The Specialization Model of Network Growth: Real-World Dynamics and Structure

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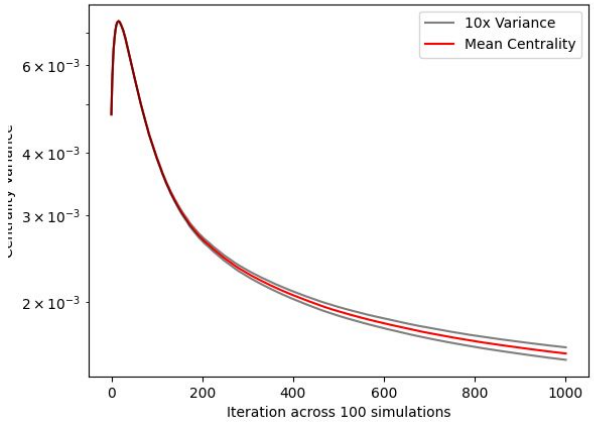
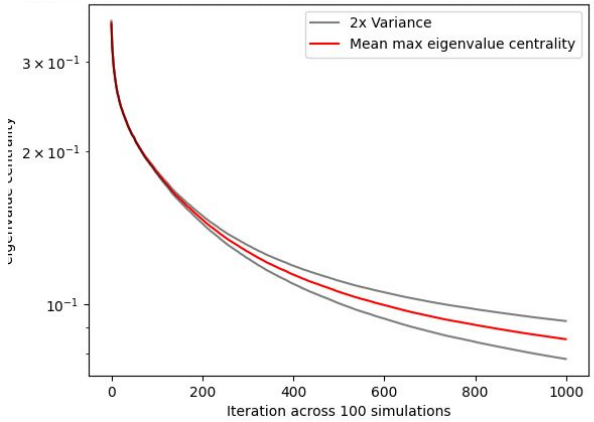
Centrality Variance



