THE INFINITY MIRROR TEST FOR GRAPH GENERATORS

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University of Notre Dame
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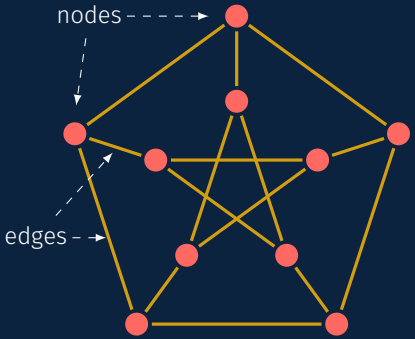
UNIVERSITY OF NOTRE DAME

WENINGER LAB

Preliminaries

WHAT ARE GRAPHS?



Domain	Nodes	Edges
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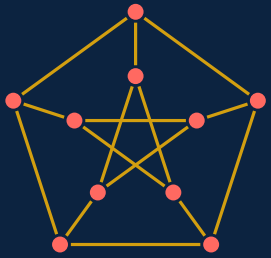
Scientific Papers	Papers	Citations
Flights	Airports	Non-stop flights
Facebook	Users	Friendships

WHAT ARE GRAPH GENERATIVE MODELS?

Original Graph



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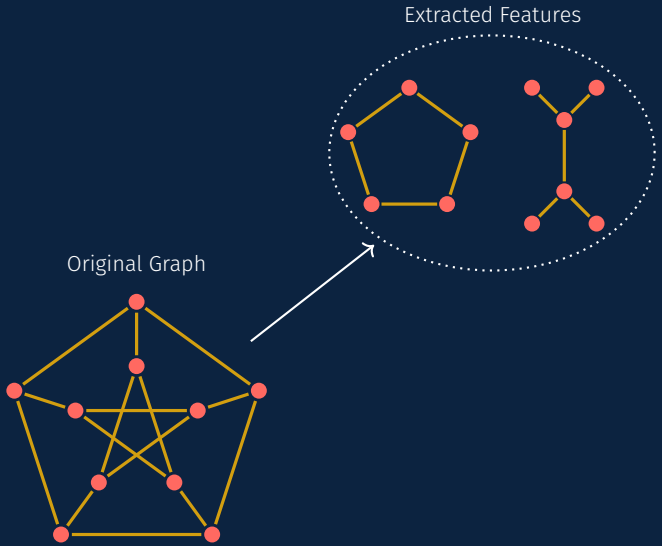

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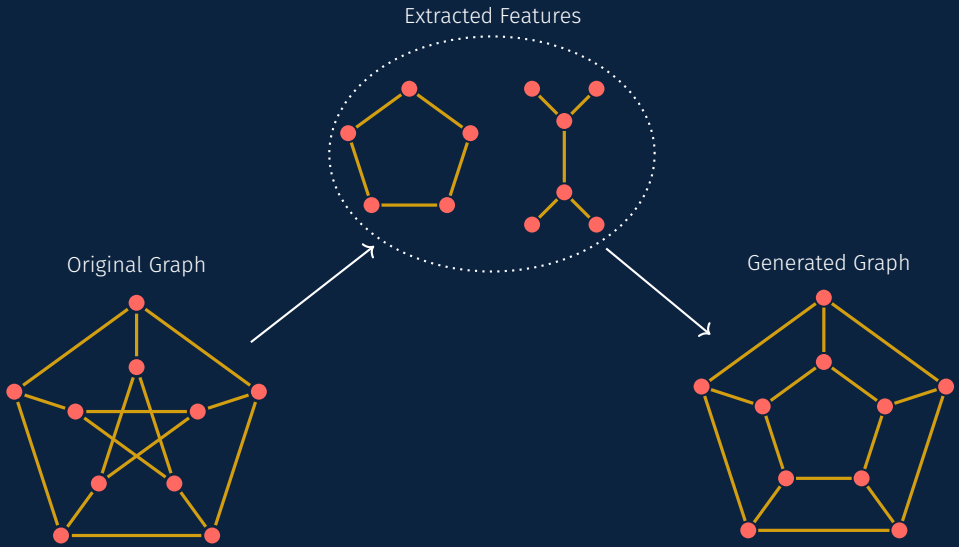

A BRIEF HISTORY OF RECENT GRAPH GENERATORS

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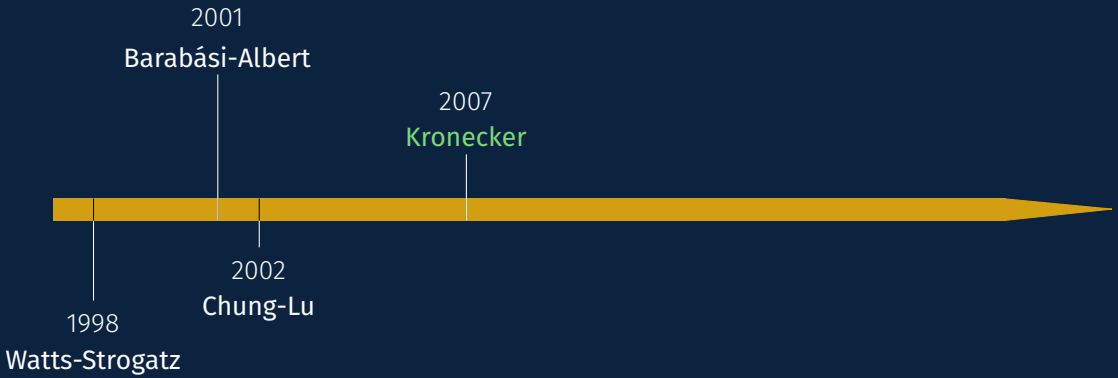

