%	26.34%
Top $L/2$	MI	6.12%	6.51%	6.98%	7.58%
	MI+ND	12.95%	13.43%	14.22%	16.16%
	MI+BND	15.49%	16.38%	17.36%	19.37%
Top L	MI	5.16%	5.43%	5.82%	6.47%
	MI+ND	10.05%	10.52%	11.31%	12.47%
	MI+BND	11.86%	12.55%	13.39%	14.90%

Part 2 MIp					
Evaluation methods	Predictors	$i-j >23$	$i-j >20$	$i-j >15$	$i-j >8$
Top $L/10$	MIp	10.39%	10.68%	10.68%	11.37%
	MIp+ND	22.22%	22.64%	23.56%	25.28%
	MIp+BND	26.49%	27.24%	28.80%	30.40%
Top $L/5$	MIp	8.46%	8.66%	9.06%	9.94%
	MIp+ND	18.13%	18.79%	19.82%	21.64%
	MIp+BND	21.26%	22.74%	23.36%	25.75%
Top $L/2$	MIp	6.16%	6.54%	6.95%	7.60%
	MIp+ND	13.19%	13.80%	14.59%	16.23%
	MIp+BND	15.81%	16.50%	17.50%	19.45%
Top L	MIp	5.19%	5.44%	5.82%	6.44%
	MIp+ND	10.25%	10.76%	11.43%	12.58%
	MIp+BND	12.38%	12.96%	13.79%	14.99%

Part 3 DCA					
Evaluation methods	Predictors	$i-j >23$	$i-j >20$	$i-j >15$	$i-j >8$
Top $L/10$	DCA	29.88%	30.49%	31.21%	33.19%
	DCA+ND	29.86%	30.51%	31.80%	33.90%
	DCA+BND	31.34%	31.42%	32.89%	35.67%

Top $L/5$	DCA	24.93%	25.81%	26.75%	27.82%
	DCA+ND	25.59%	26.46%	27.56%	28.58%
	DCA+BND	26.34%	27.32%	28.64%	30.86%
Top $L/2$	DCA	17.69%	18.61%	19.73%	21.63%
	DCA+ND	17.82%	18.78%	20.13%	22.14%
	DCA+BND	18.87%	19.75%	21.30%	23.24%
Top L	DCA	12.71%	13.50%	14.59%	16.25%
	DCA+ND	13.24%	13.87%	14.93%	16.64%
	DCA+BND	14.00%	14.83%	15.94%	17.61%

Part 4 PSICOV

Evaluation methods	Predictors	$ i-j >23$	$ i-j >20$	$ i-j >15$	$ i-j >8$
Top $L/10$	PSICOV	31.94%	32.21%	33.90%	36.73%
	PSICOV+ND	31.57%	31.99%	33.32%	36.70%
	PSICOV+BND	33.70%	34.23%	35.89%	39.54%
Top $L/5$	PSICOV	25.02%	26.28%	27.16%	29.76%
	PSICOV+ND	24.47%	25.52%	26.88%	29.93%
	PSICOV+BND	26.21%	27.58%	28.94%	32.62%
Top $L/2$	PSICOV	17.53%	18.56%	19.27%	20.97%
	PSICOV+ND	16.35%	17.39%	18.50%	20.55%
	PSICOV+BND	17.38%	18.19%	19.47%	22.22%
Top L	PSICOV	13.18%	13.83%	14.70%	16.16%
	PSICOV+ND	12.21%	12.62%	13.55%	15.27%
	PSICOV+BND	12.94%	13.50%	14.38%	16.39%

Part 5 gDCA

Evaluation methods	Predictors	$ i-j >23$	$24> i-j >11$	$12> i-j >5$	$ i-j >5$
Top $L/10$	gDCA	34.29%	35.67%	36.55%	38.02%
	gDCA+ND	35.32%	35.67%	36.32%	37.44%
	gDCA+BND	35.87%	36.57%	37.37%	39.63%
Top $L/5$	gDCA	27.66%	28.95%	29.73%	32.23%
	gDCA+ND	28.57%	29.68%	30.84%	32.18%
	gDCA+BND	29.06%	30.17%	31.25%	33.90%
Top $L/2$	gDCA	20.71%	21.43%	21.99%	23.65%
	gDCA+ND	20.02%	21.15%	22.44%	23.99%
	gDCA+BND	20.10%	20.99%	22.36%	24.39%
Top L	gDCA	15.23%	16.09%	17.09%	18.36%
	gDCA+ND	14.89%	15.64%	16.66%	18.13%
	gDCA+BND	14.68%	15.56%	16.66%	18.22%

Table S8. Results for predicting protein residue contact maps on the CASP10

dataset at different cutoff values of long-range contacts.