Max Centrality



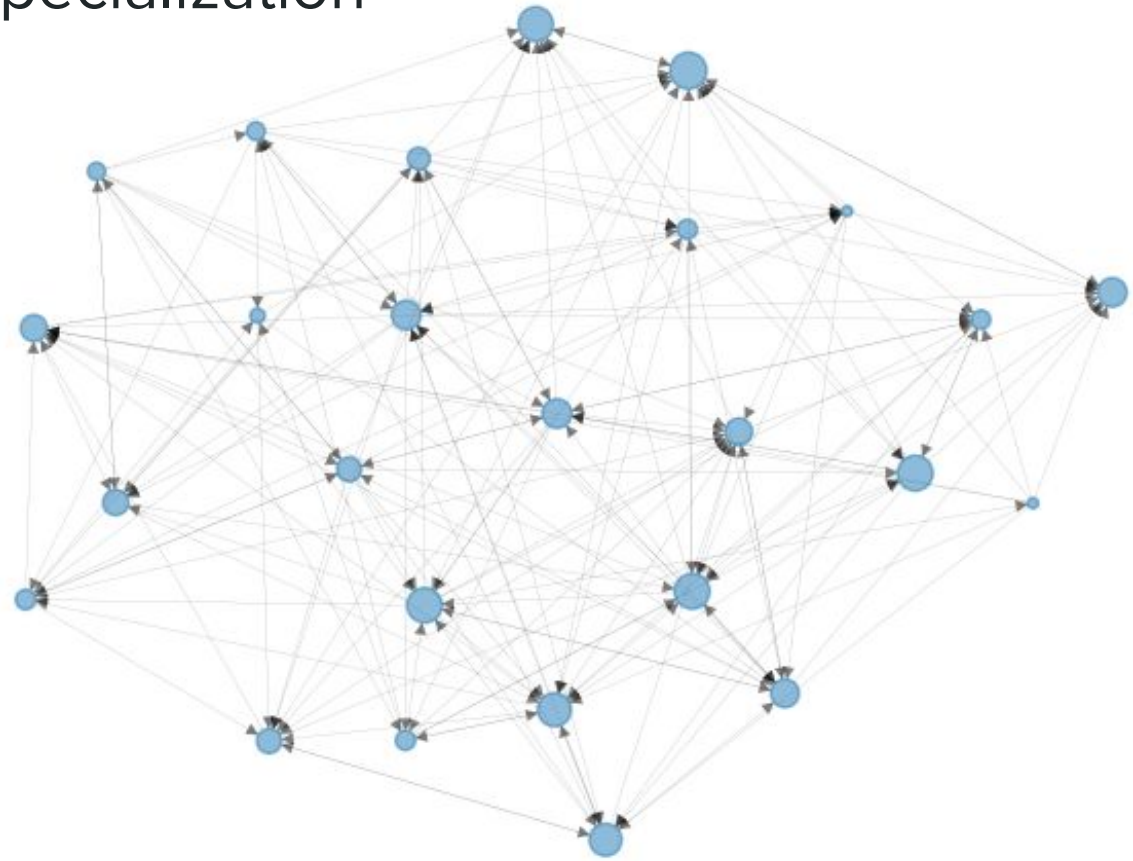
Eigenvector Centrality

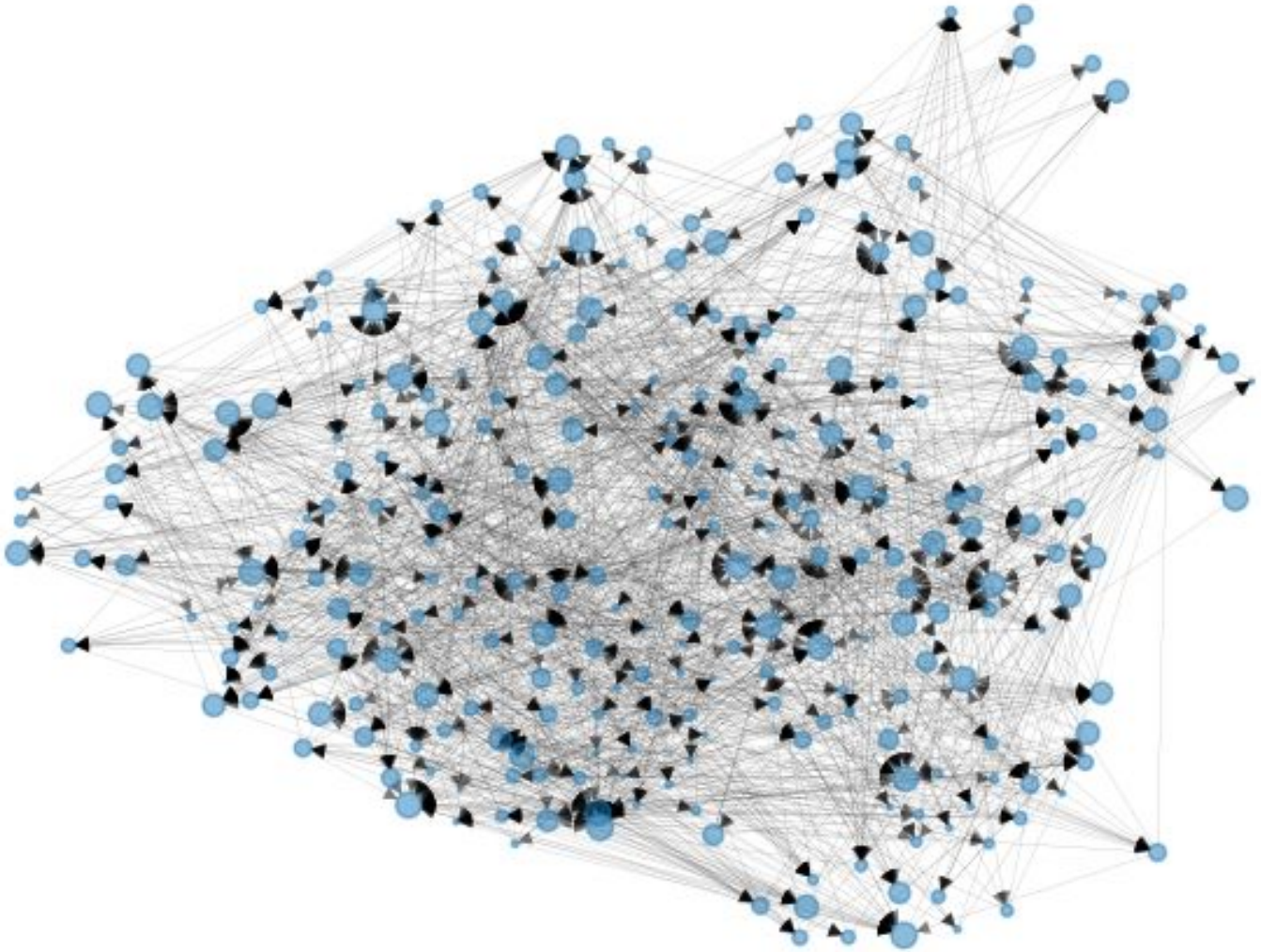
- On a long journey through the network, leading eigenvector represents probability of being in a given node.
- Suggests uniformity in how much each node influences the graph