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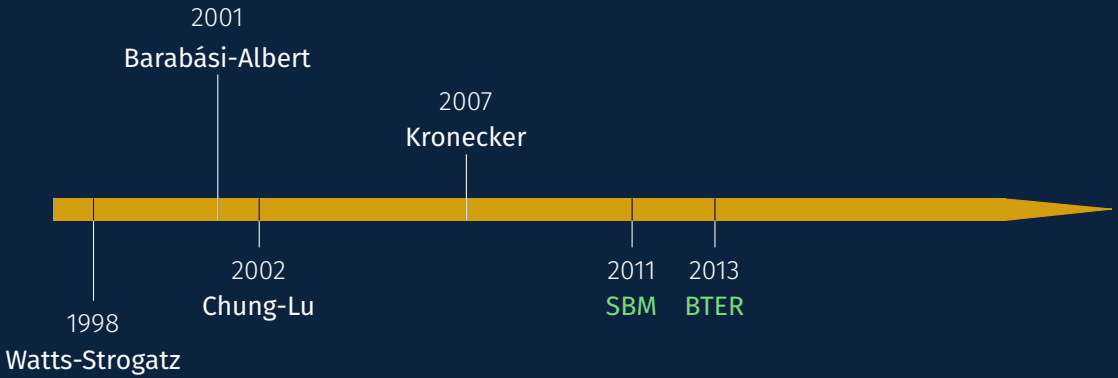

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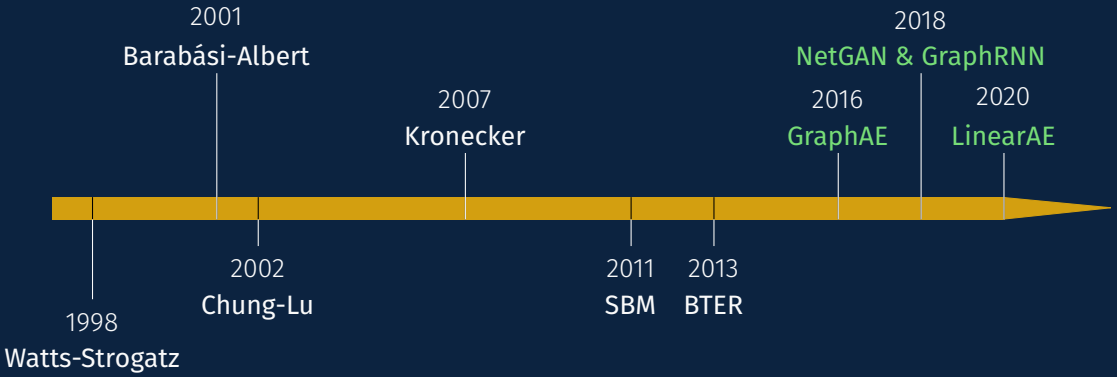

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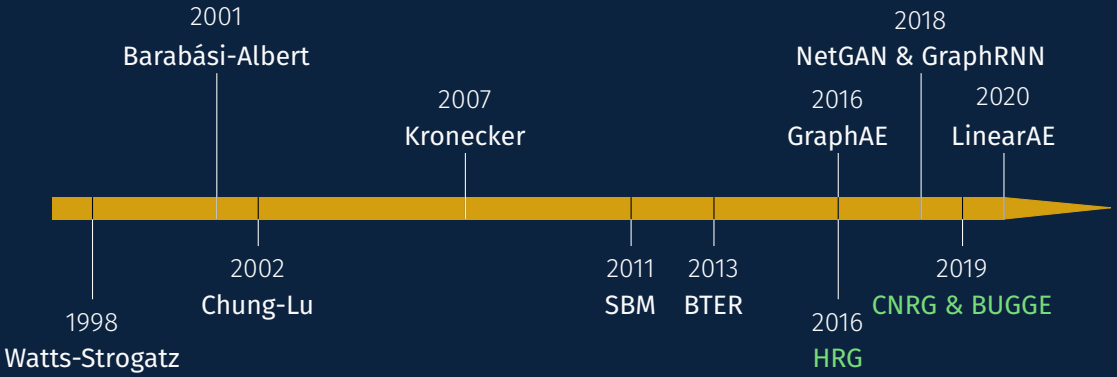


The Infinity Mirror Test

THE INFINITY MIRROR TEST FOR DUCK VADER

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Key Idea

Iteratively fitting and generating from a model will amplify the model's implicit biases.

