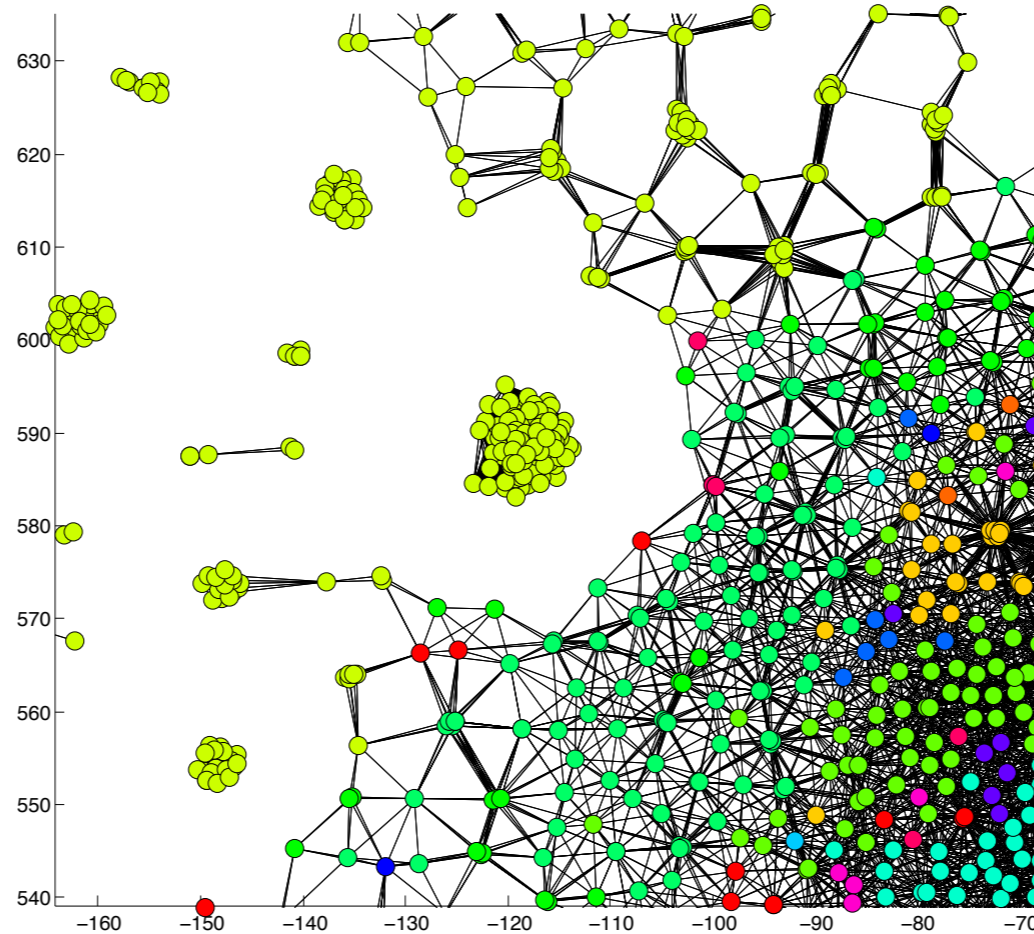


Using networks to explore, quantify, and summarize phylogenetic tree space



Jeremy M. Brown¹, Guifang Zhou², Wen Huang², Jeremy Ash¹,
Melissa Marchand², Kyle Gallivan², and Jim Wilgenbusch³

¹ Louisiana State University, Dept. of Biological Sciences

² Florida State University, Dept. of Mathematics

³ Florida State University, Dept. of Scientific Computing

The Team



Jeremy Brown



Jeremy Ash



Jim Wilgenbusch



Guifang Zhou



Wen Huang



Kyle Gallivan

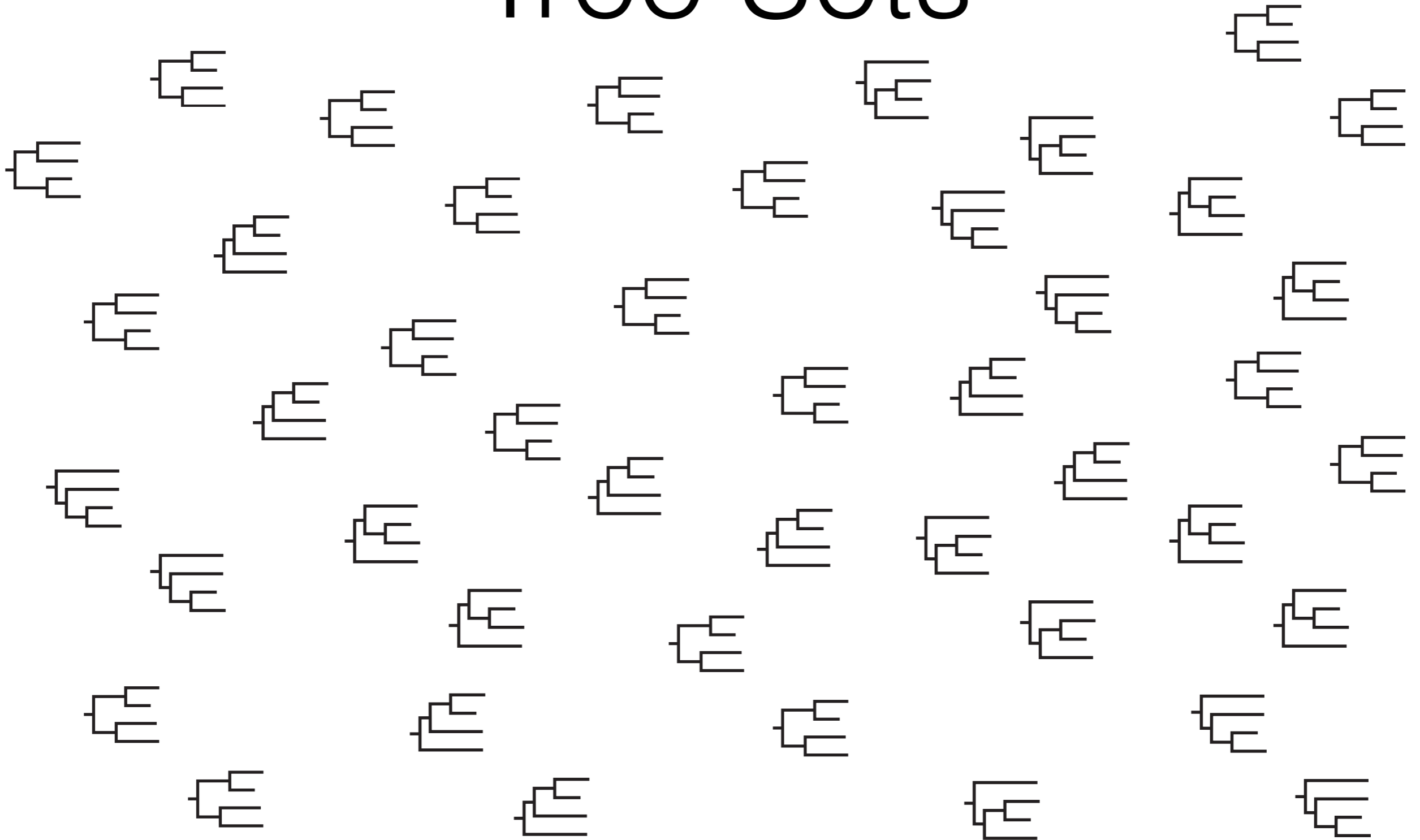


Melissa Marchand

Overview

- Motivation
- Our network approaches
- Some applications
- Initial results
- Software

Tree Sets



Motivation

Our Approaches

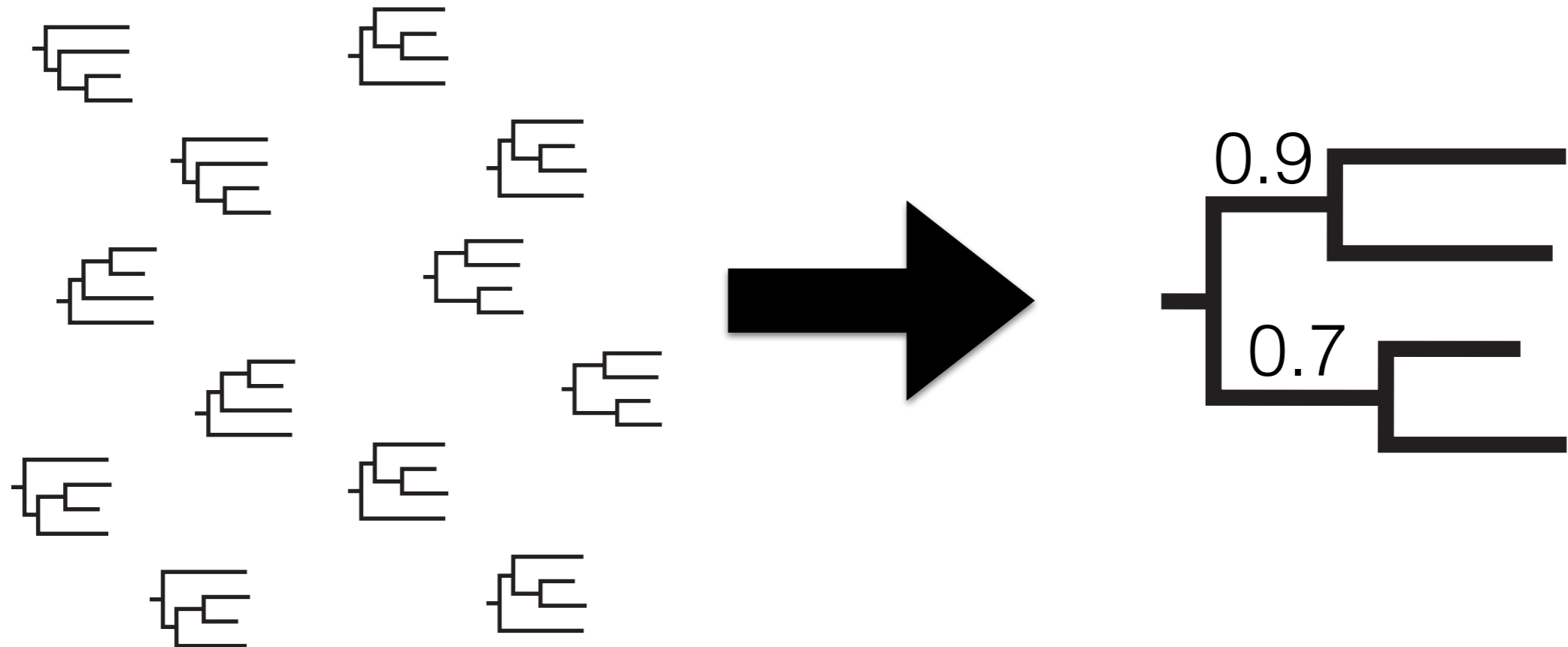
Applications

Initial Results

Software

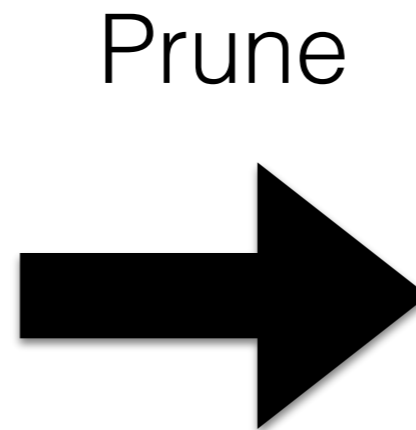
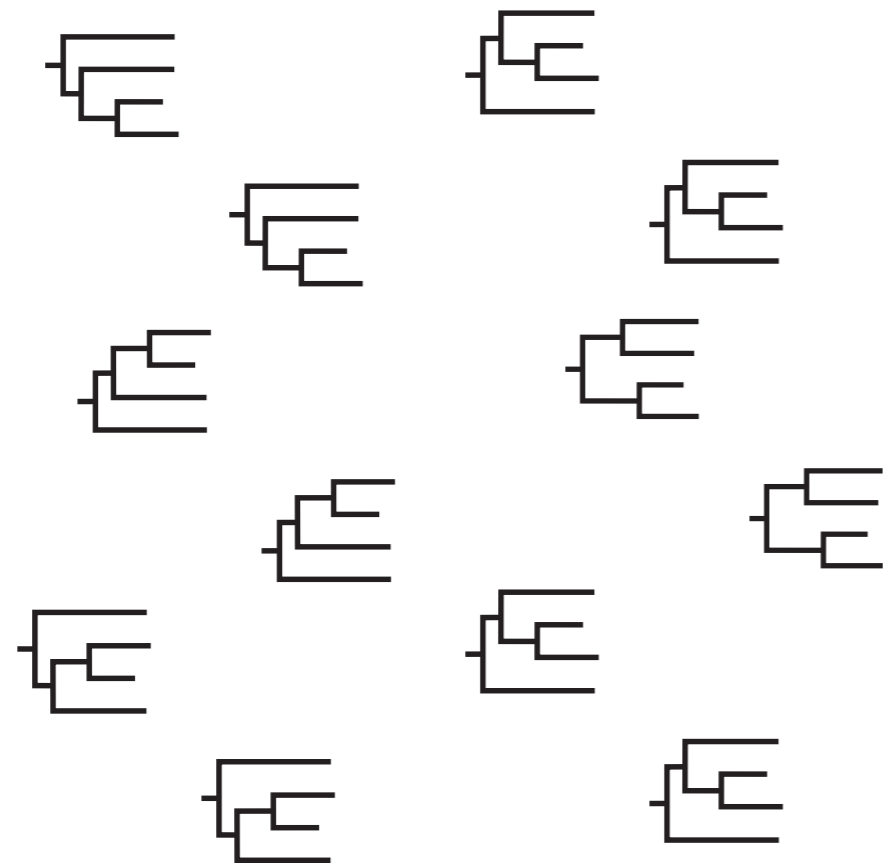
Summarizing Tree Sets