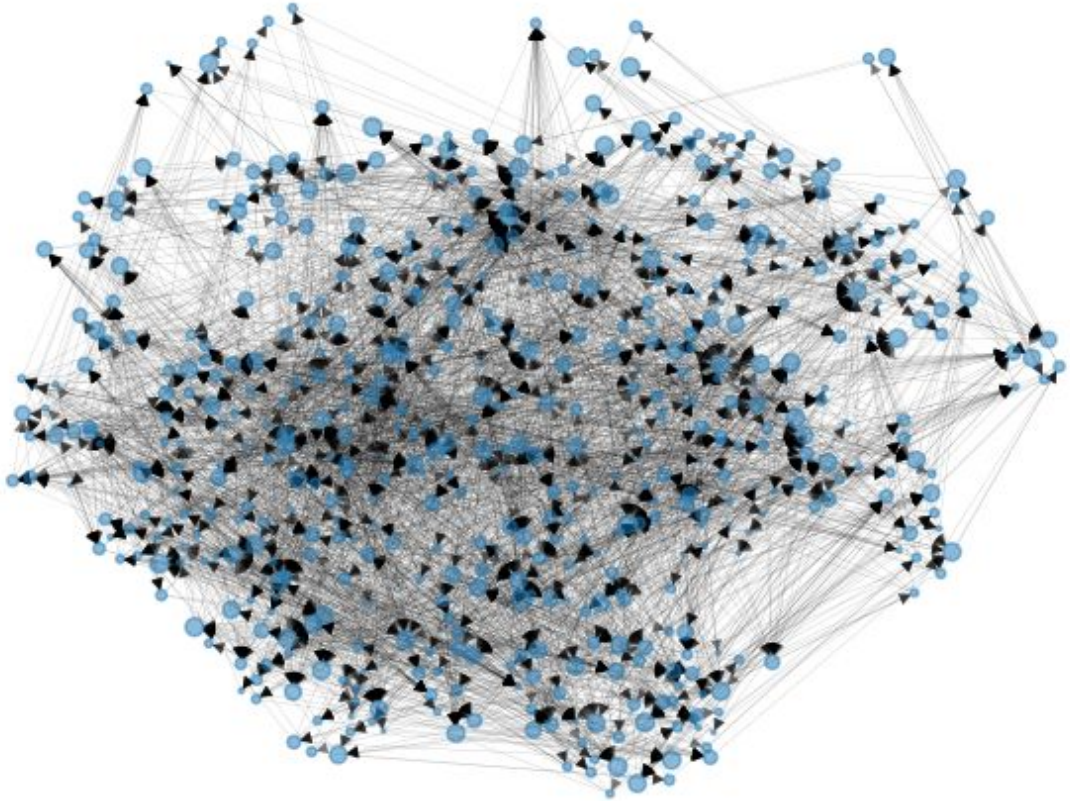
$$Ax = \lambda x$$

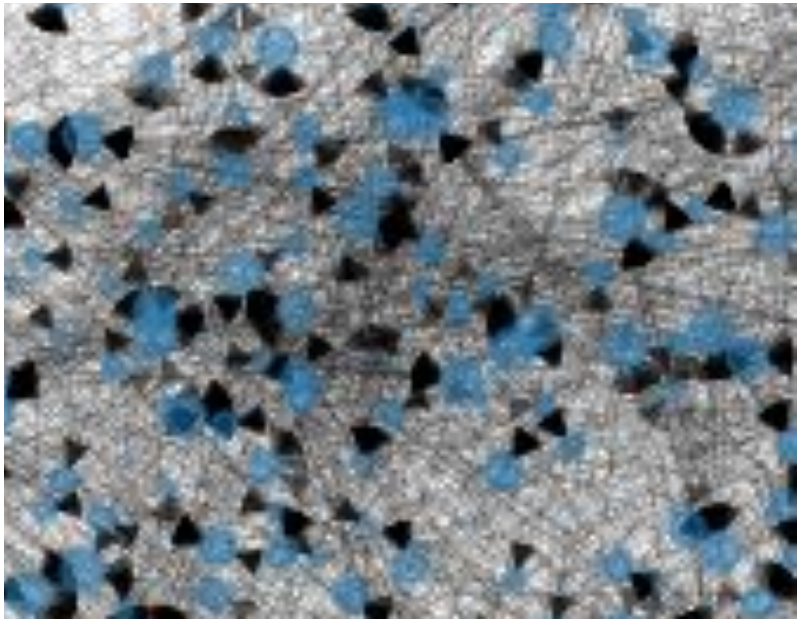
$$\lambda = \sigma(A)$$

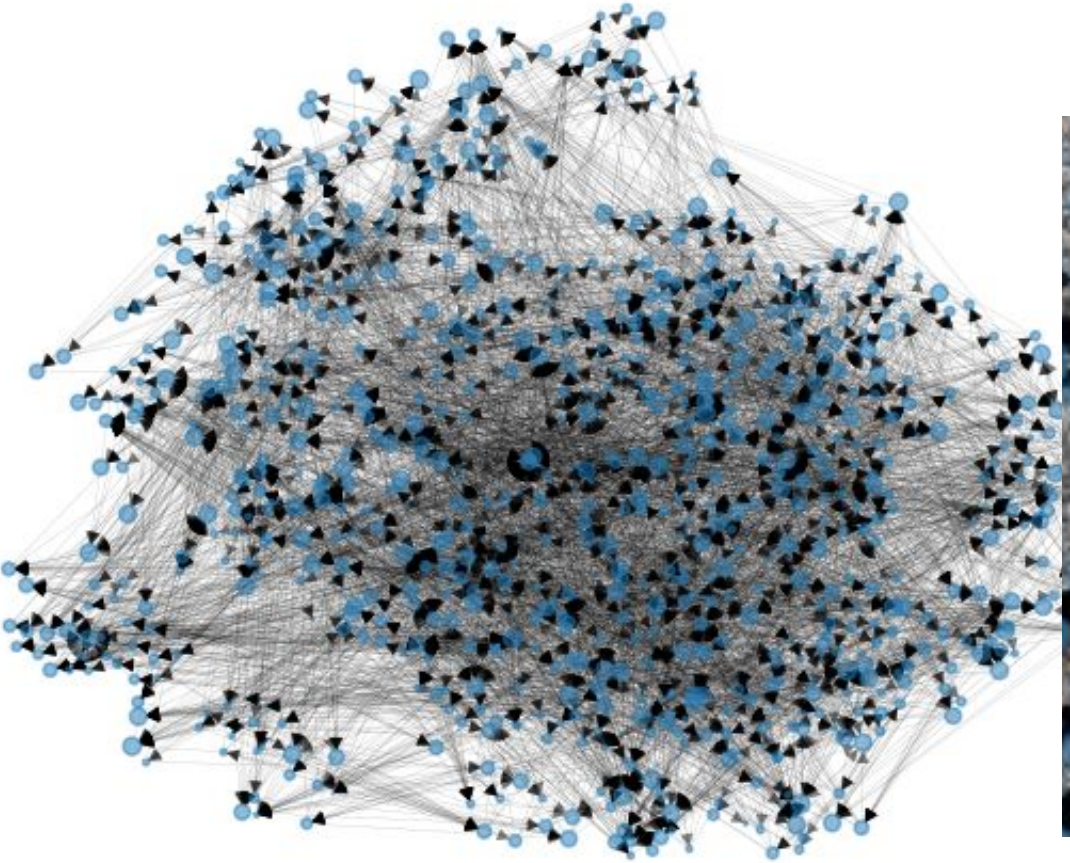