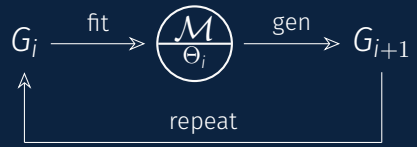

Figure 1: The Infinity Mirror Test

THE INFINITY MIRROR TEST: A STRESS TEST FOR GRAPH GENERATORS

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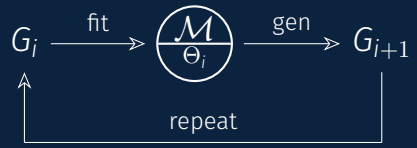
Methodology

Given an initial graph G_0 and a model $\mathcal{M}$, compute 50 independent chains of graphs $\langle G_1, G_2, \ldots G_n \rangle$.



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Evaluation

Compare graph G_i with G_0 in a given chain to expose different biases.

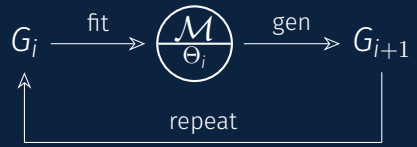
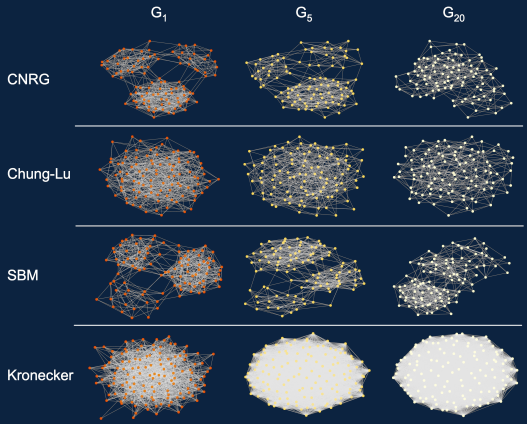


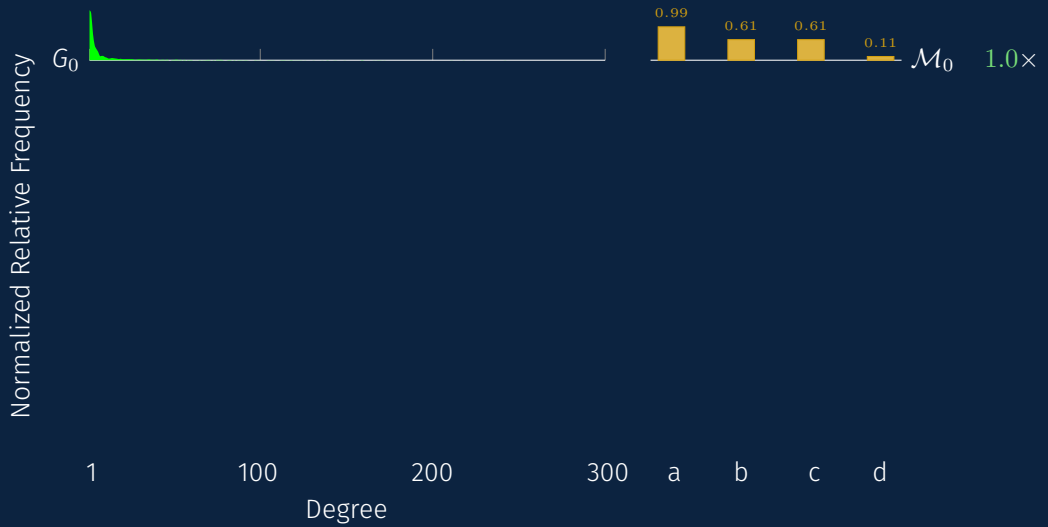
Figure 1: The Infinity Mirror Test

EXAMPLE INFINITY MIRROR



KRONECKER DEGREE DISTRIBUTION RIDGE PLOT

$\mathcal{M} = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$



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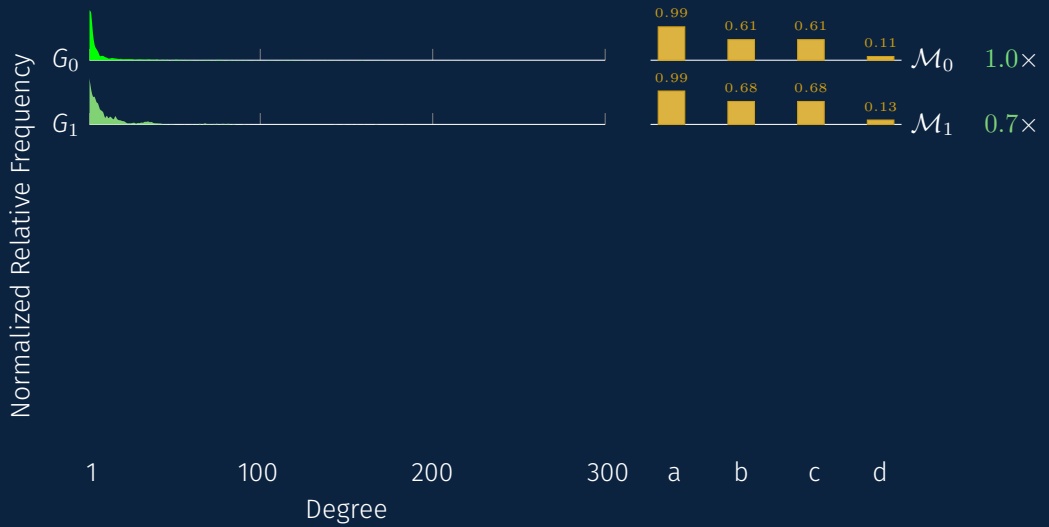

