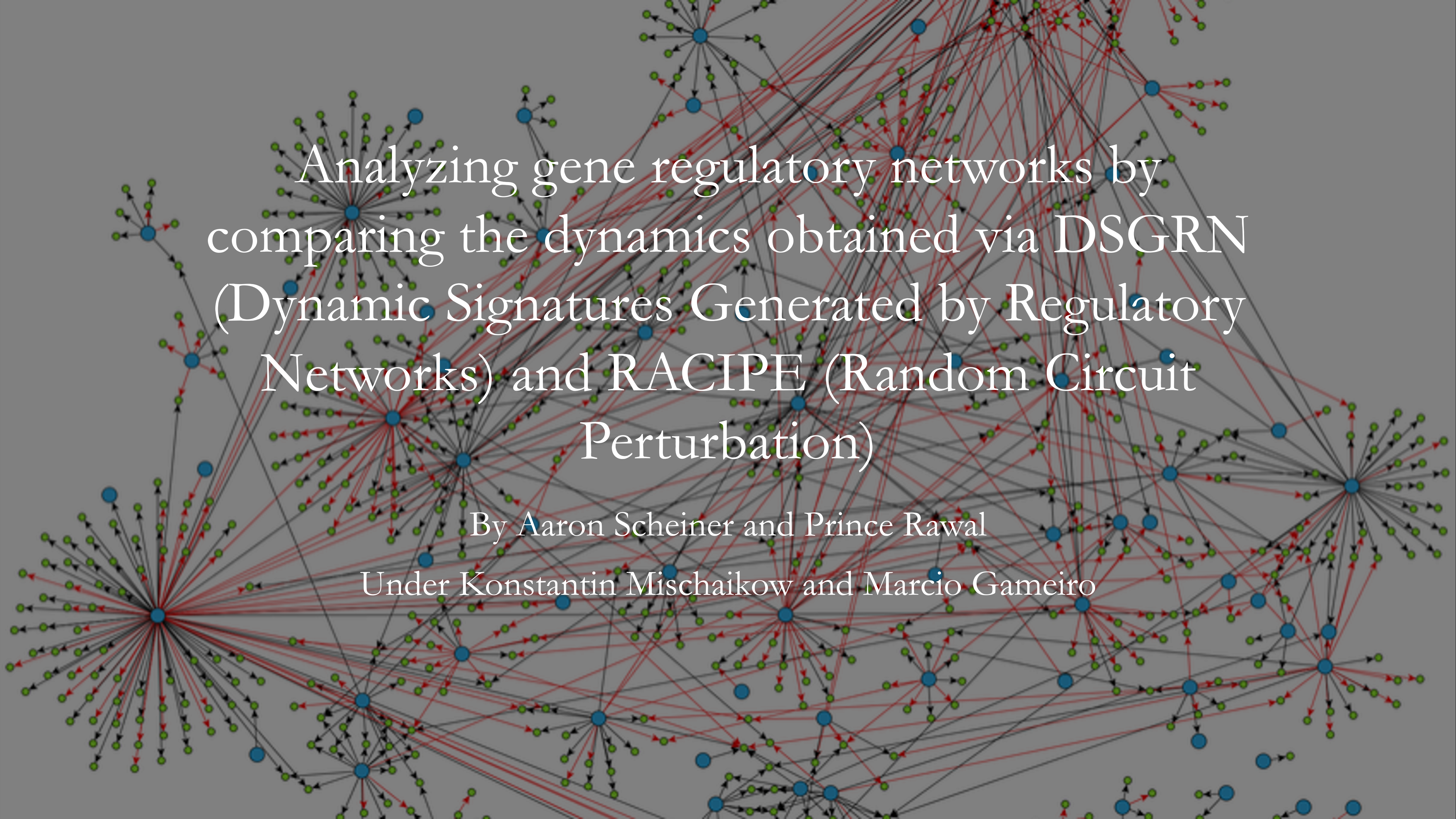


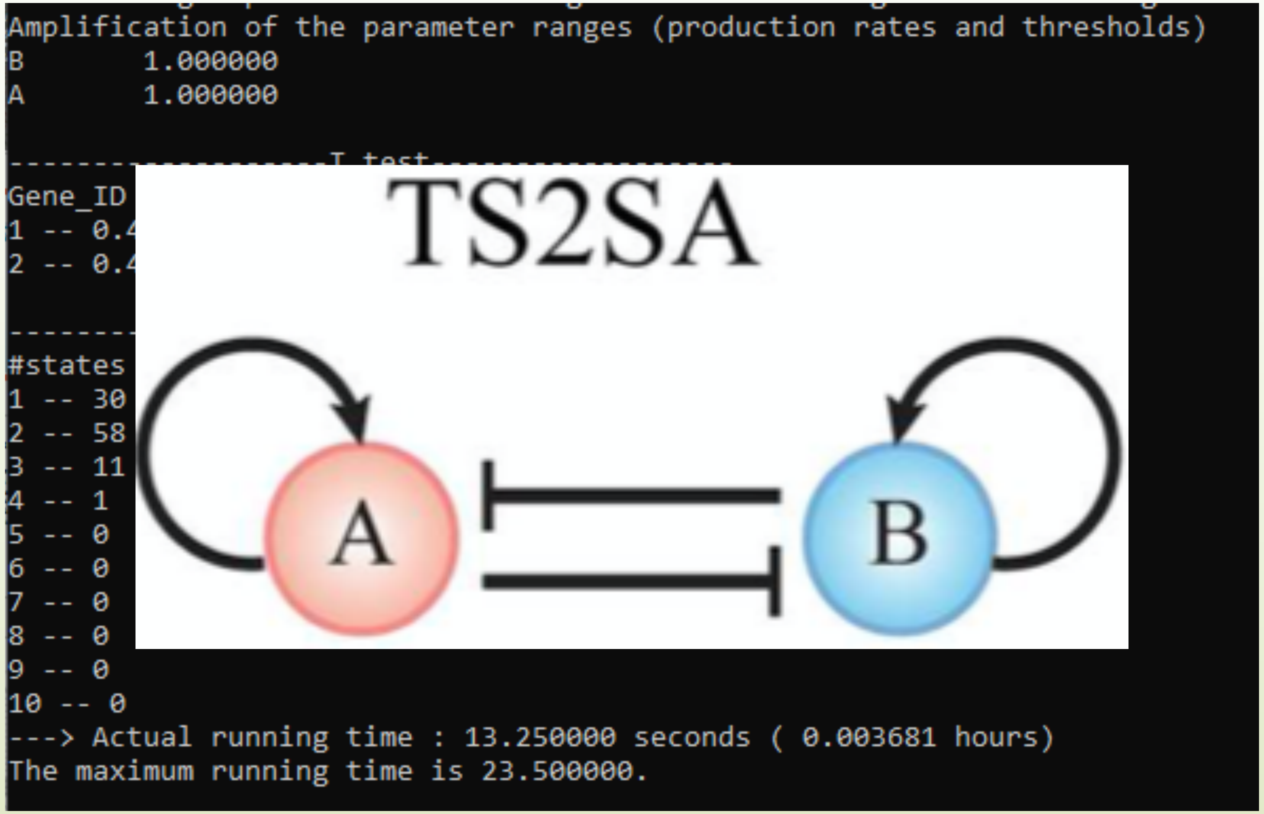
Analyzing gene regulatory networks by comparing the dynamics obtained via DSGRN (Dynamic Signatures Generated by Regulatory Networks) and RACIPE (Random Circuit Perturbation)

By Aaron Scheiner and Prince Rawal

Under Konstantin Mischaikow and Marcio Gameiro

Our final table of test cases comparing DSGRN and RACIPE:-

- All the following tables use the TS2SA fixed circuit topology.



Project Progress:-

We ran many test cases while messing with the initial conditions set by RACIPE. We changed num_ode, which correlates to how many initial conditions RACIPE uses to solve the ODE. We also changed the ODE solver type to RK45, as it was set to the Euler solver by default. We settled on default values for future test cases. We also stored the data on a google drive to make it easily accessible for future use. Finally, we generated three data tables for RACIPE data, each of which include the running time of each simulation.