- Consensus trees



Summarizing Tree Sets

- Consensus trees
- Agreement subtrees



0.9

Summarizing Tree Sets

- Consensus trees
- Agreement subtrees
- Clustering

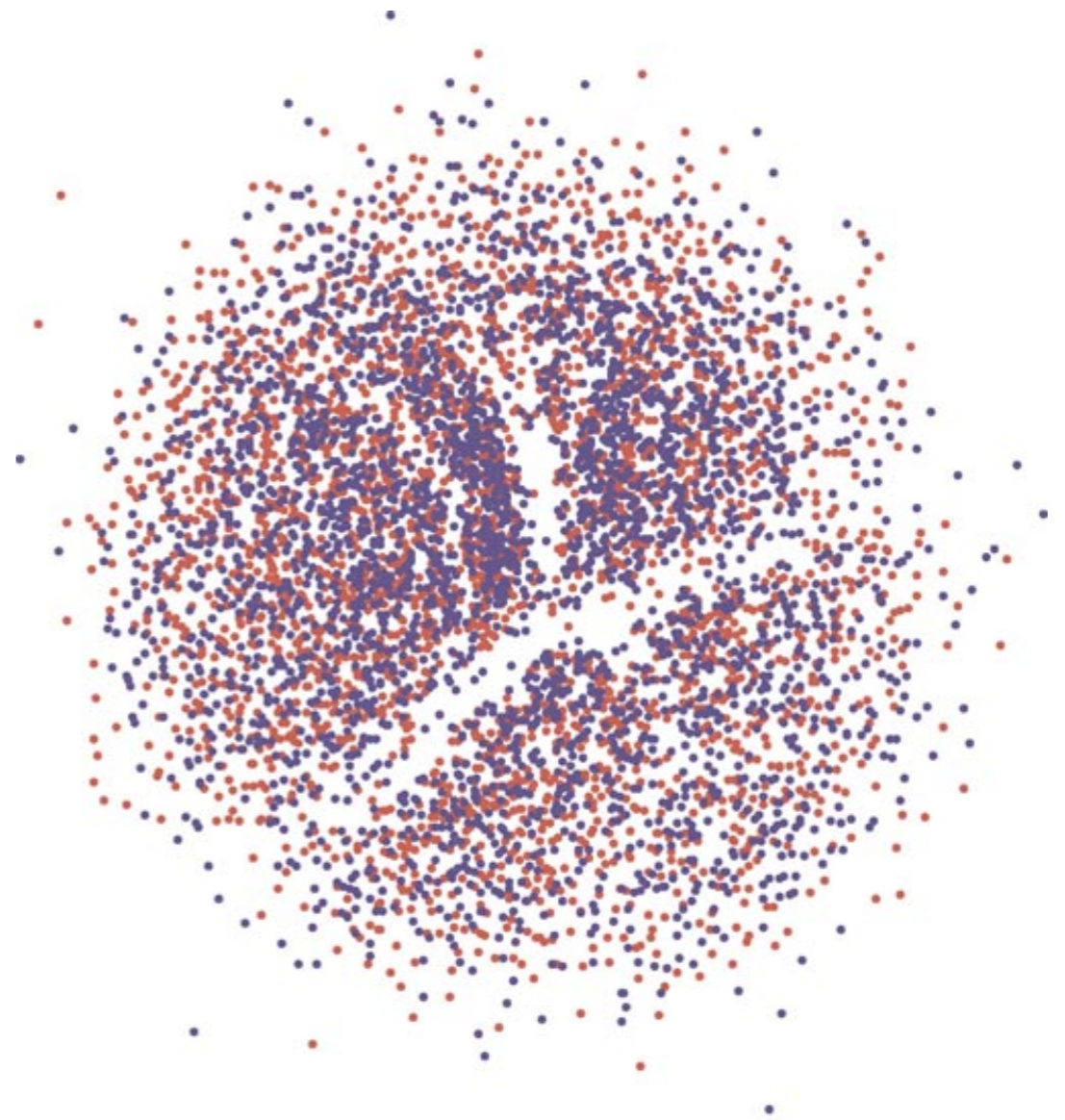
***Statistically based postprocessing of
phylogenetic analysis by clustering***

Cara Stockham¹, Li-San Wang^{2,} and Tandy Warnow²*

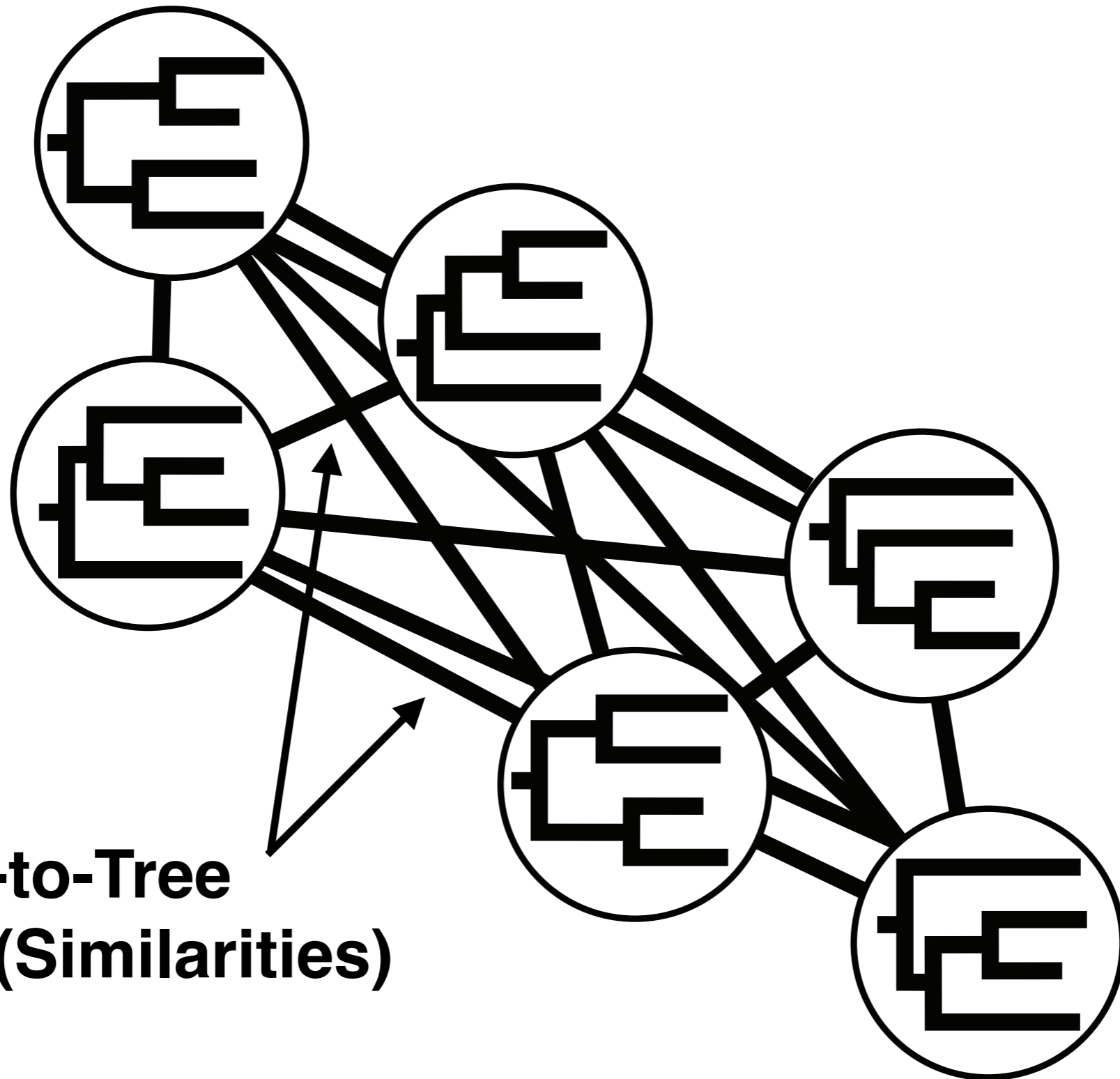
Report multiple consensus trees,
while attempting to minimize the amount
of information lost from the full distribution.