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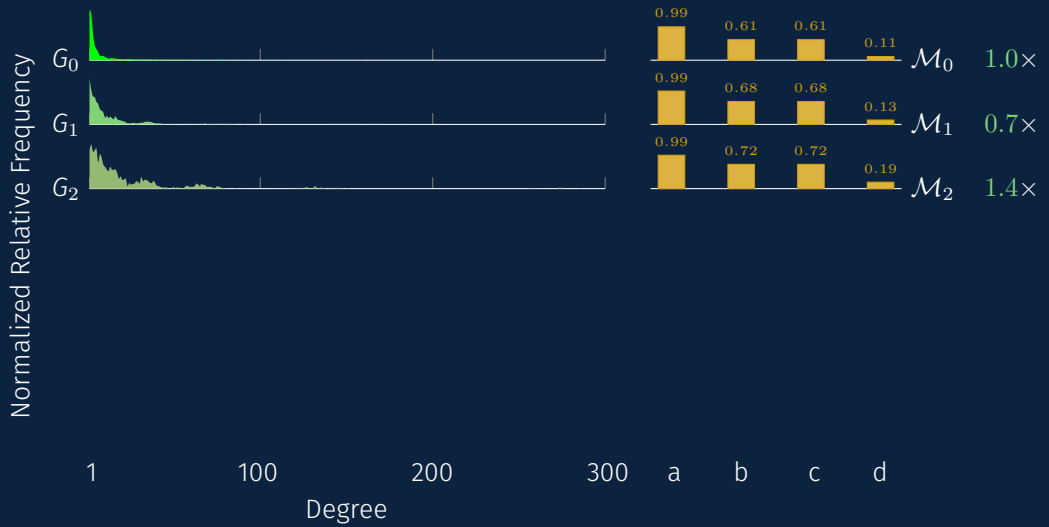

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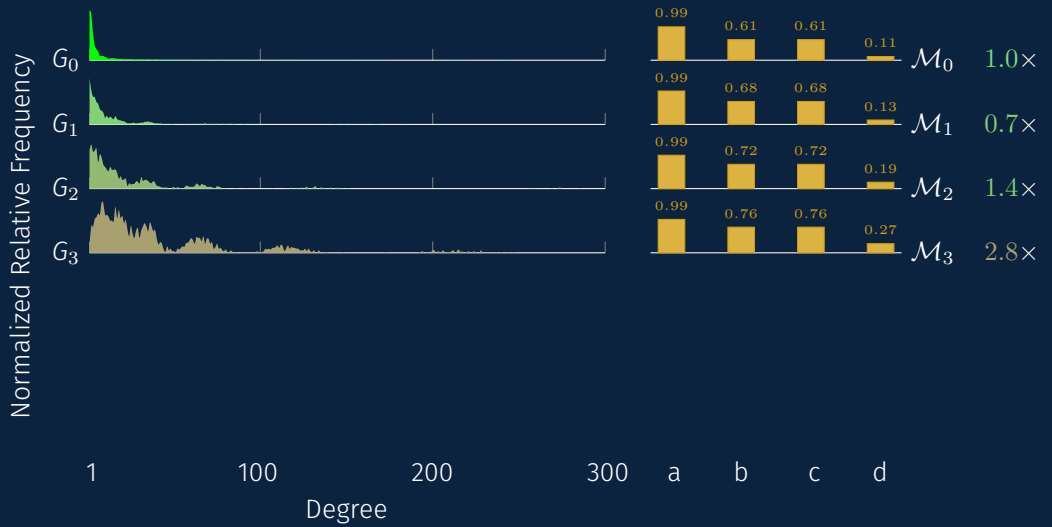

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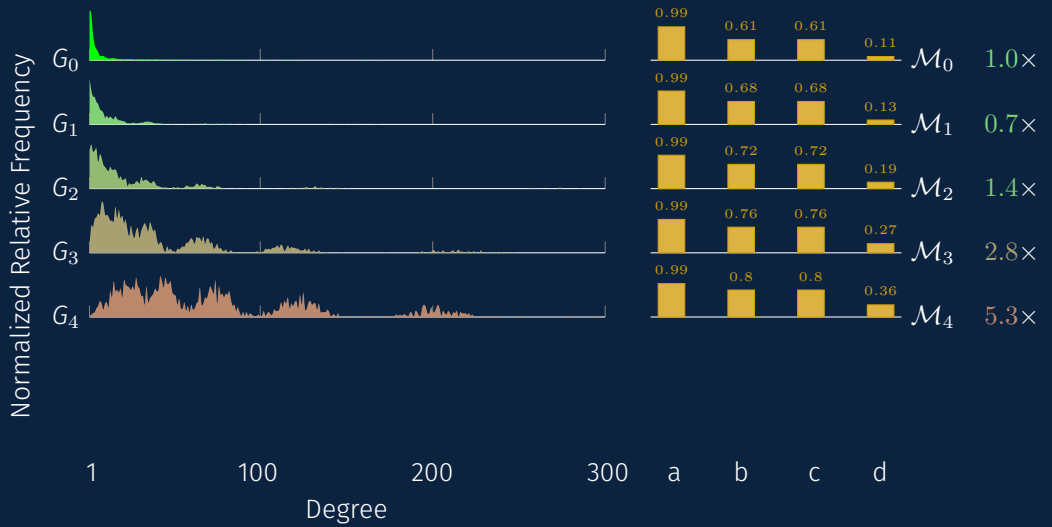