Network Specialization

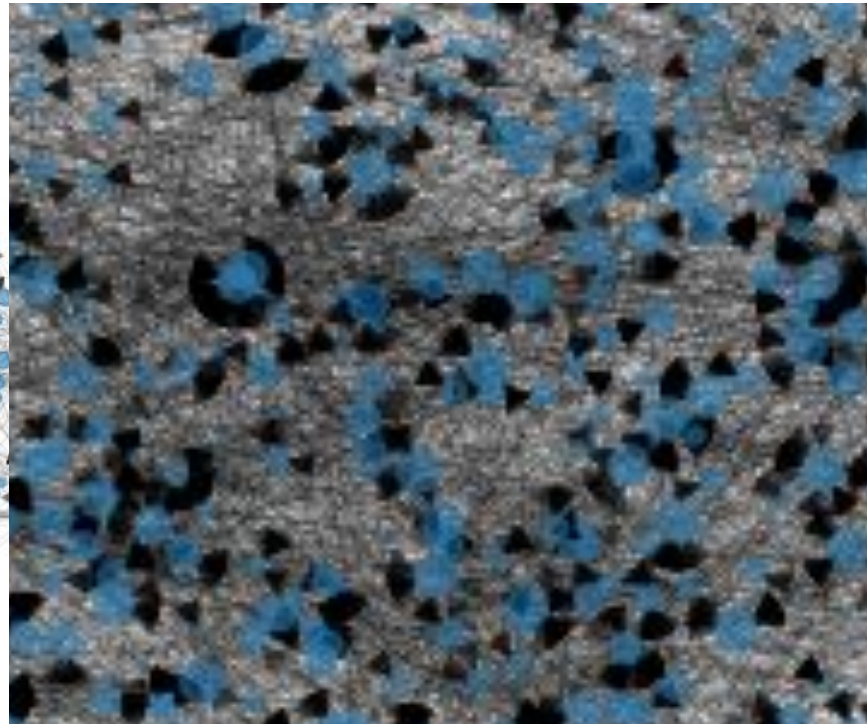


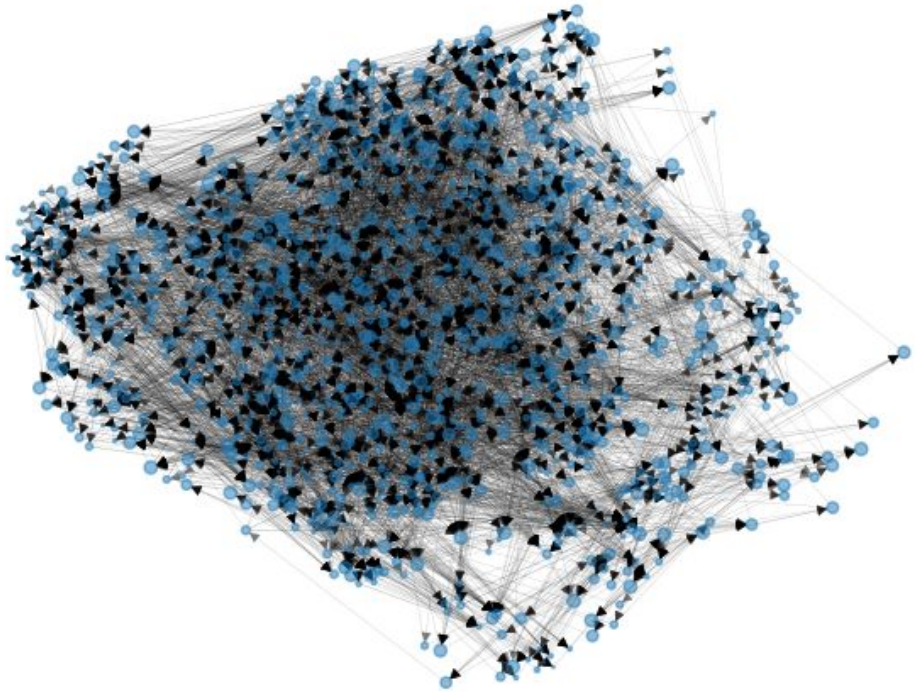


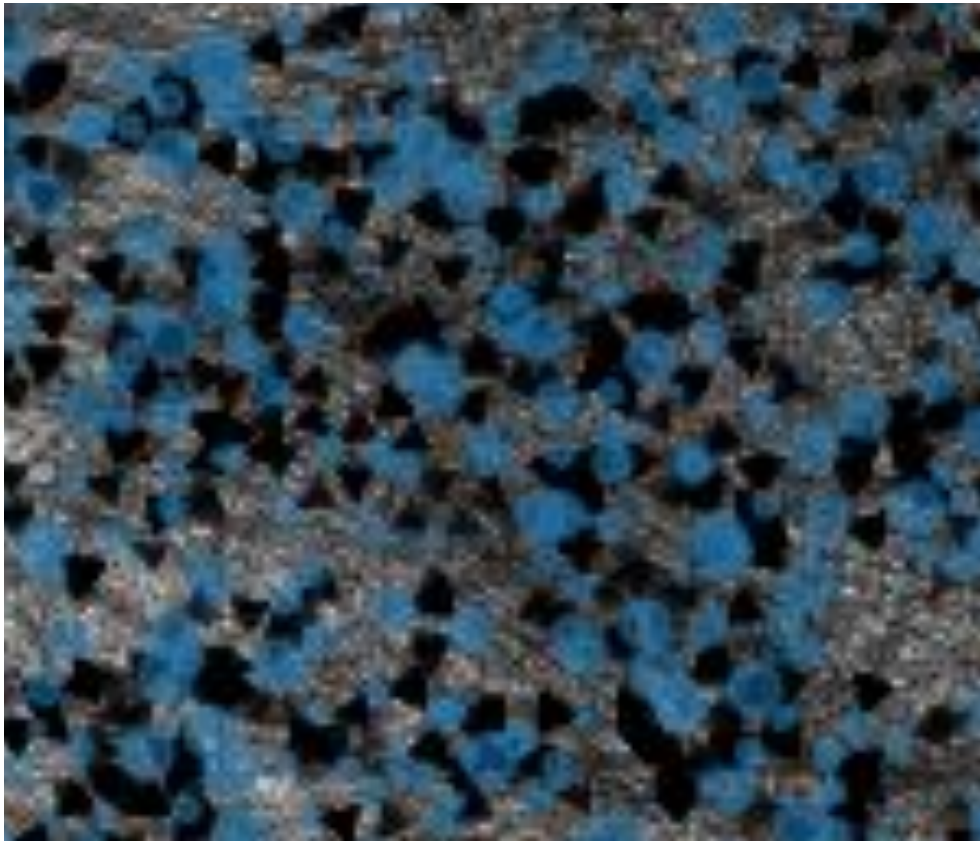