Summarizing Tree Sets

- Consensus trees
- Agreement subtrees
- Clustering
- Dimensionality Reduction



Networks of Trees



**Tree-to-Tree
Affinities (Similarities)**

Motivation

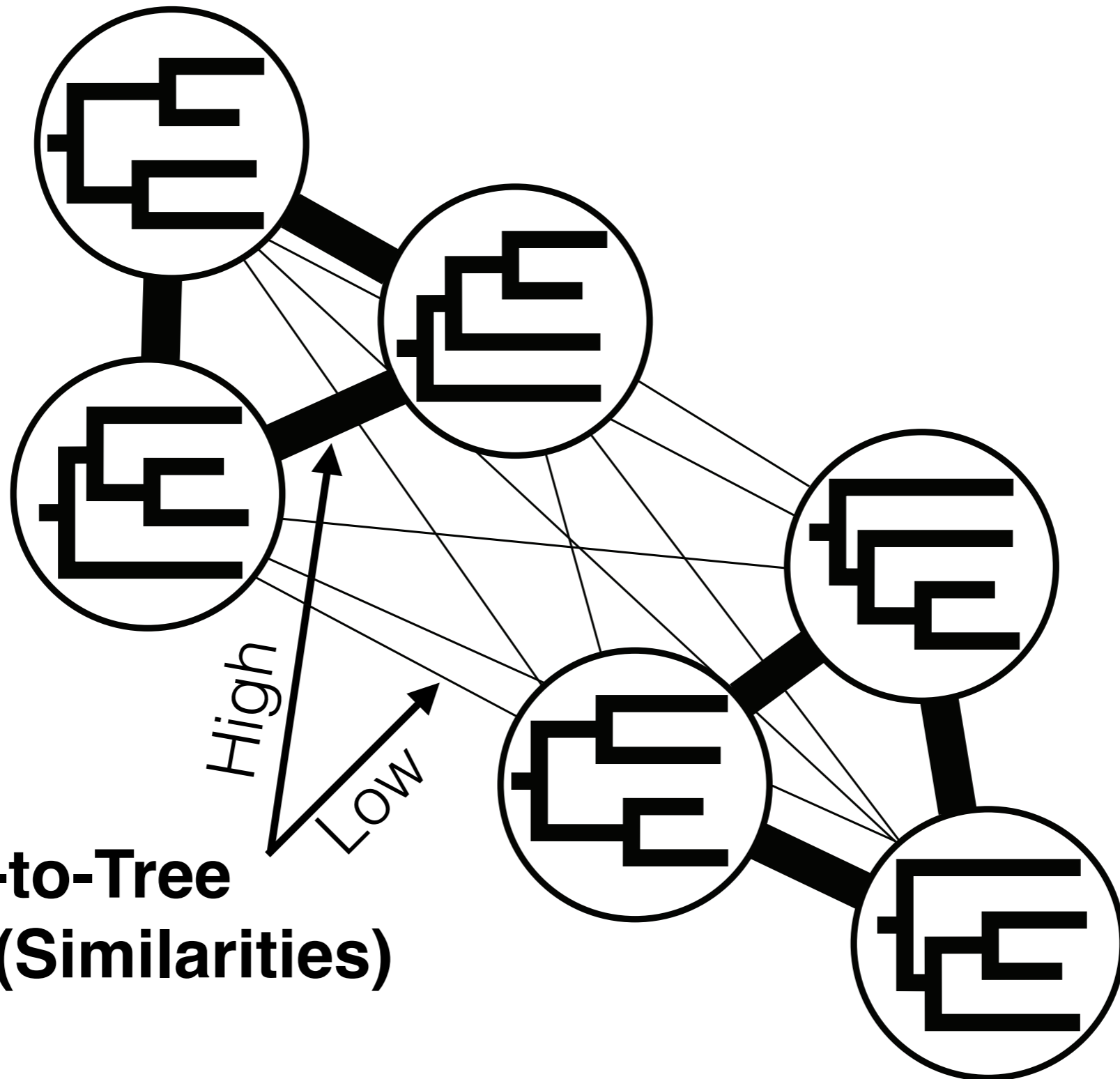
Our Approaches

Applications

Initial Results

Software

Networks of Trees



**Tree-to-Tree
Affinities (Similarities)**

Motivation

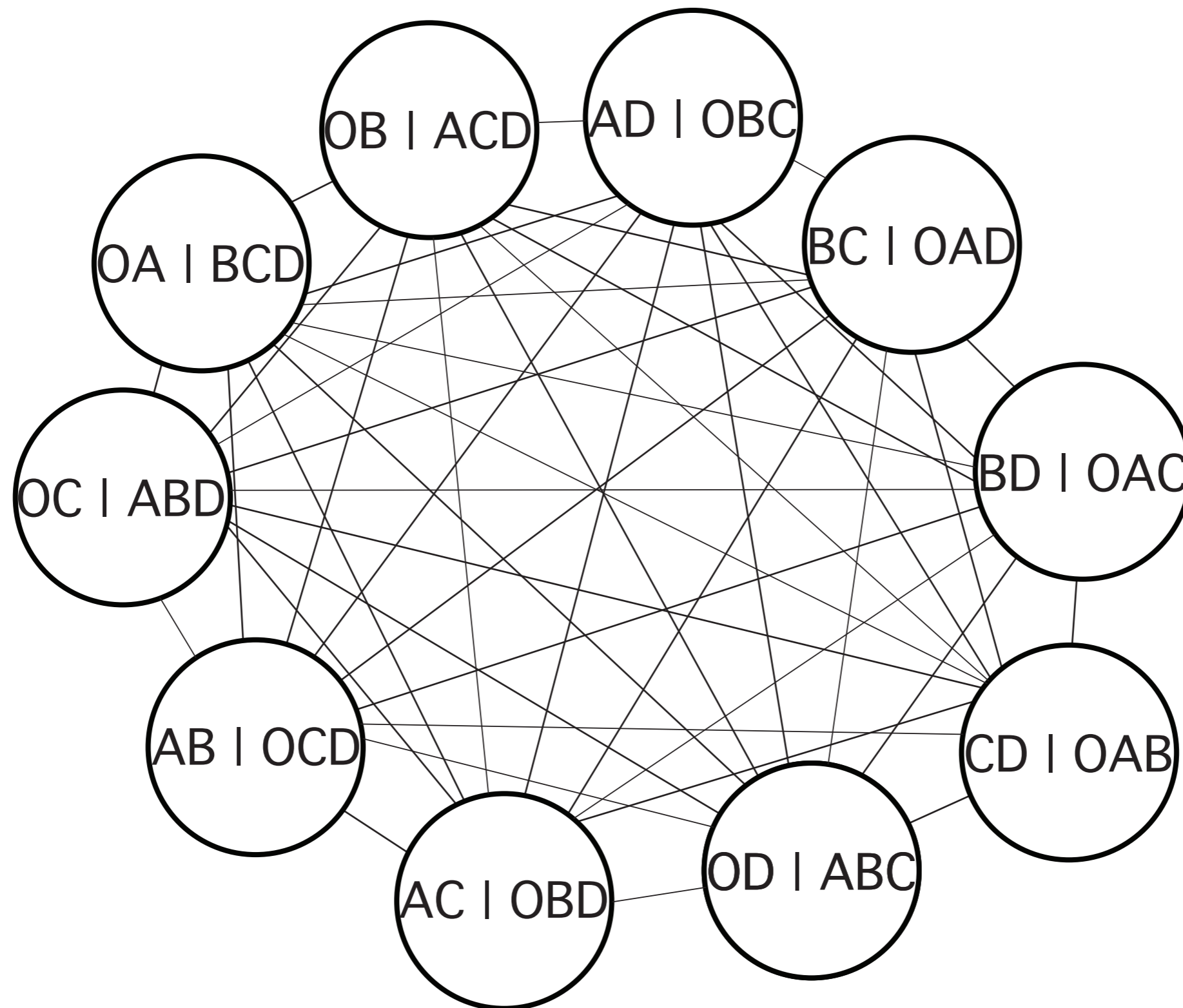
Our Approaches

Applications

Initial Results

Software

Networks of Bipartitions



Motivation

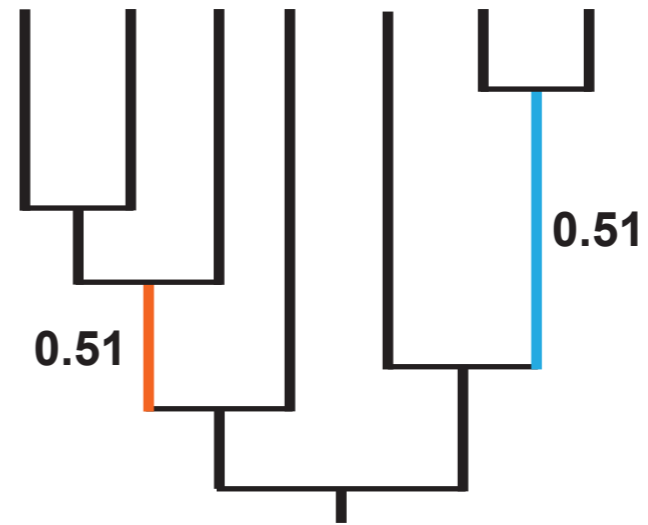
Our Approaches

Applications

Initial Results

Software

Bipartition Covariances



Motivation

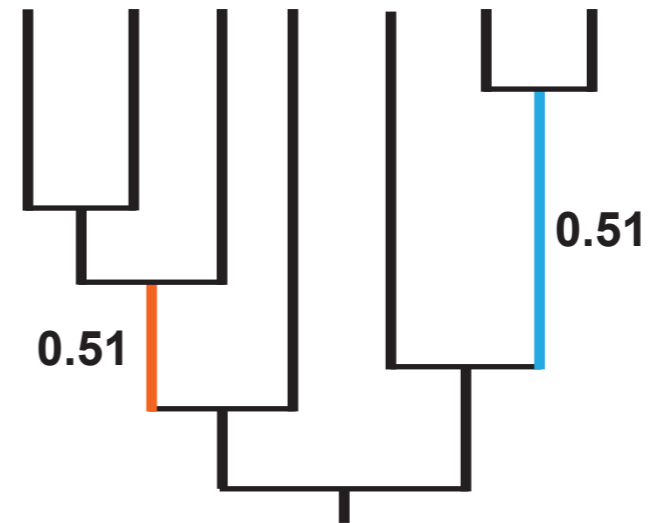
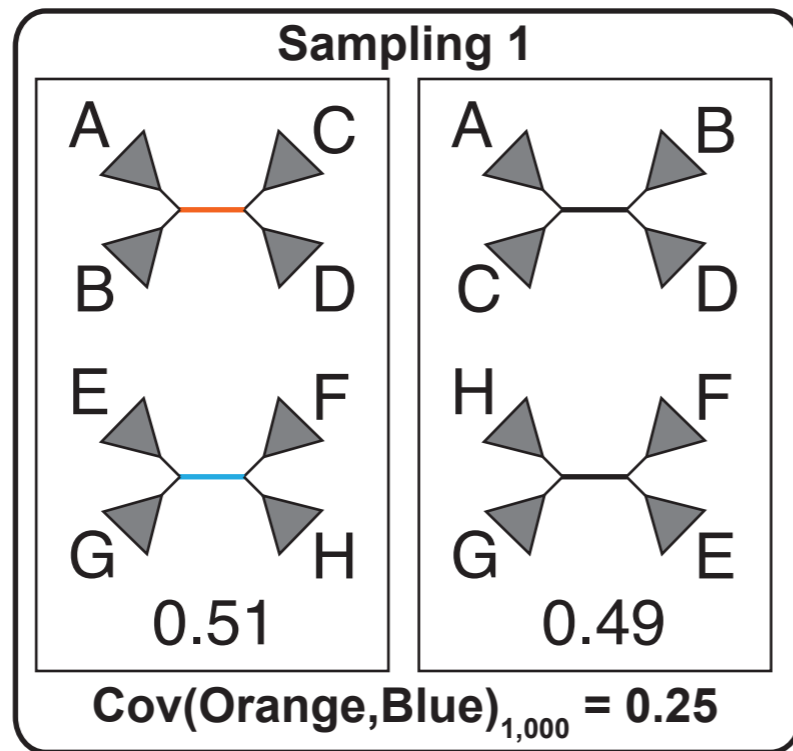
Our Approaches

Applications

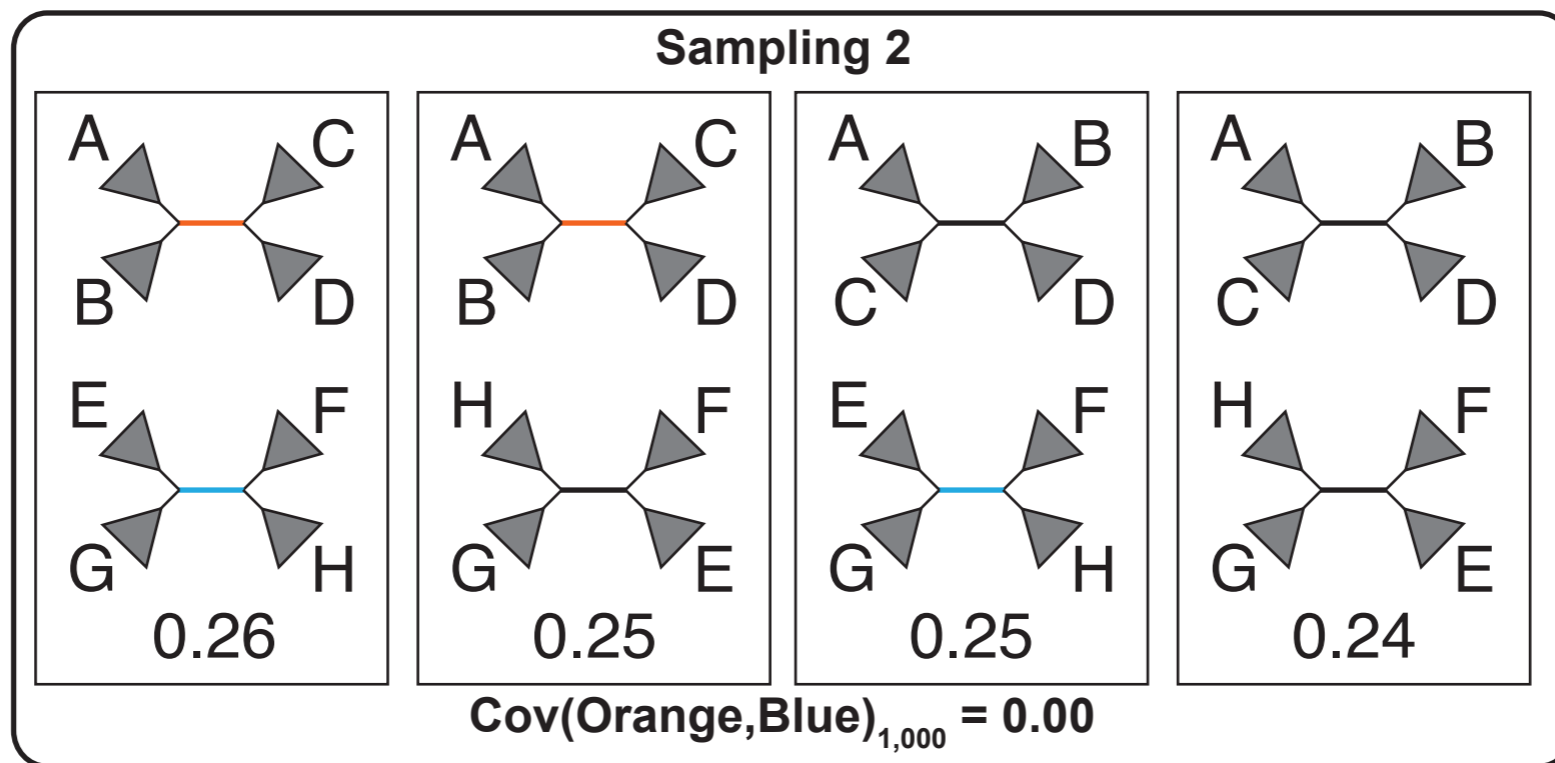
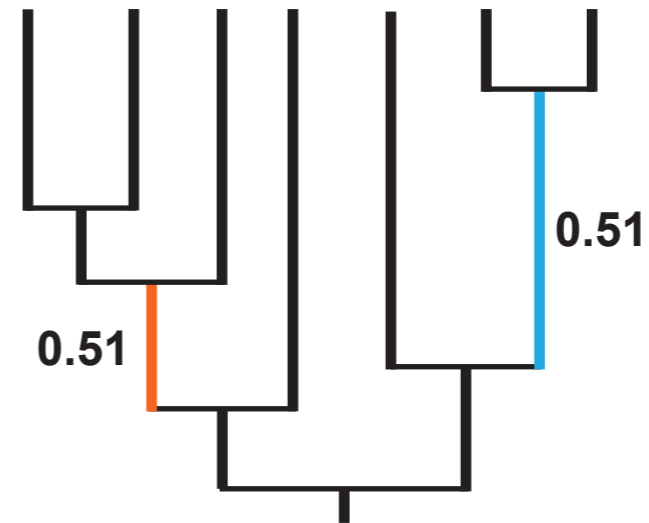
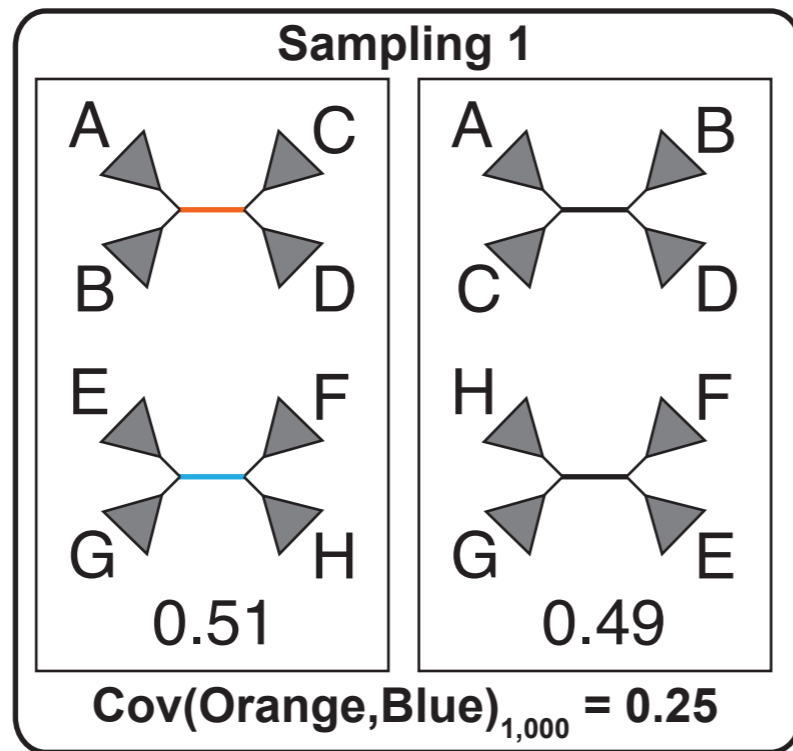
Initial Results