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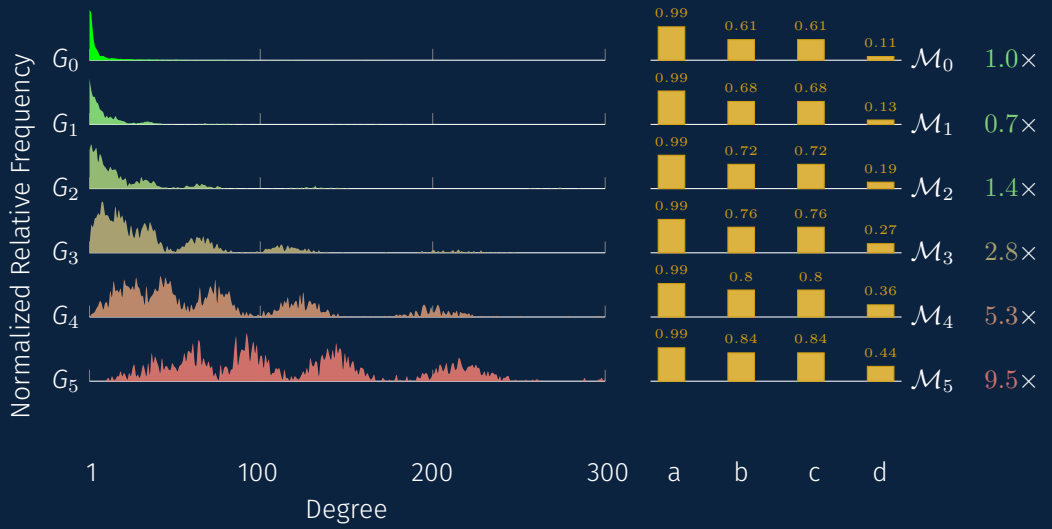