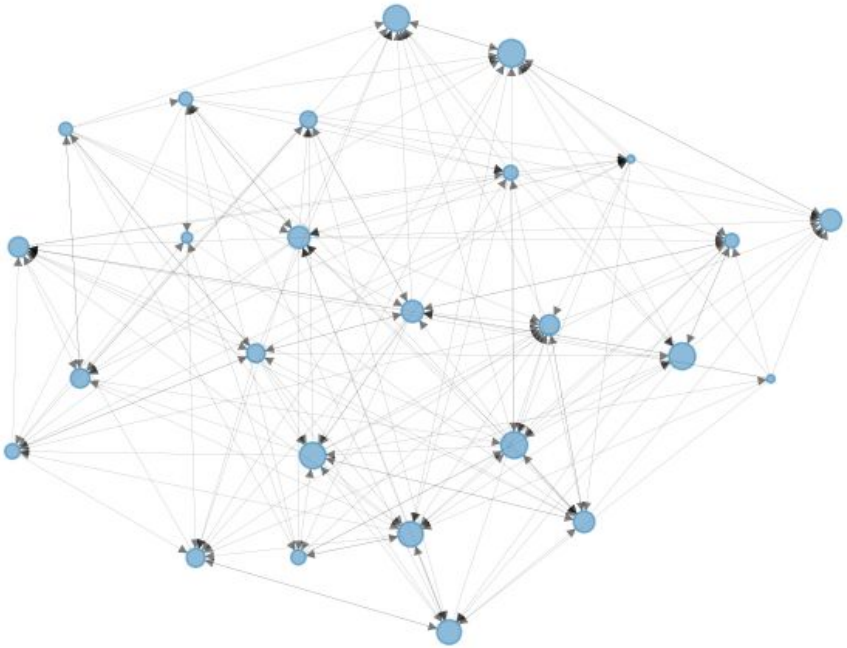


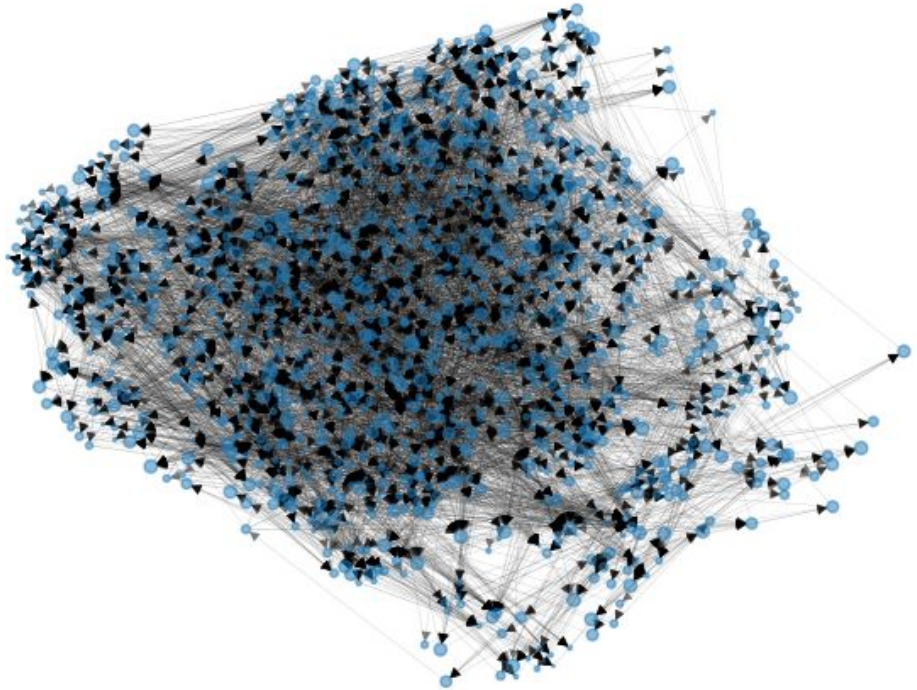






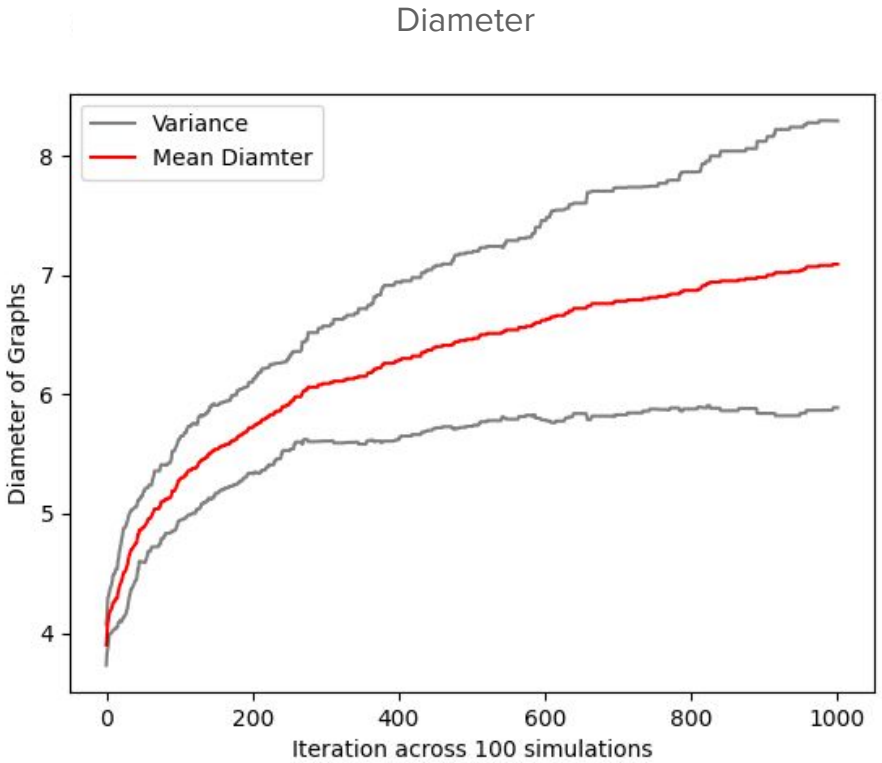