Software

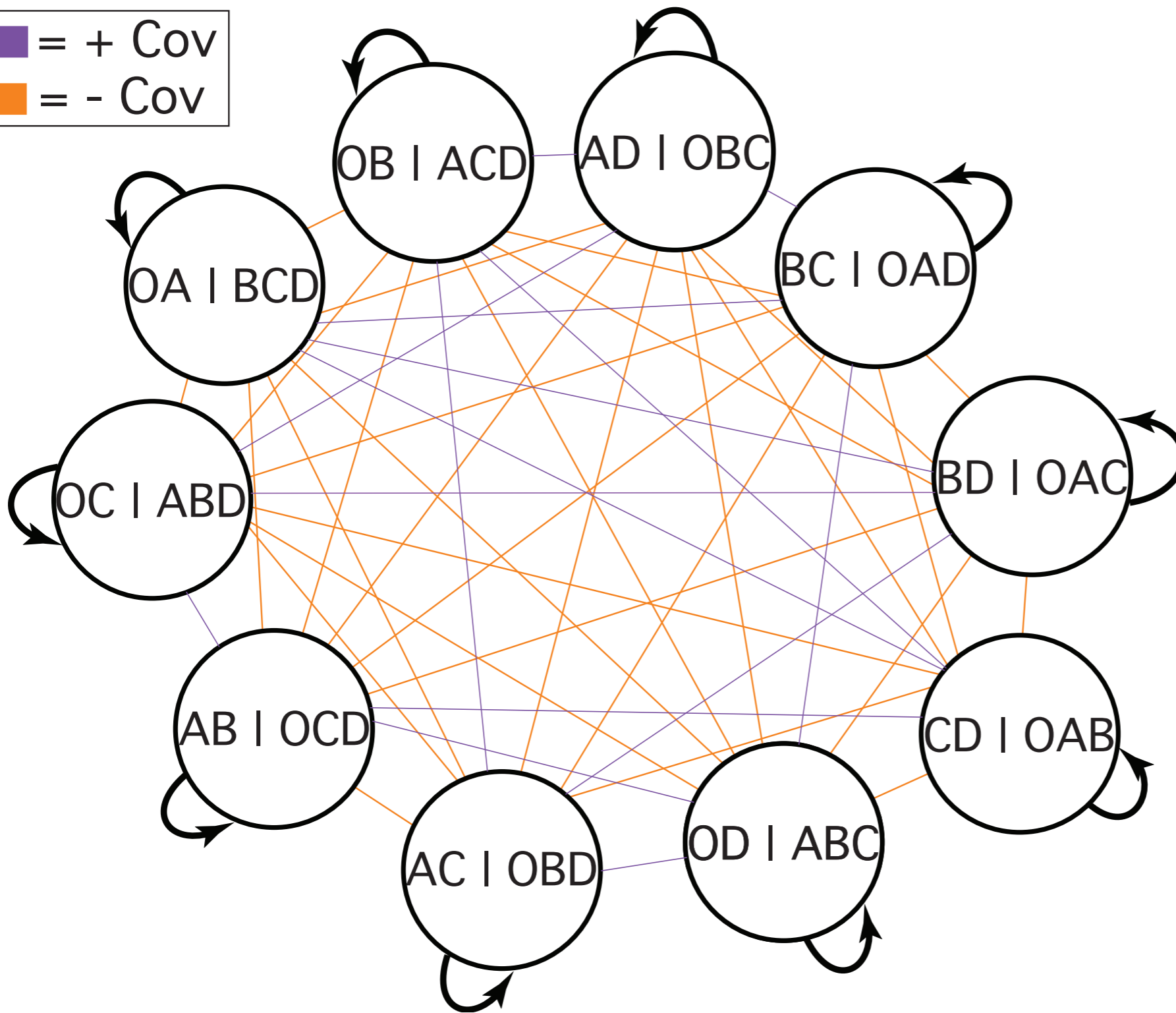
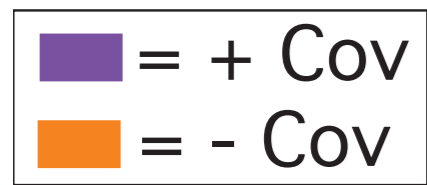
Bipartition Covariances