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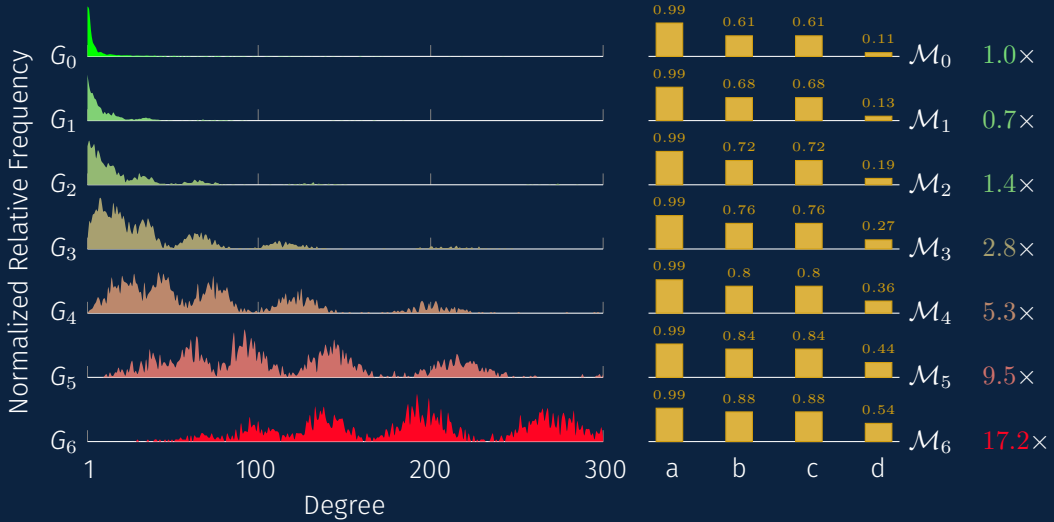
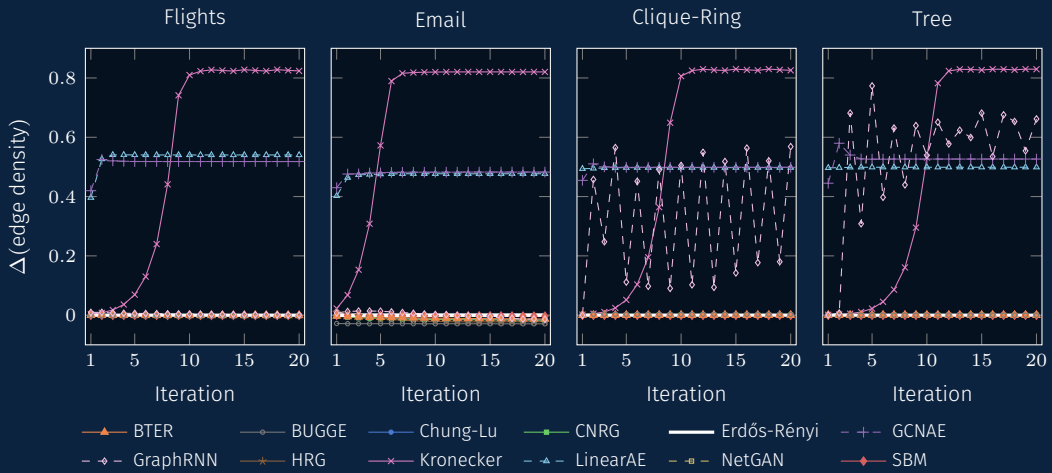
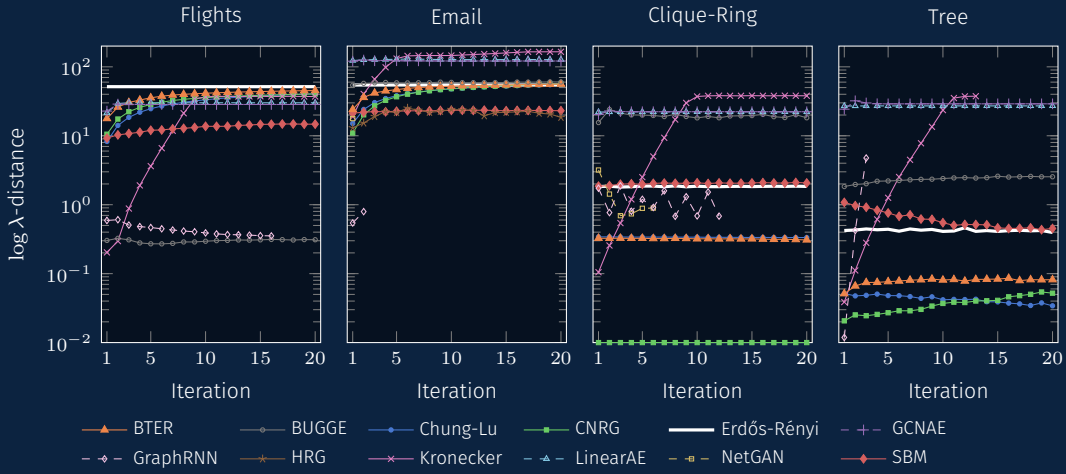