Part 1 MI					
Evaluation methods	Predictors	$i-j >23$	$i-j >20$	$i-j >15$	$i-j >8$
Top $L/10$	MI	15.82%	18.81%	17.77%	19.77%
	MI+ND	30.63%	35.39%	36.62%	40.60%
	MI+BND	36.78%	39.65%	40.66%	44.97%
Top $L/5$	MI	13.82%	16.30%	14.70%	16.78%
	MI+ND	25.45%	29.22%	30.98%	33.80%
	MI+BND	30.77%	34.33%	36.02%	39.24%
Top $L/2$	MI	9.97%	11.97%	11.68%	12.69%
	MI+ND	18.89%	21.93%	23.71%	26.14%
	MI+BND	22.63%	26.04%	27.79%	30.48%
Top L	MI	7.71%	9.67%	9.47%	9.84%
	MI+ND	14.15%	17.05%	18.31%	20.03%
	MI+BND	16.69%	19.61%	21.25%	23.36%

Part 2 MIp					
Evaluation methods	Predictors	$i-j >23$	$i-j >20$	$i-j >15$	$i-j >8$
Top $L/10$	MIp	15.82%	18.81%	17.77%	19.86%
	MIp+ND	30.81%	35.52%	37.01%	40.45%
	MIp+BND	36.53%	39.63%	40.81%	45.05%
Top $L/5$	MIp	13.82%	16.30%	14.82%	16.99%
	MIp+ND	25.77%	29.73%	31.32%	34.45%
	MIp+BND	30.99%	34.81%	36.00%	39.16%
Top $L/2$	MIp	10.02%	11.97%	11.68%	12.69%
	MIp+ND	19.24%	22.44%	23.88%	26.26%
	MIp+BND	22.88%	26.49%	28.44%	30.67%
Top L	MIp	7.69%	9.66%	9.43%	9.99%
	MIp+ND	14.32%	17.26%	18.68%	20.33%
	MIp+BND	16.98%	19.84%	21.43%	23.72%

Part 3 DCA					
Evaluation methods	Predictors	$i-j >23$	$i-j >20$	$i-j >15$	$i-j >8$
Top $L/10$	DCA	40.74%	44.21%	44.66%	46.96%
	DCA+ND	38.98%	42.98%	44.49%	47.13%
	DCA+BND	41.42%	45.41%	46.73%	49.49%

Top $L/5$	DCA	34.48%	38.47%	39.87%	41.94%
	DCA+ND	34.24%	38.98%	39.92%	42.08%
	DCA+BND	35.62%	40.18%	41.51%	44.11%
Top $L/2$	DCA	25.94%	29.80%	31.88%	33.78%
	DCA+ND	25.96%	30.04%	31.81%	34.36%
	DCA+BND	26.80%	31.17%	33.19%	35.52%
Top L	DCA	19.13%	22.87%	24.84%	26.69%
	DCA+ND	18.79%	22.55%	24.59%	27.27%
	DCA+BND	19.51%	23.30%	25.55%	28.24%

Part 4 PSICOV

Evaluation methods	Predictors	$ i-j >23$	$ i-j >20$	$ i-j >15$	$ i-j >8$
Top $L/10$	PSICOV	41.45%	45.29%	47.93%	52.01%
	PSICOV+ND	39.89%	44.20%	46.70%	50.13%
	PSICOV+BND	41.55%	45.46%	47.19%	50.99%
Top $L/5$	PSICOV	35.87%	40.31%	41.40%	45.37%
	PSICOV+ND	34.75%	39.23%	40.52%	44.21%
	PSICOV+BND	36.50%	40.68%	42.74%	45.89%
Top $L/2$	PSICOV	26.72%	30.69%	33.03%	35.09%
	PSICOV+ND	24.81%	29.12%	31.58%	34.08%
	PSICOV+BND	25.99%	30.52%	32.59%	35.27%
Top L	PSICOV	18.90%	22.26%	24.33%	26.72%
	PSICOV+ND	17.14%	20.62%	22.58%	25.25%
	PSICOV+BND	17.94%	15.99%	12.04%	27.47%