Small World: Diameter

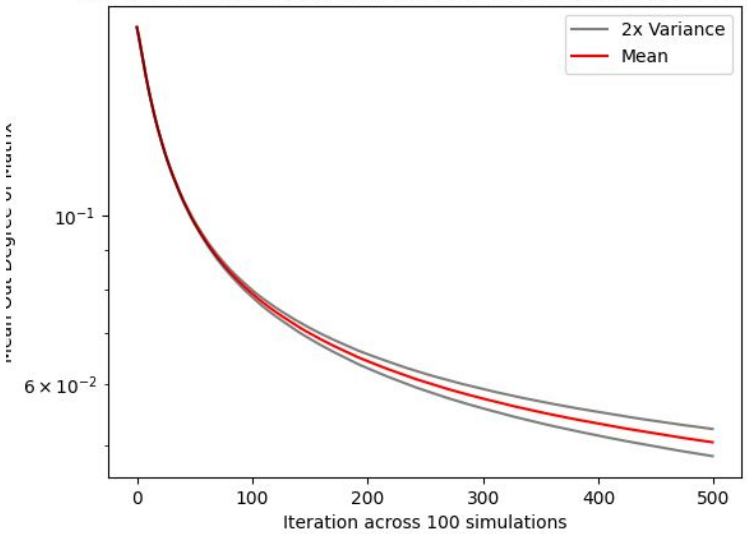
- Small world graphs have nodes with few neighbors but have a low diameter
- Diameter increases logarithmically