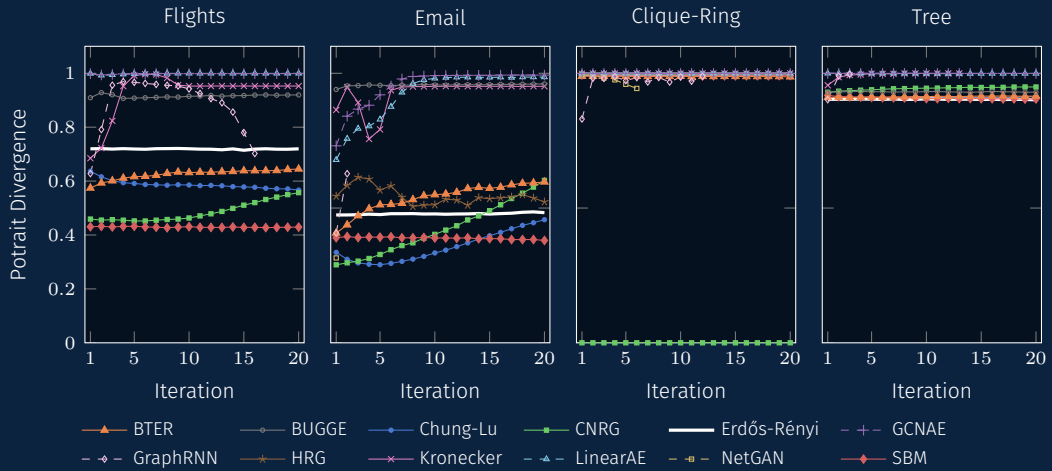
EVOLUTION OF RELATIVE EDGE DENSITY ACROSS ITERATIONS



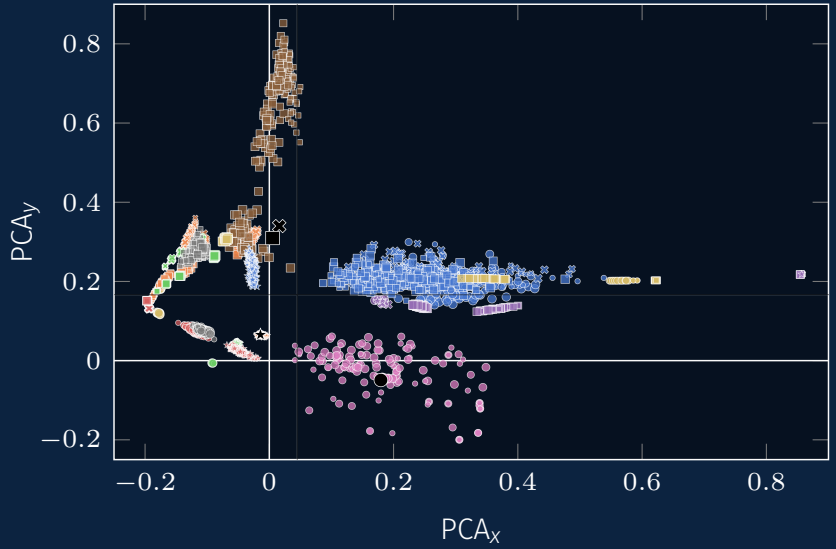
EVOLUTION OF λ-DISTANCE ACROSS ITERATIONS



PORTRAIT DIVERGENCE OVER TIME



2D PCA ON GRAPHLET COUNT VECTORS



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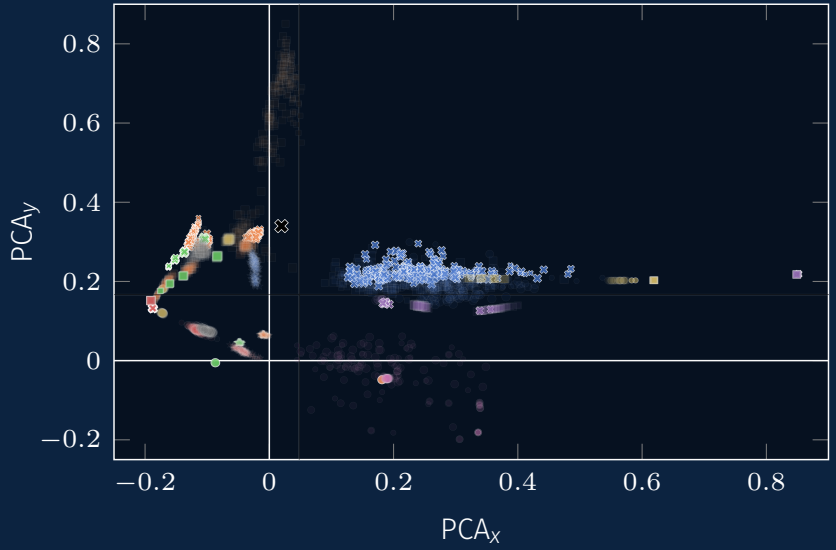

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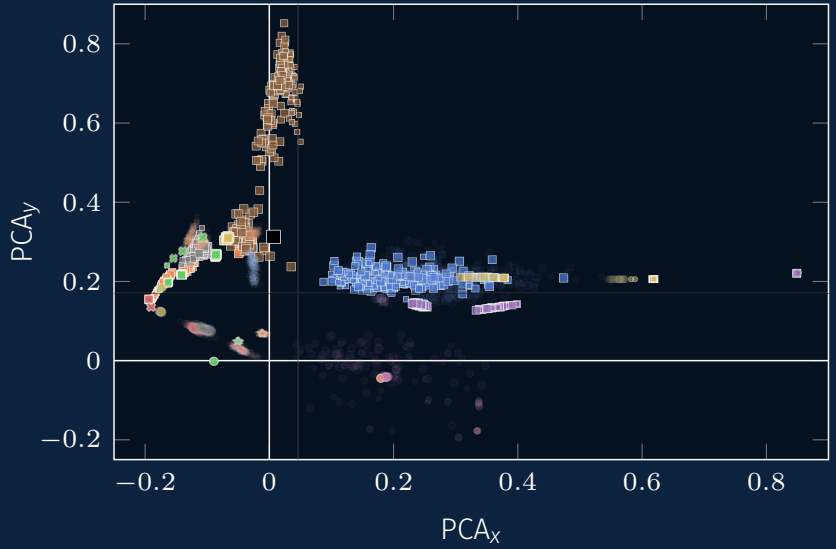

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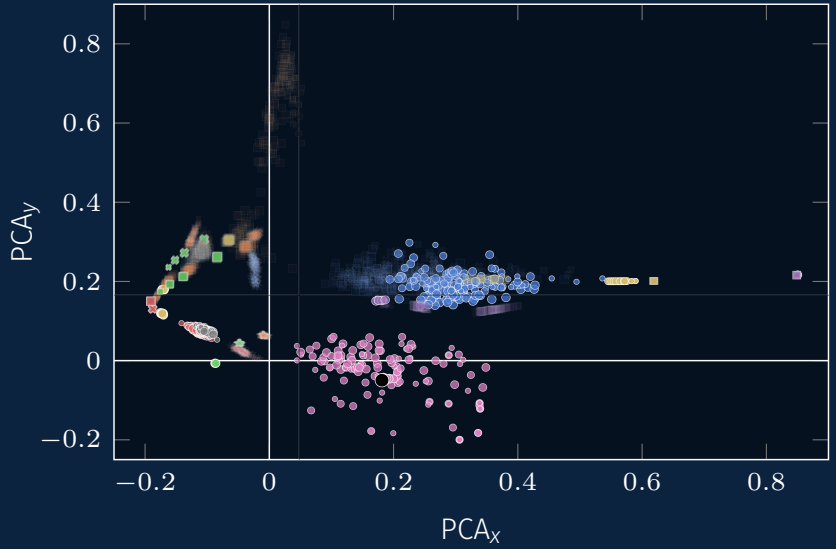