Bipartition Covariances



Networks of Bipartitions



Uniform
Distribution
of Topologies

Motivation

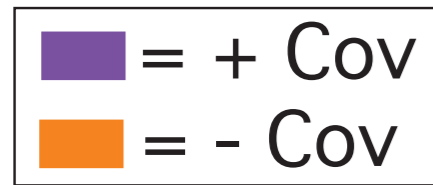
Our Approaches

Applications

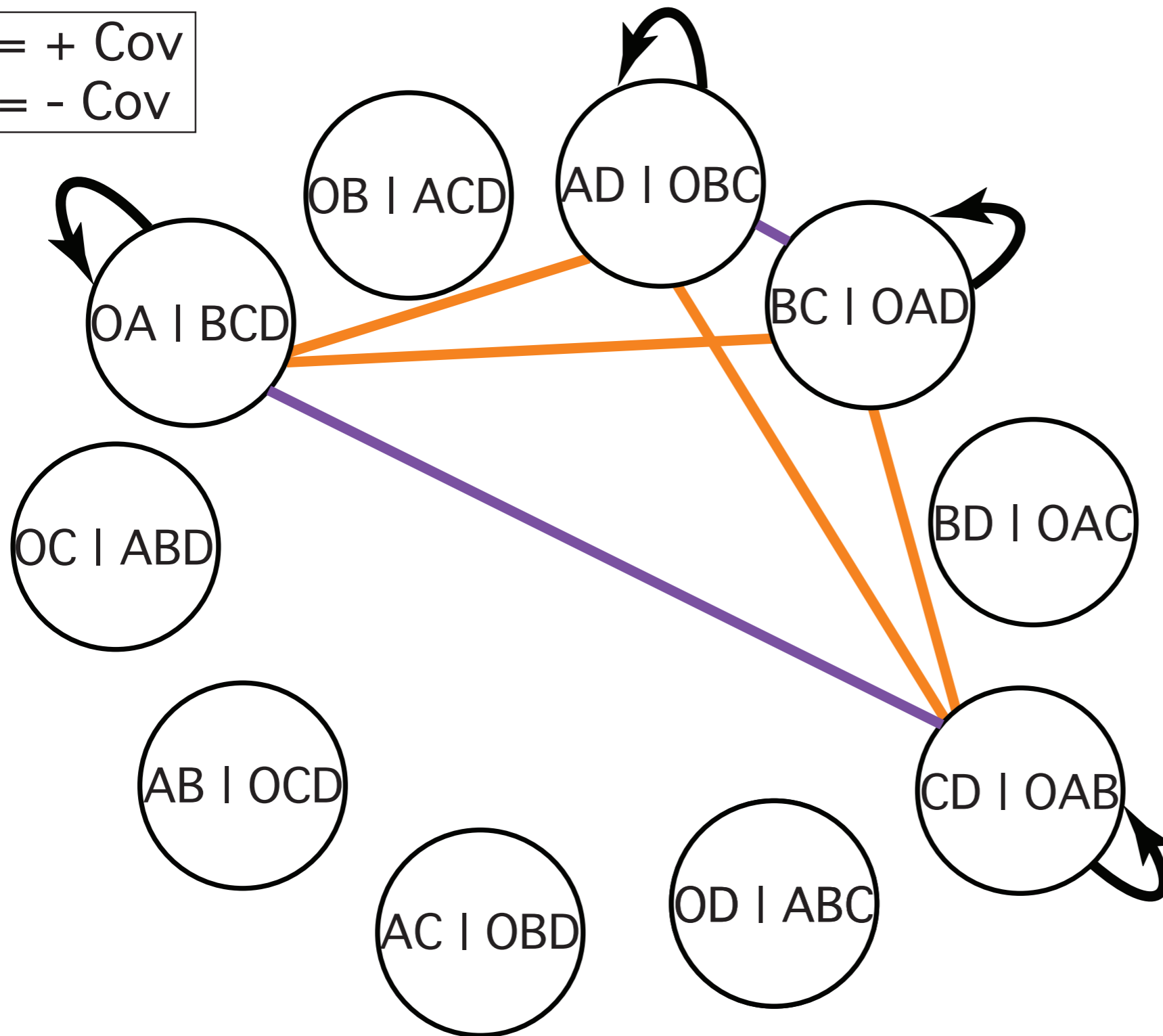
Initial Results

Software

Networks of Bipartitions



Two Equally
Frequent
Topologies



Motivation

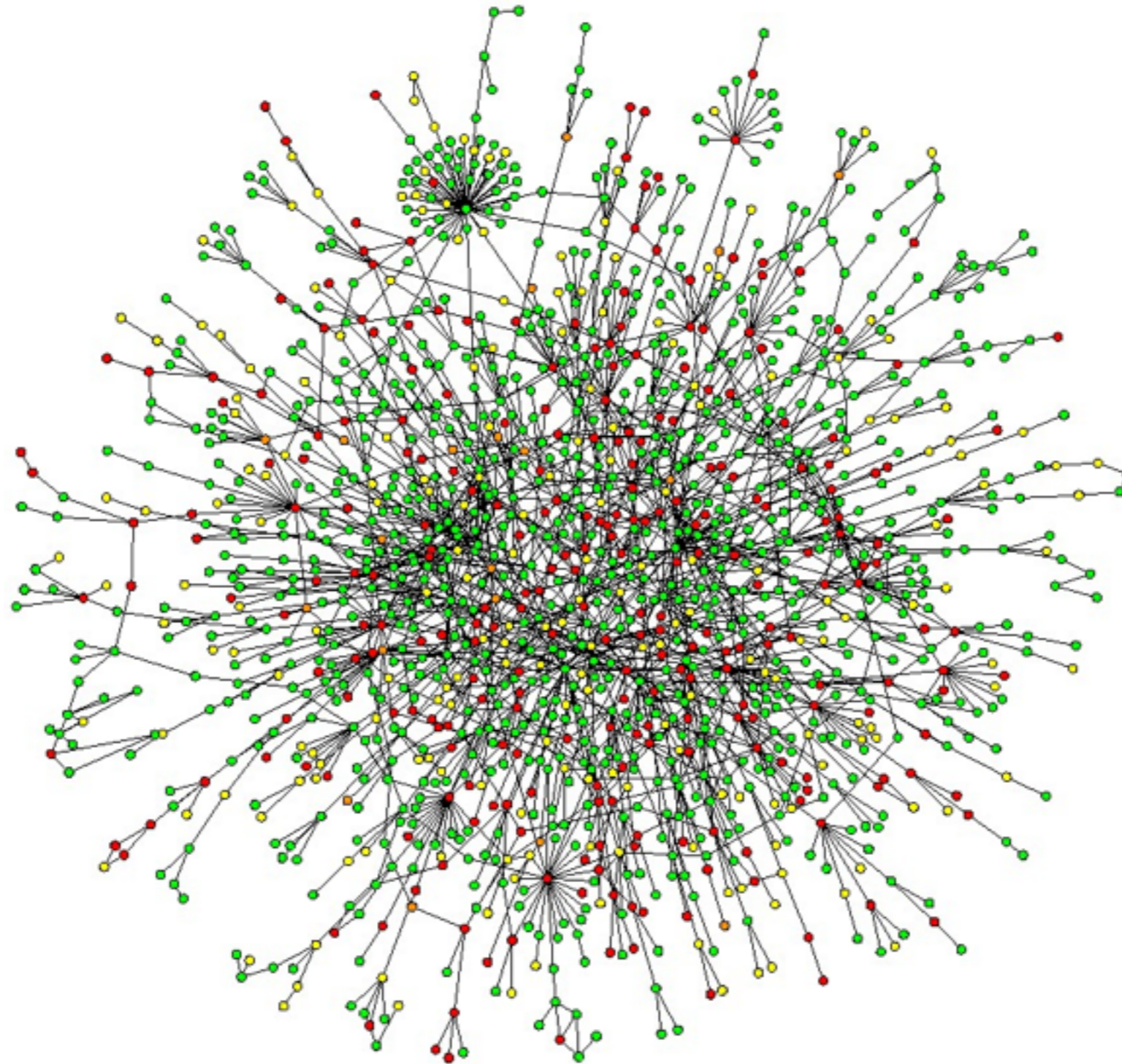
Our Approaches

Applications

Initial Results

Software

Network Visualizations



Motivation

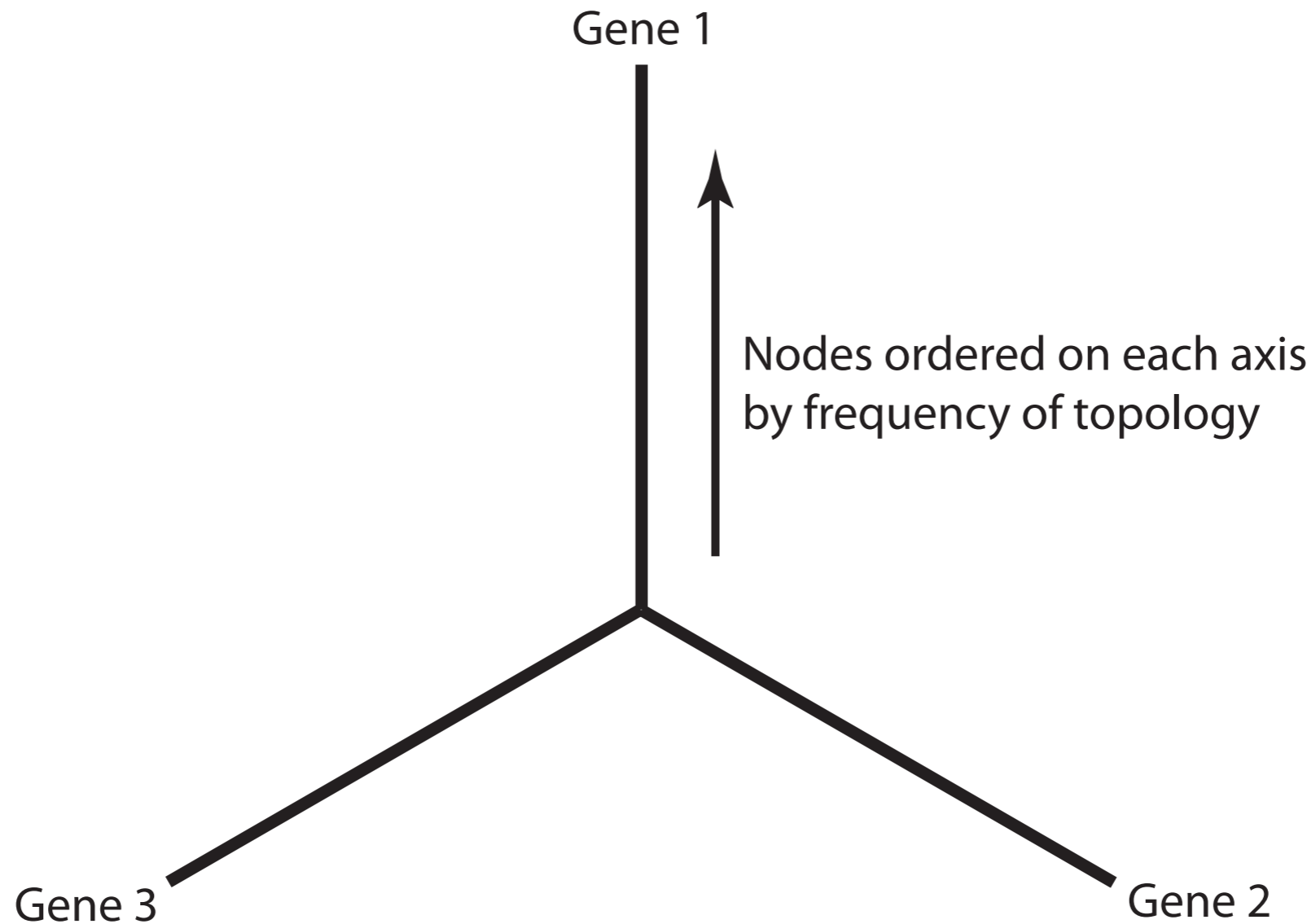
Our Approaches

Applications

Initial Results

Software

Network Visualizations



Motivation

Our Approaches

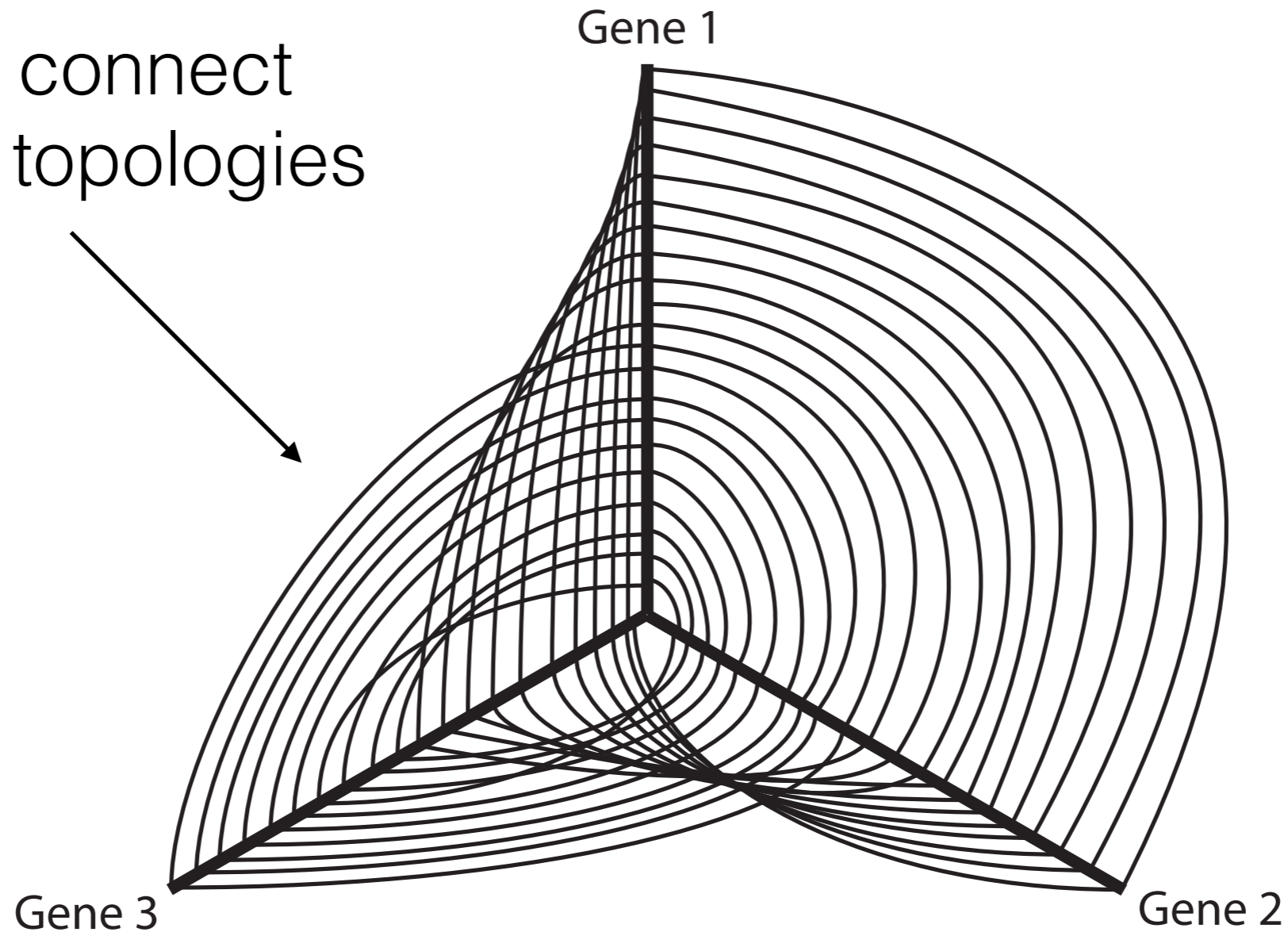
Applications

Initial Results

Software

Network Visualizations

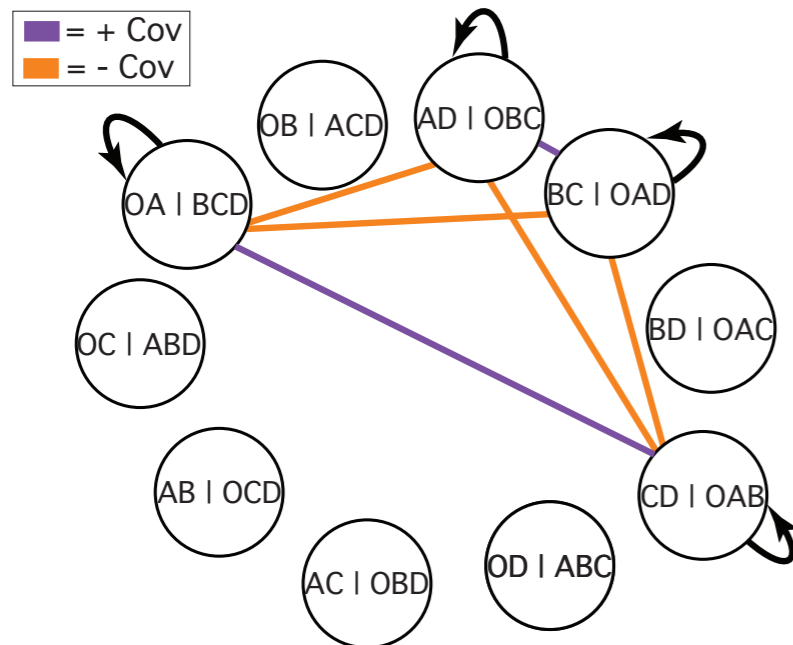
Edges connect
identical topologies



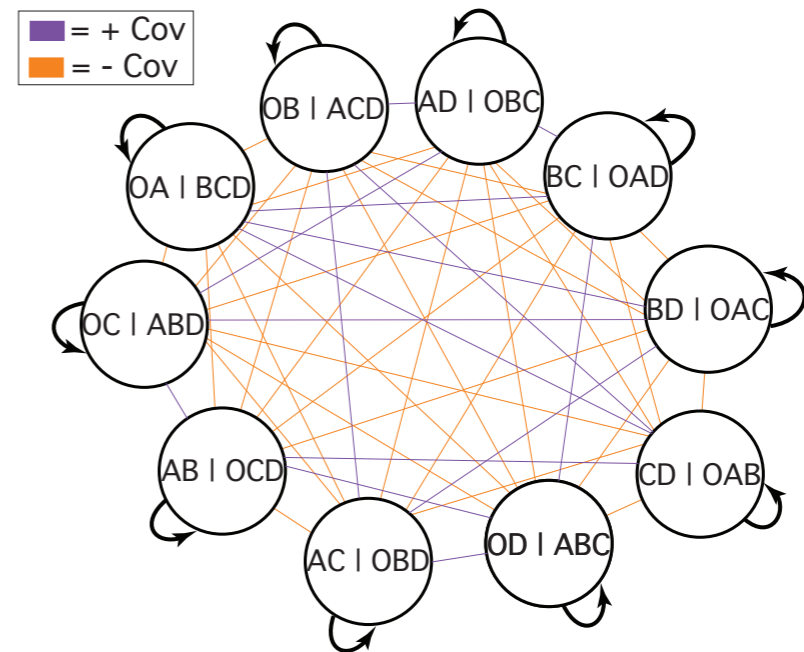
Assessing Model Fit

Using parametric bootstrapping or posterior prediction, we can compare network structures between observed and simulated datasets.