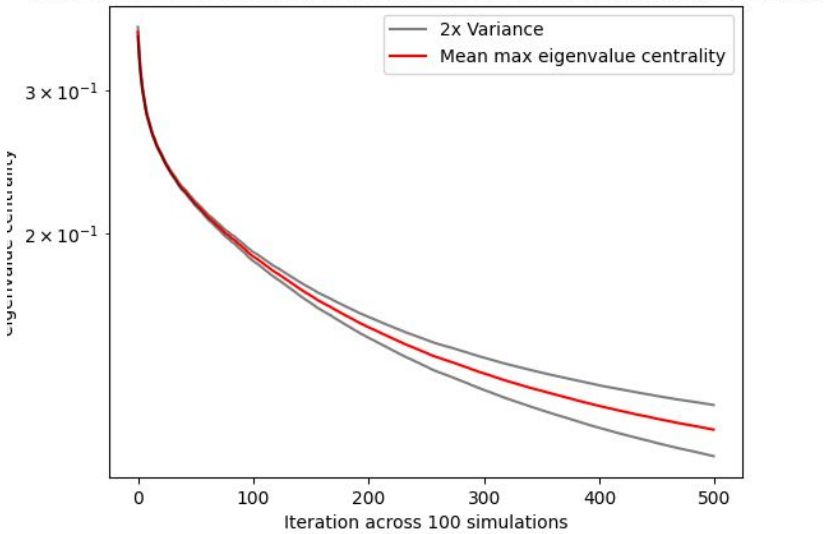
Degree

- Number of edges connected to each node
- Real-world graphs have few nodes with high degree