Difference between the solvers:-

solver	num_paras	minN/maxN		stable: 1 %	stable: 2 %	stable: 3 %	stable: 4 %	stable: 5 %		running time (hours)
1	10000	2		42.34	53.69	3.94	0.03	0		0.82934
1	10000	6		11.83	58.63	28.25	1.11	0.18		0.79932
1	10000	10		9.27	53.99	34.2	2.26	0.28		0.82259
1	10000	22		8.17	46.87	40.59	3.44	0.93		0.75249
1	10000	30		8.06	45.21	41.96	3.7	1.07		0.98706
2	10000	2		41.47	54.51	3.98	0.04	0		1.69189
2	10000	6		11.48	59.36	27.93	1.1	0.13		1.73513
2	10000	10		9.54	53.98	33.94	2.14	0.4		1.81374
2	10000	22		8.58	46.59	40.67	3.36	0.8		1.73867
2	10000	30		7.78	45.01	41.79	4.14	1.28		1.8757
	DSGRN (196 Essential)			0	23.4694	52.0408	14.2857	10.2041		
	DSGRN (756 Essential + Neighbors)			14.8148	39.9471	32.5397	10.0529	2.6455		
	DSGRN (1600 Parameters)			35	40.875	16.375	6.5	1.25		

TS2SA num_ode=1000

Changing num_ode:-

num_ode		stable: 1 %	stable: 2 %	stable: 3 %	stable: 4 %	stable: 5 %		running time (hours)
500		7.86	45.75	41.34	3.89	1.16		0.90906
1000		7.78	45.01	41.79	4.14	1.28		1.8757
2000		7.94	45	41.78	4.23	1.05		3.43997

n=30	solver 2	num_paras=10000

Final Table:-

num_paras	minN/maxN	num_ode	stable: 1 %	stable: 2 %	stable: 3 %	stable: 4 %	stable: 5 %	running time (hours)
1000	2	1000	42.3	53.5	4.2	0	0	0.17596
1000	4	1000	15.6	65.4	18.3	0.6	0.1	0.169278
1000	6	1000	12.4	58.4	28.1	0.9	0.2	0.182331
1000	10	1000	11.5	49.2	36	2.9	0.4	0.164788
1000	20	1000	7.7	45.5	42.6	3.5	0.7	0.165
1000	30	1000	6	46.8	42.2	4	1	0.189721
10000	2	1000	41.47	54.51	3.98	0.04	0	1.691891
10000	4	1000	16.17	63.98	19.43	0.37	0.05	1.742552
10000	6	1000	11.48	59.36	27.93	1.1	0.13	1.735127
10000	10	1000	9.54	53.98	33.94	2.14	0.4	1.813741
10000	20	1000	8.42	47.72	39.7	3.45	0.71	2.048873
10000	30	1000	7.78	45.01	41.79	4.14	1.28	1.875704
	DSGRN (756 Essential + Neighbors		14.8148	39.9471	32.5397	10.0529	2.6455	
	DSGRN (196 Essential)		0	23.4694	52.0408	14.2857	10.2041	
	DSGRN (1600 Parameters)		35	40.875	16.375	6.5	1.25	
TS2SA	Solver 2	num_ode=1000						

Our resulting decisions for future RACIPE simulations:-

- Both ODE solvers give similar results. So we decided to do all our future test cases with solver 2: RK45.
- The number of models generated will depend on the size of the parameter space for an associated fixed circuit topology. For TS2SA, DSGRN says there are total 1600 parameter nodes, so 5000 for RACIPE seems fair.
- The number of initial conditions to solve the ODE, which was set to 100 as default, appears to give similar results for 100, 500, 1000, and 2000, with a linear increase in time taken. So keeping it low might be the best for now.
- The hill coefficient seems to give stable results when it is greater than or equal to 20 for TS2SA.

Next Steps:-

Our next steps will be to see what parameter regions correspond to the RACIPE data. We have already started understanding and working on Lun's code. We will work to efficiently run the code on TS, TS1SA, and TS2SA. This week we will find out if using essential nodes and their neighbors succeeds as a way of adapting RACIPE's sampling methods.

Thank You for Listening!

and

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