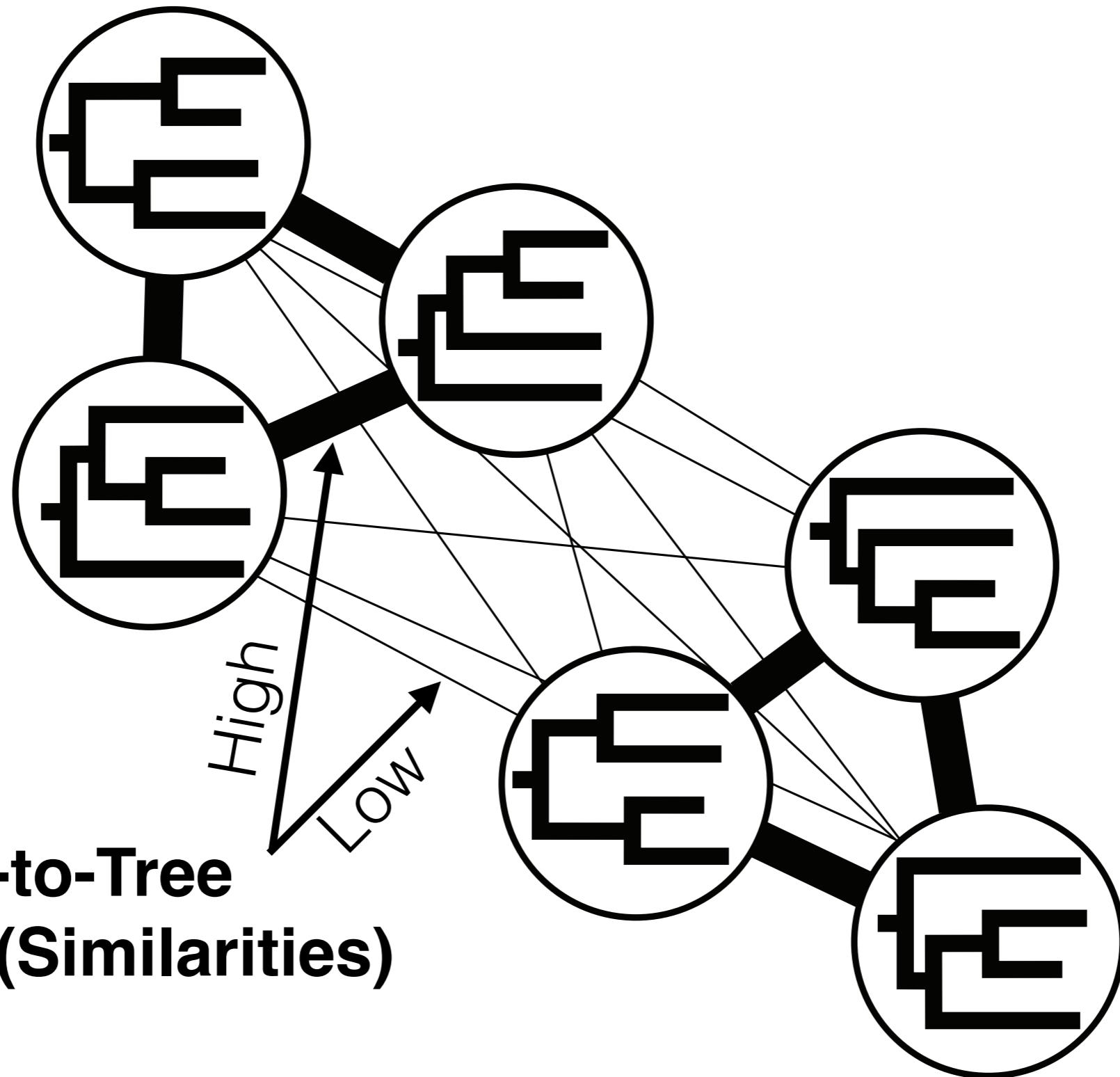
Empirical



Simulated



Detecting Distinct Phylogenetic Signals



**Tree-to-Tree
Affinities (Similarities)**

Motivation

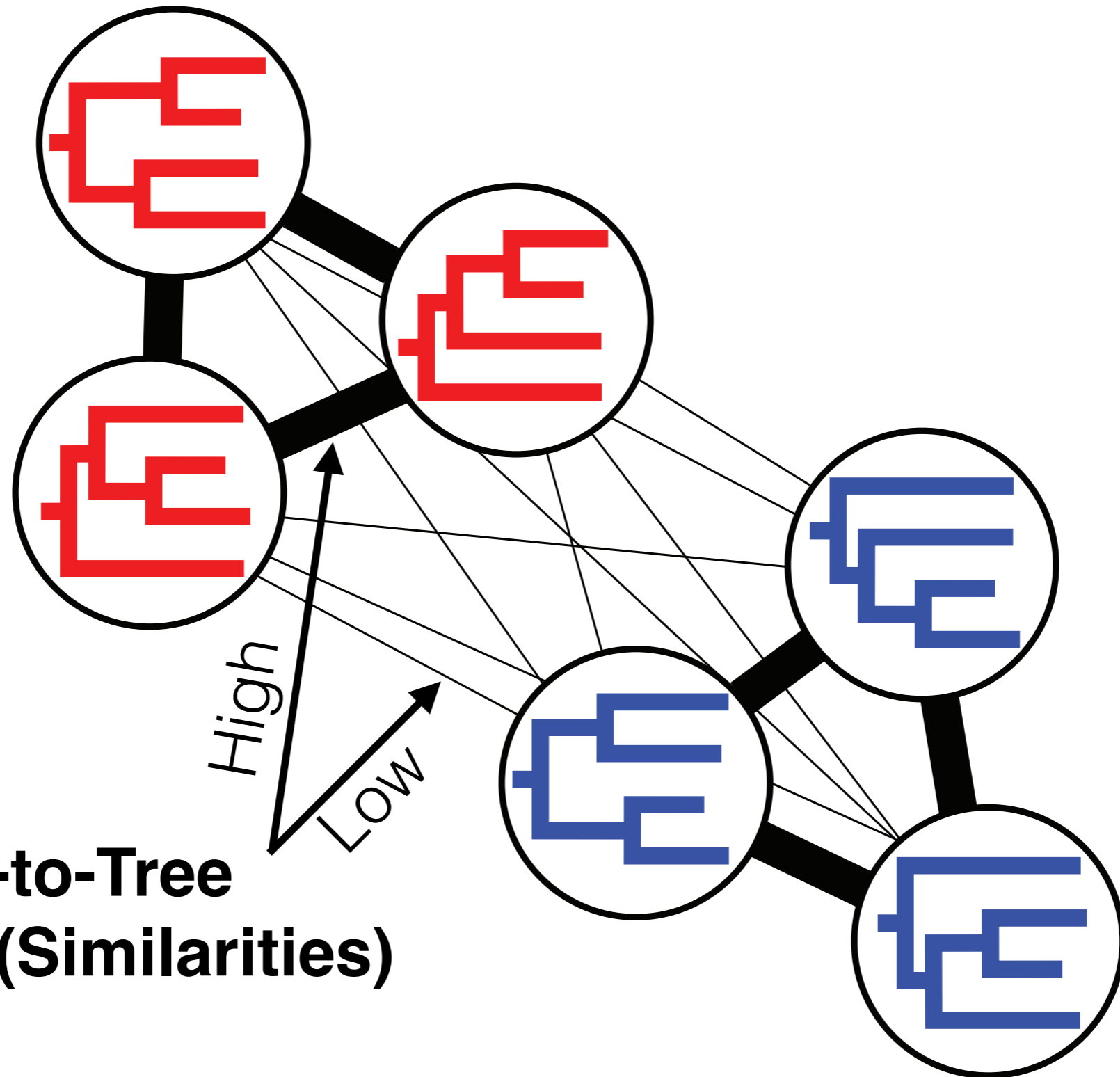
Our Approaches

Applications

Initial Results

Software

Detecting Distinct Phylogenetic Signals



**Tree-to-Tree
Affinities (Similarities)**

Motivation

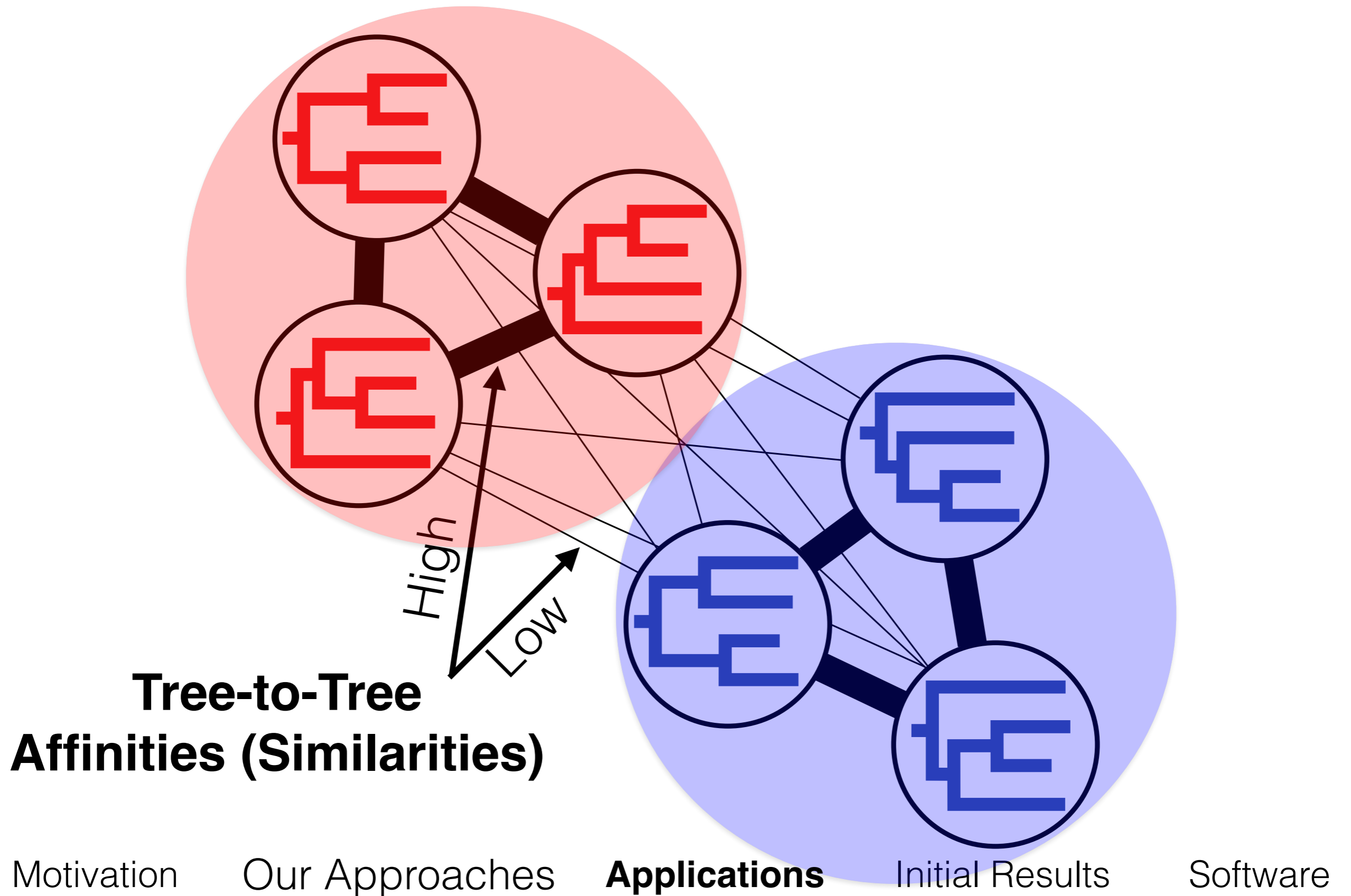
Our Approaches

Applications

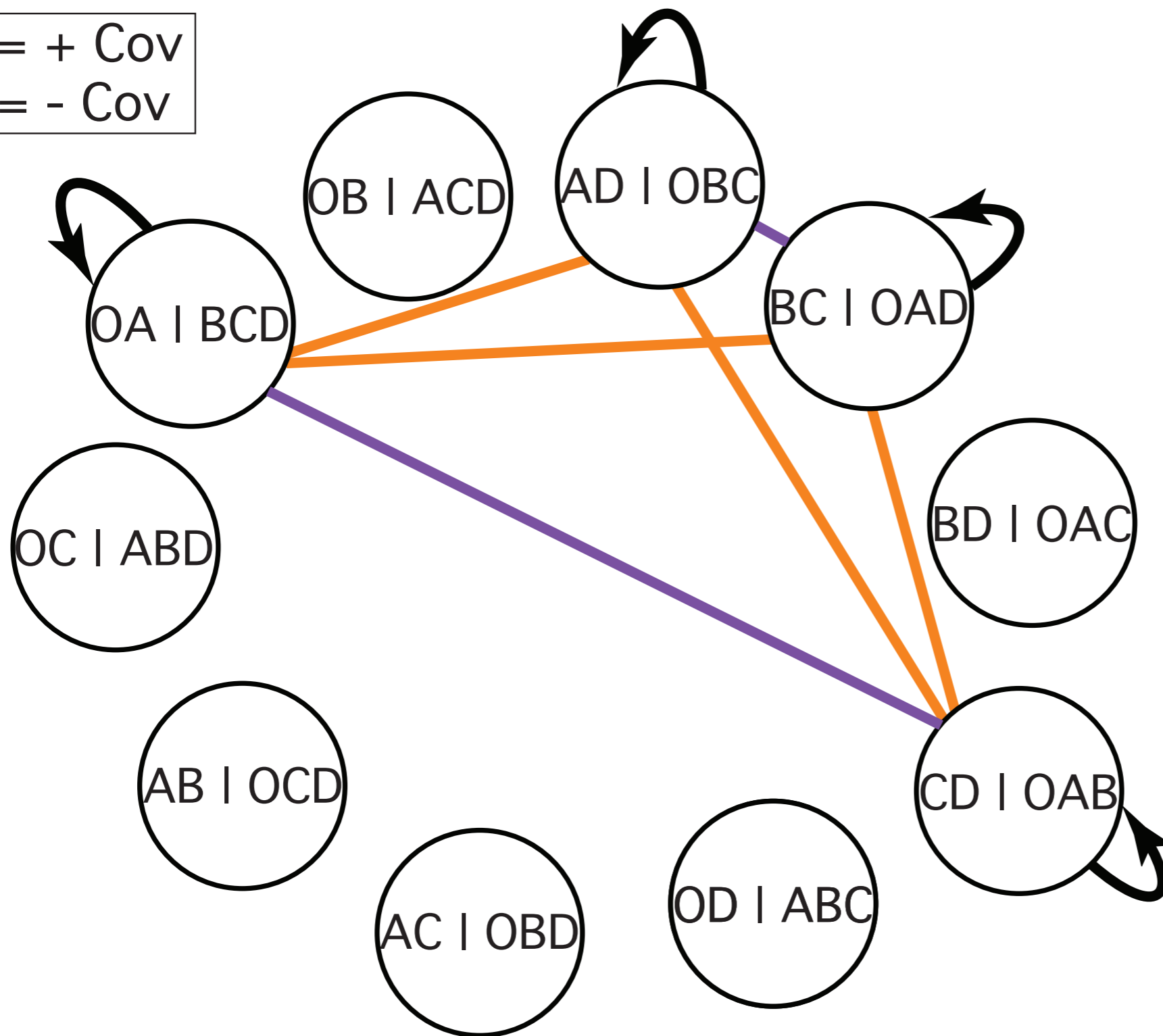
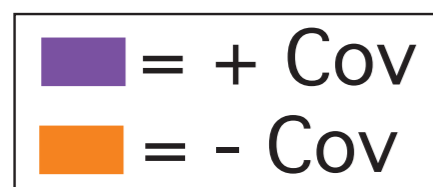
Initial Results

Software

Detecting Distinct Phylogenetic Signals

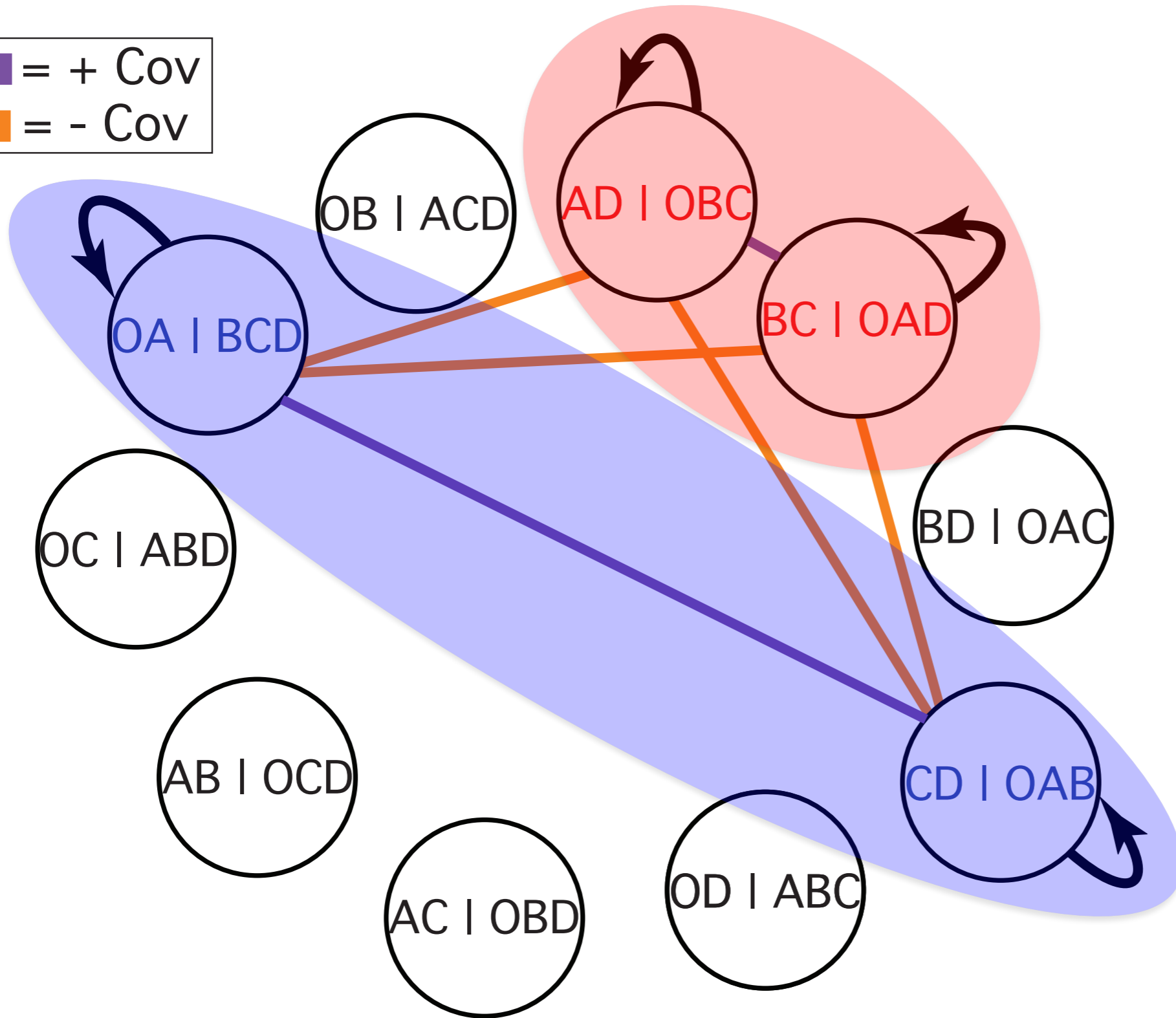
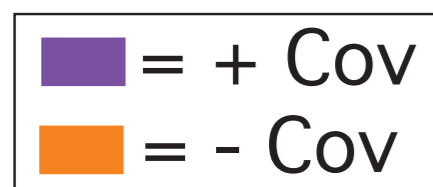