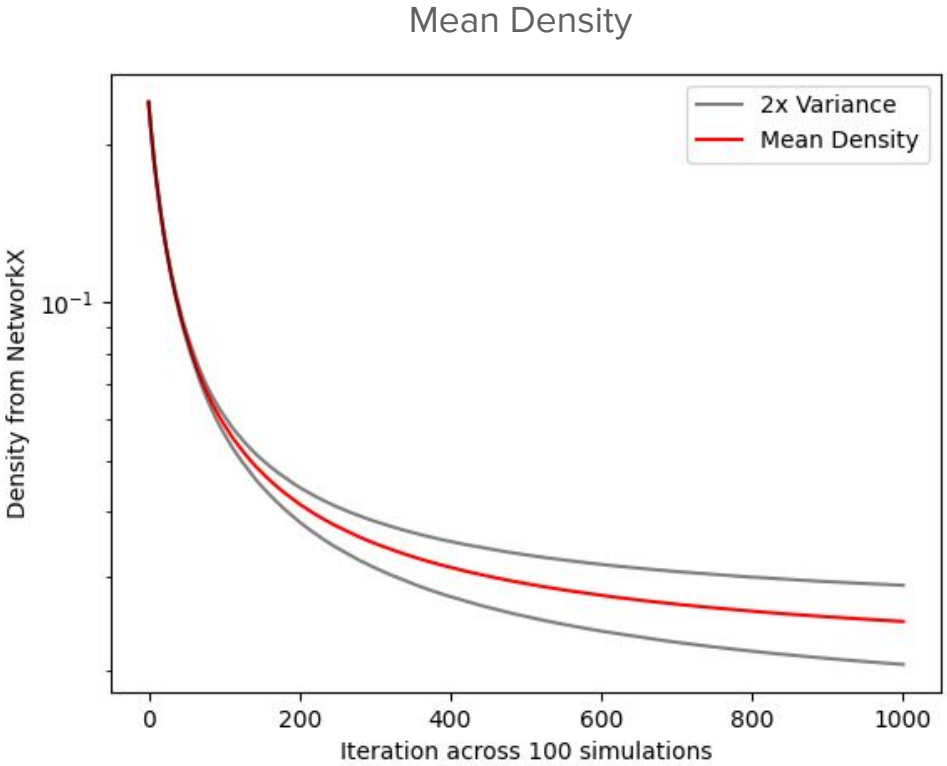
Mean Degree



Max Degree

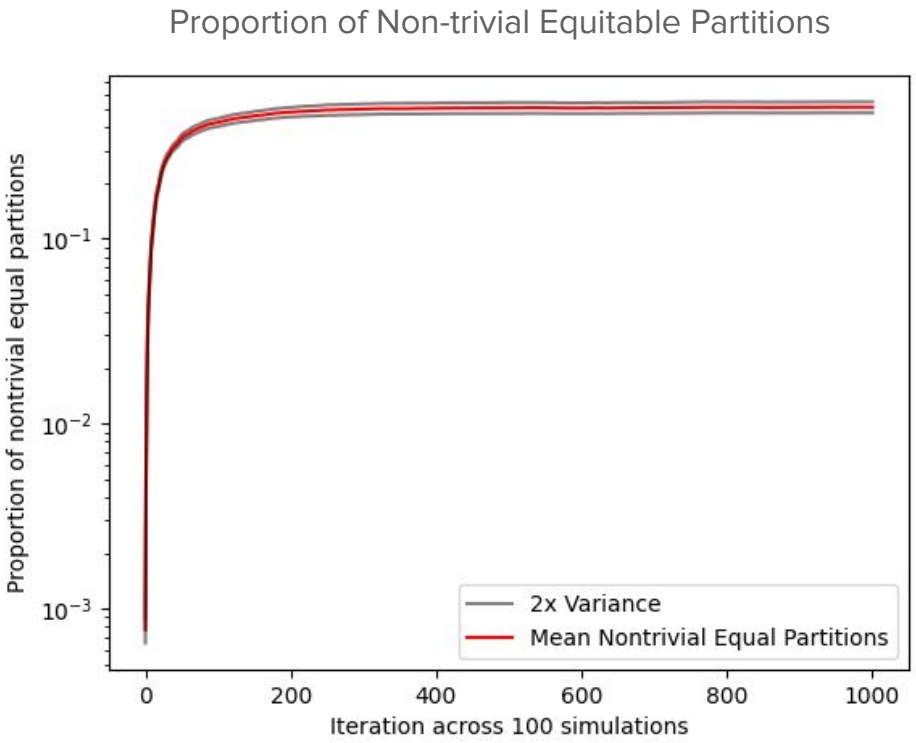


Other metrics: Density

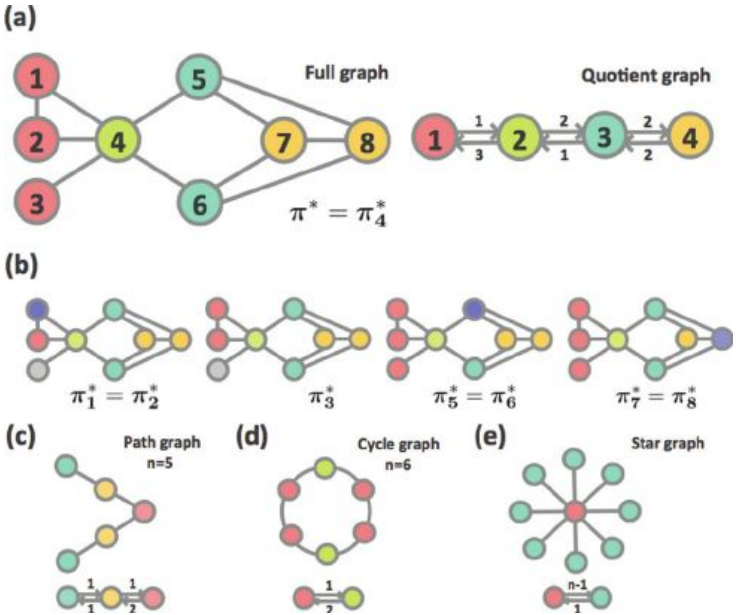


- The number of edges present in a graph divided by the total possible number of nodes
- Real-world networks are less dense

Nontrivial Equitable Partitions



- Describes how networks form communities
- Node is assigned “color” based on what other “colors” the node is connected to



Summary: Real-world Properties

- Small-world
  - Diameter Increases Logarithmically
- Decreasing Degree
  - Nodes have few neighbors
- Low Density
  - Fewer edges than possible
- Non-trivial equitable partitions
  - Nodes with similar “friend groups”