Part 5 gDCA

Evaluation methods	Predictors	$ i-j >23$	$24> i-j >11$	$12> i-j >5$	$ i-j >5$
Top $L/10$	gDCA	45.22%	47.87%	49.55%	51.77%
	gDCA+ND	42.78%	46.16%	47.82%	50.89%
	gDCA+BND	45.13%	47.99%	48.89%	51.87%
Top $L/5$	gDCA	40.11%	44.07%	45.97%	47.68%
	gDCA+ND	38.26%	42.79%	44.02%	46.96%
	gDCA+BND	39.67%	44.08%	46.07%	48.32%
Top $L/2$	gDCA	30.36%	34.74%	37.07%	39.32%
	gDCA+ND	27.57%	32.17%	34.35%	37.38%
	gDCA+BND	29.35%	33.74%	36.44%	39.22%
Top L	gDCA	22.25%	26.33%	28.43%	30.74%
	gDCA+ND	19.16%	23.26%	25.37%	28.21%
	gDCA+BND	20.65%	24.67%	27.02%	30.15%

Table S9. Results for predicting protein residue contact maps on the PSICOV

dataset at different cutoff values of long-range contacts.

Part 1 MI					
Evaluation methods	Predictors	$i-j >23$	$i-j >20$	$i-j >15$	$i-j >8$
Top $L/10$	MI	29.12%	29.91%	32.40%	31.83%
	MI+ND	55.04%	55.65%	58.04%	61.57%
	MI+BND	60.76%	61.32%	64.08%	67.30%
Top $L/5$	MI	23.15%	23.54%	24.73%	25.79%
	MI+ND	46.89%	47.76%	50.19%	53.64%
	MI+BND	52.23%	53.87%	56.63%	59.45%
Top $L/2$	MI	16.33%	17.25%	18.40%	18.91%
	MI+ND	33.58%	35.30%	37.59%	41.55%
	MI+BND	38.61%	40.46%	43.21%	46.32%
Top L	MI	12.42%	13.10%	14.03%	15.14%
	MI+ND	24.18%	25.73%	27.72%	30.57%
	MI+BND	27.99%	29.72%	31.95%	35.09%

Part 2 MIp					
Evaluation methods	Predictors	$i-j >23$	$i-j >20$	$i-j >15$	$i-j >8$
Top $L/10$	MIp	29.12%	29.91%	32.40%	31.83%
	MIp+ND	55.15%	55.89%	58.28%	61.69%
	MIp+BND	60.20%	61.02%	63.79%	66.99%
Top $L/5$	MIp	23.15%	23.54%	24.73%	25.79%
	MIp+ND	46.96%	47.96%	50.23%	53.59%
	MIp+BND	52.29%	53.94%	56.73%	59.35%
Top $L/2$	MIp	16.33%	17.25%	18.40%	18.91%
	MIp+ND	33.86%	35.45%	37.81%	41.74%
	MIp+BND	38.73%	40.56%	43.20%	46.42%
Top L	MIp	12.42%	13.10%	14.03%	15.14%
	MIp+ND	24.35%	25.82%	27.89%	30.66%
	MIp+BND	28.11%	29.75%	32.16%	35.26%

Part 3 DCA					
Evaluation methods	Predictors	$i-j >23$	$i-j >20$	$i-j >15$	$i-j >8$
Top $L/10$	DCA	54.92%	55.81%	57.94%	60.26%
	DCA+ND	56.06%	57.27%	60.27%	63.70%
	DCA+BND	58.03%	58.85%	62.01%	65.54%

Top $L/5$	DCA	50.55%	51.54%	53.84%	57.02%
	DCA+ND	51.42%	52.83%	55.09%	58.14%
	DCA+BND	53.44%	54.51%	56.92%	60.46%
Top $L/2$	DCA	40.00%	41.68%	44.33%	47.53%
	DCA+ND	40.81%	42.77%	45.55%	49.02%
	DCA+BND	42.39%	44.34%	47.18%	50.51%
Top L	DCA	29.18%	30.81%	33.56%	37.24%
	DCA+ND	29.58%	31.36%	34.18%	37.93%
	DCA+BND	30.72%	32.74%	35.52%	39.48%