Detecting Distinct Phylogenetic Signals



Two Equally
Frequent
Topologies

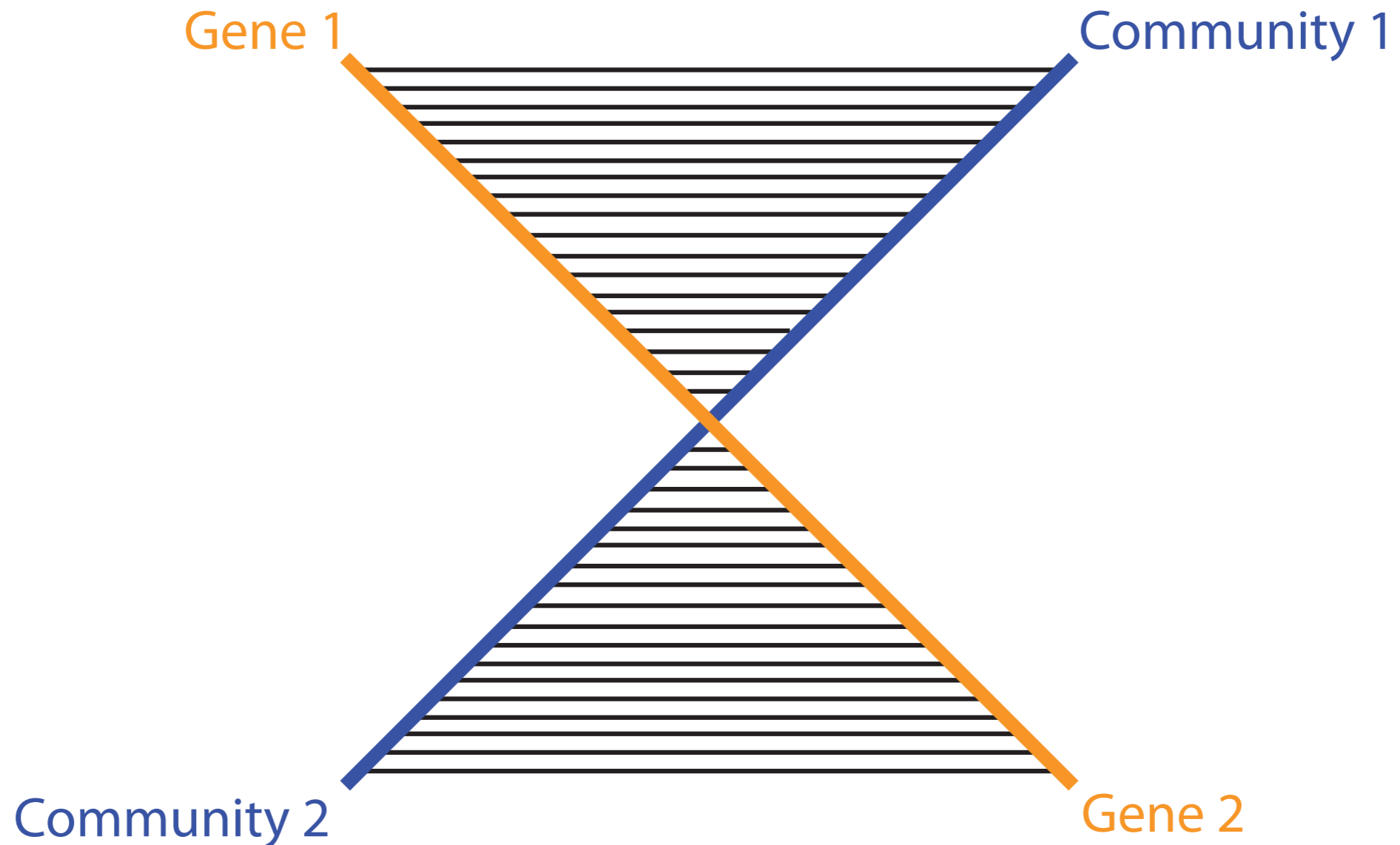
Detecting Distinct Phylogenetic Signals



Two Equally
Frequent
Topologies

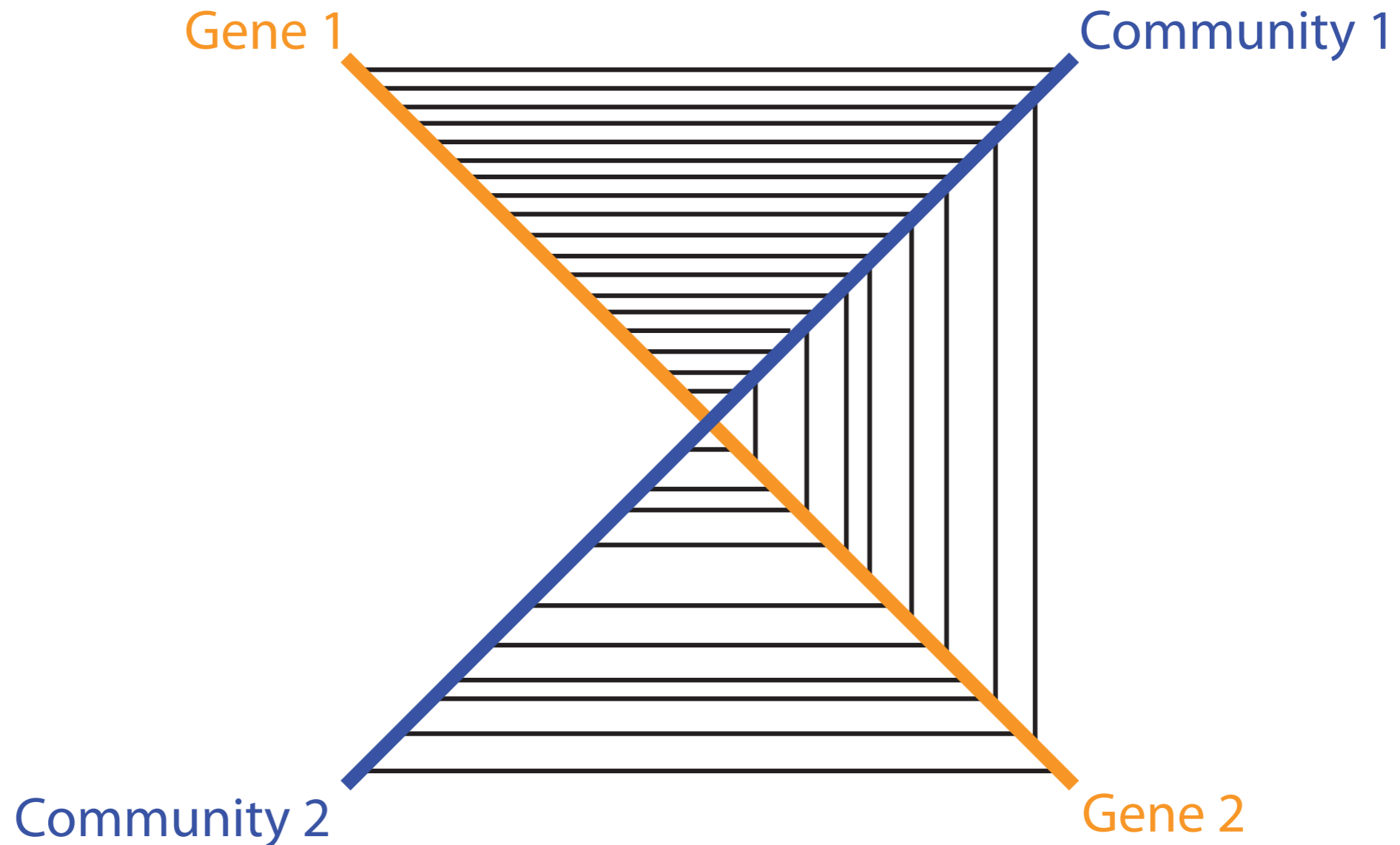
Network Visualizations

Completely distinct signals
in two genes



Network Visualizations

Partially overlapping signal



Motivation

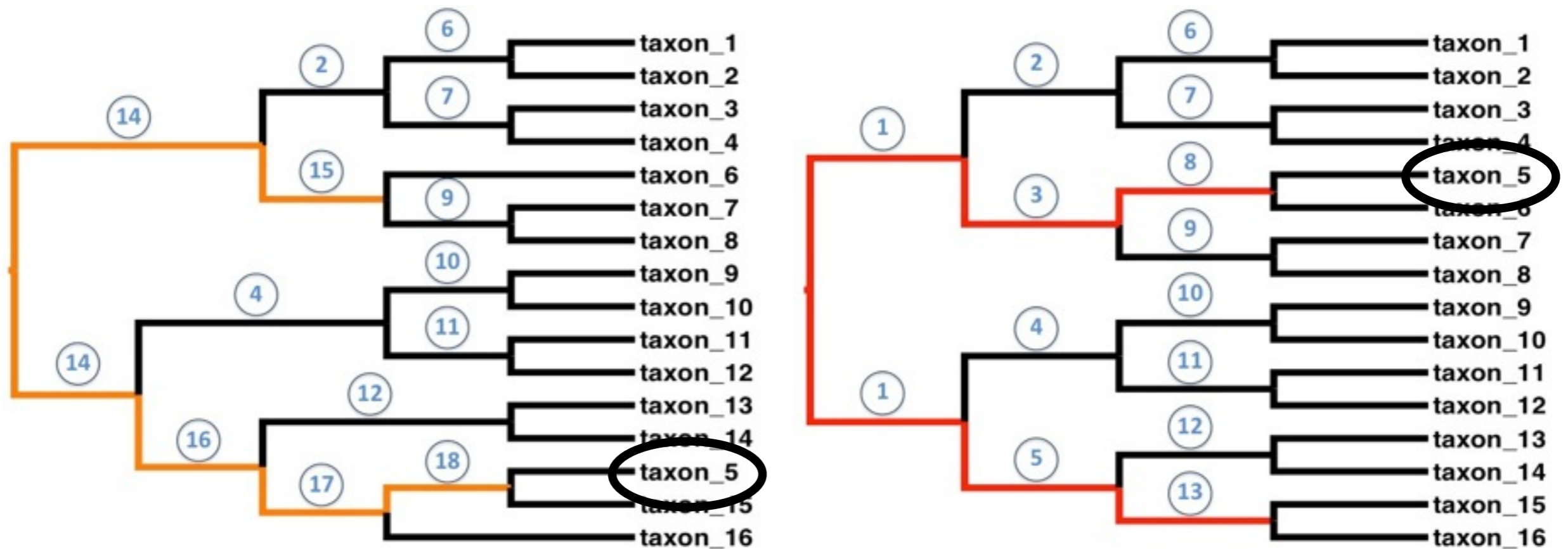
Our Approaches

Applications

Initial Results

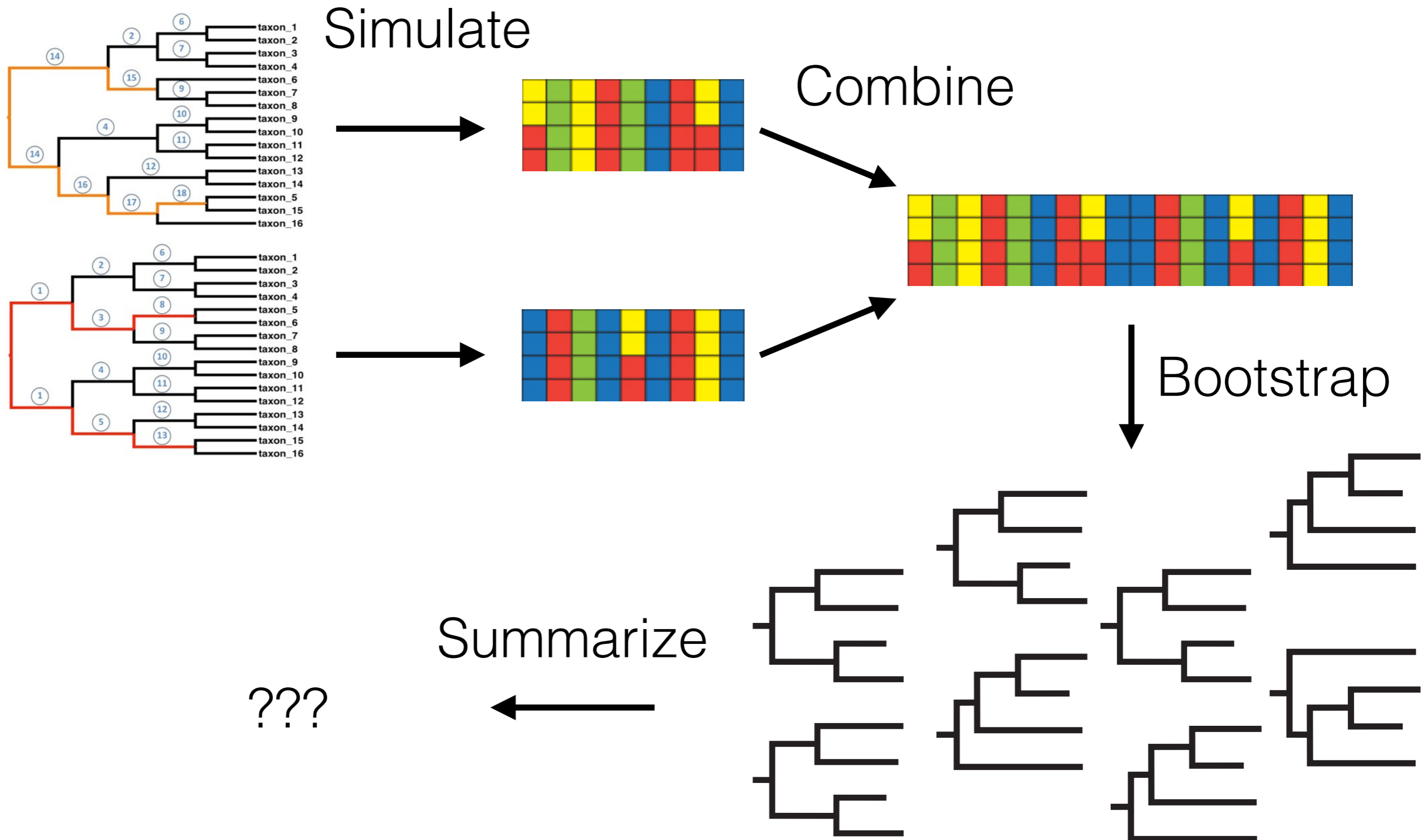