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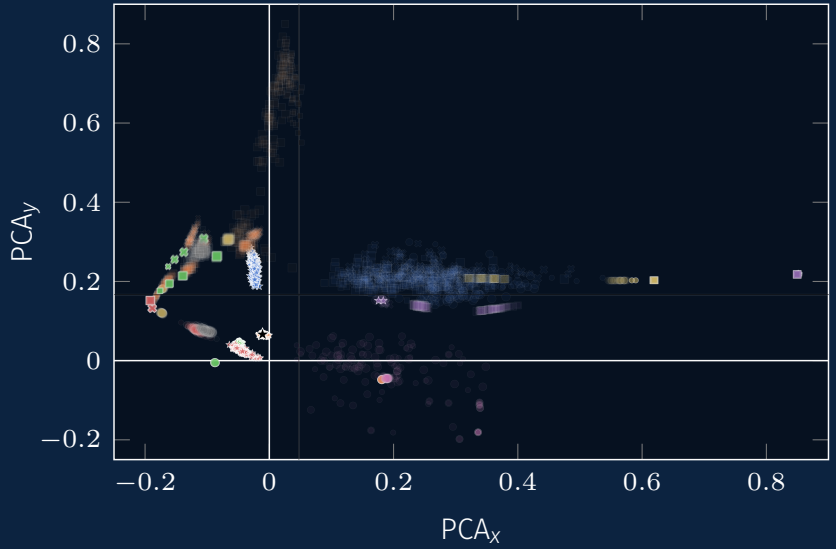

INVESTIGATING INDIVIDUAL MODEL PARAMETERS ON THE CLIQUE RING DATASET

	Θ_1	Θ_5	Θ_{10}	Θ_{20}
Kronecker	$\begin{bmatrix} 0.444 & 0.697 \\ 0.697 & 0.411 \end{bmatrix}$	$\begin{bmatrix} 0.757 & 0.813 \\ 0.813 & 0.498 \end{bmatrix}$	$\begin{bmatrix} 0.999 & 0.999 \\ 0.999 & 0.775 \end{bmatrix}$	$\begin{bmatrix} 0.999 & 0.999 \\ 0.999 & 0.775 \end{bmatrix}$

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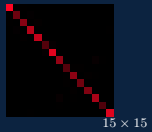
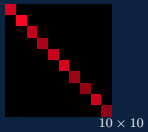
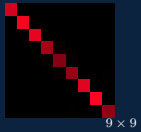
SBM	 15×15	 10×10	 9×9	 7×7

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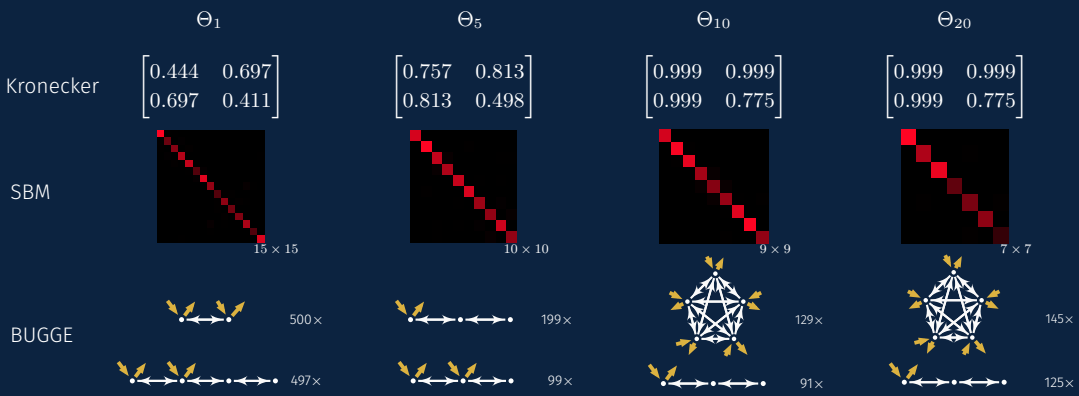

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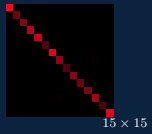
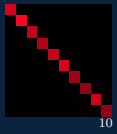
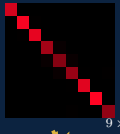
SBM				
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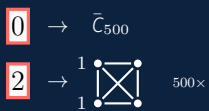
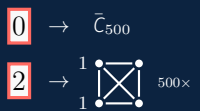
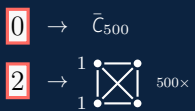
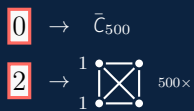
CNRG				

CONCLUSIONS

Key Findings and Contributions

- Confirms previously known biases in Kronecker models.
- Uncovers distortion patterns in popularly used graph models
- Could be used as a tool to design better, more parsimonious graph models


Thank You!