Part 4 PSICOV

Evaluation methods	Predictors	$ i-j >23$	$ i-j >20$	$ i-j >15$	$ i-j >8$
Top $L/10$	PSICOV	71.77%	72.84%	74.96%	76.88%
	PSICOV+ND	70.53%	71.95%	74.27%	77.08%
	PSICOV+BND	71.22%	72.37%	74.51%	77.01%
Top $L/5$	PSICOV	62.56%	64.21%	67.01%	70.59%
	PSICOV+ND	60.69%	62.57%	65.85%	69.56%
	PSICOV+BND	62.42%	63.77%	66.81%	70.29%
Top $L/2$	PSICOV	44.74%	46.99%	50.02%	54.79%
	PSICOV+ND	42.10%	44.58%	47.92%	52.85%
	PSICOV+BND	44.05%	46.26%	49.83%	54.82%
Top L	PSICOV	31.48%	33.43%	36.22%	40.49%
	PSICOV+ND	28.60%	30.50%	33.18%	37.65%
	PSICOV+BND	29.91%	31.90%	34.64%	39.14%

Part 5 gDCA

Evaluation methods	Predictors	$ i-j >23$	$24> i-j >11$	$12> i-j >5$	$ i-j >5$
Top $L/10$	gDCA	72.86%	73.91%	76.00%	76.67%
	gDCA+ND	72.86%	73.99%	76.14%	78.80%
	gDCA+BND	73.62%	74.63%	77.08%	78.80%
Top $L/5$	gDCA	64.70%	66.27%	68.50%	71.63%
	gDCA+ND	64.31%	65.55%	68.18%	72.12%
	gDCA+BND	66.38%	67.62%	69.64%	73.64%
Top $L/2$	gDCA	50.61%	52.72%	55.81%	59.38%
	gDCA+ND	47.27%	49.43%	52.82%	58.31%
	gDCA+BND	50.39%	52.43%	55.96%	61.13%
Top L	gDCA	36.90%	38.94%	41.80%	47.19%
	gDCA+ND	32.24%	34.27%	37.25%	43.49%
	gDCA+BND	35.19%	37.31%	40.61%	46.77%

Table S10. The p -value in the t -test on all contacts.

Method	CASP9	CASP9	CASP10	CASP10	PSICOV	PSICOV
	$ i-j >5$	$ i-j >23$	$ i-j >5$	$ i-j >23$	$ i-j >5$	$ i-j >23$
MI/ND	1.24E-05	5.05E-03	9.06E-04	1.69E-03	7.40E-14	1.99E-06
MI/BND	3.57E-03	4.12E-03	1.38E-03	2.42E-03	8.55E-14	2.20E-06
ND/BND	1.75E-03	1.18E-02	3.48E-03	1.28E-02	1.89E-05	1.08E-05
MIp/ND	5.44E-06	3.01E-03	9.15E-04	7.28E-05	7.34E-14	1.99E-06
MIp/BND	3.69E-04	5.01E-03	1.40E-03	7.17E-04	8.35E-14	2.17E-06
ND/BND	3.18E-04	6.95E-03	1.36E-02	9.81E-03	1.19E-03	3.96E-05
DCA/ND	1.00E-07	4.54E-05	3.55E-05	3.54E-06	7.55E-14	2.08E-06
DCA/BND	1.99E-07	7.45E-05	2.91E-04	3.93E-07	4.79E-13	8.29E-06
ND/BND	9.73E-04	3.12E-03	2.83E-04	3.32E-04	5.66E-13	1.08E-05
PSICOV/ND	2.32E-09	3.27E-06	8.11E-06	8.11E-06	5.78E-13	5.30E-06
PSICOV/BND	2.16E-07	1.00E-05	4.25E-06	4.25E-06	2.63E-13	3.83E-06
ND/BND	6.72E-08	2.12E-04	8.80E-05	8.80E-05	1.70E-11	5.95E-05
gDCA/ND	4.13E-04	3.01E-03	7.19E-03	8.75E-03	1.23E-02	1.06E-02
gDCA/BND	2.78E-03	9.87E-03	1.43E-02	2.50E-02	6.48E-02	4.80E-02
ND/BND	3.30E-02	2.20E-02	5.55E-03	1.48E-02	4.78E-03	6.41E-03