Software

Proof of Principle



Topologies used for simulating two halves of an alignment.

Proof of Principle



Motivation

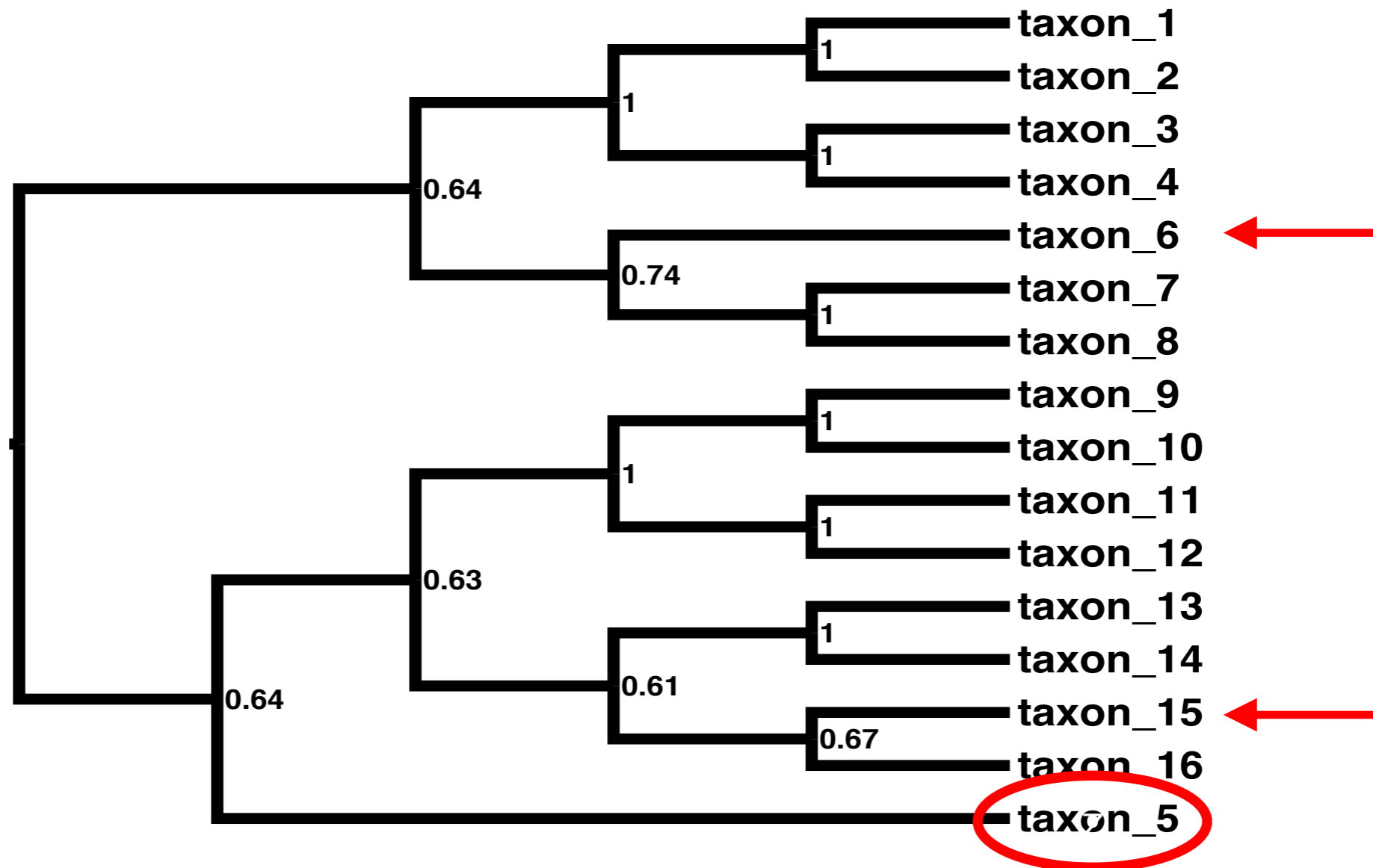
Our Approaches

Applications

Initial Results

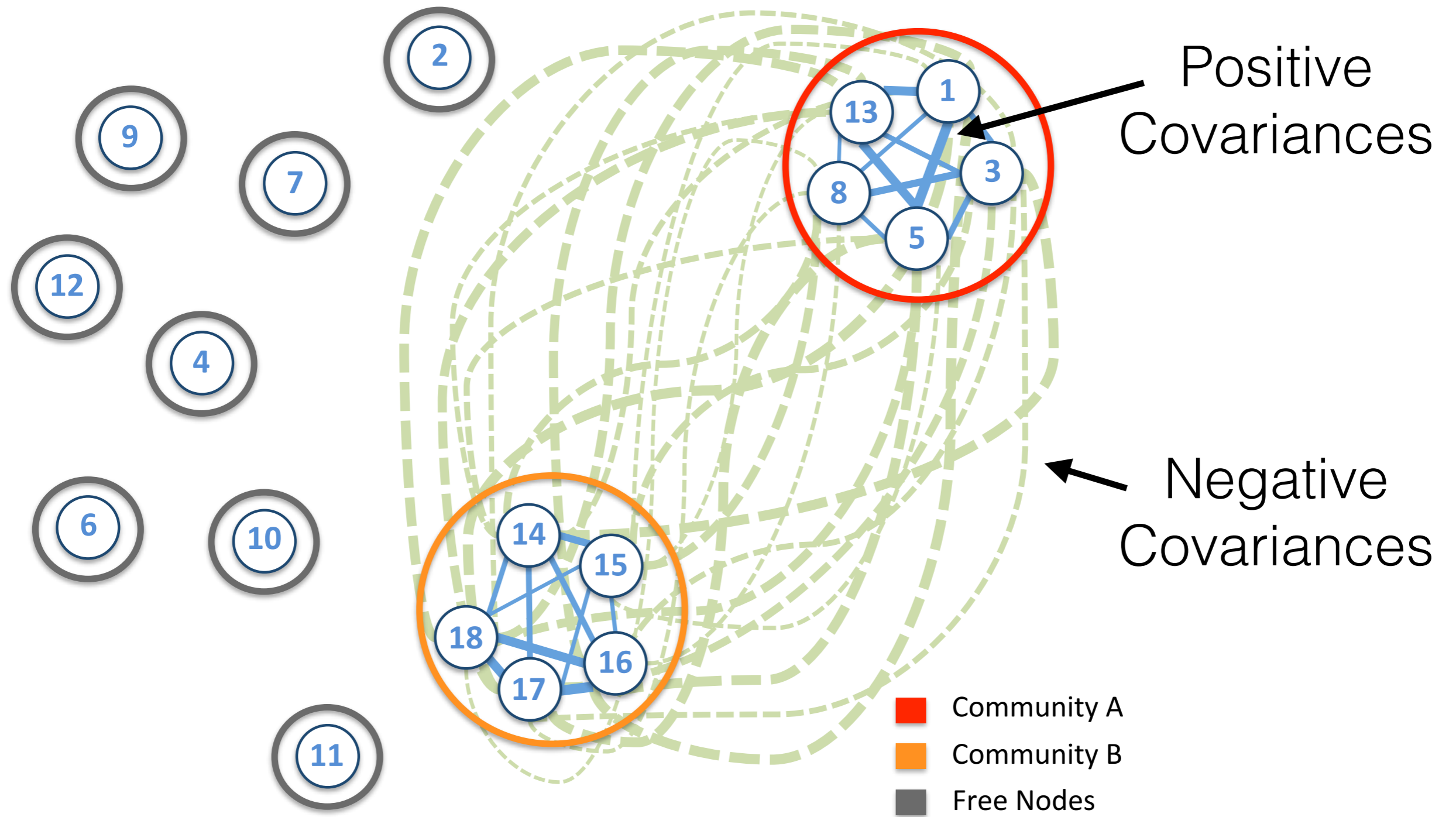
Software

Proof of Principle



Majority-Rule Consensus Tree

Proof of Principle



Motivation

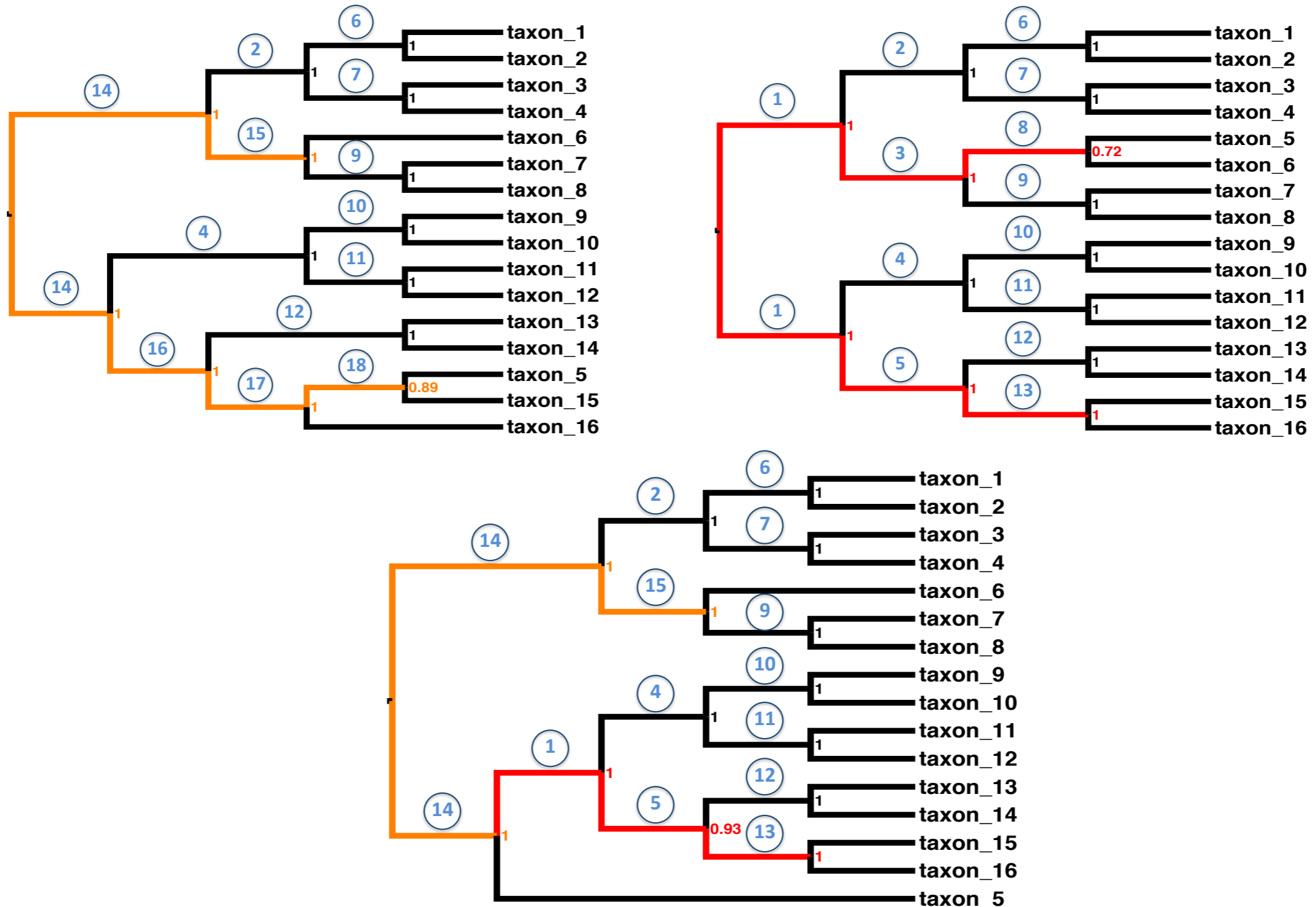
Our Approaches

Applications

Initial Results

Software

Networks Detect Strong Conflict



Motivation

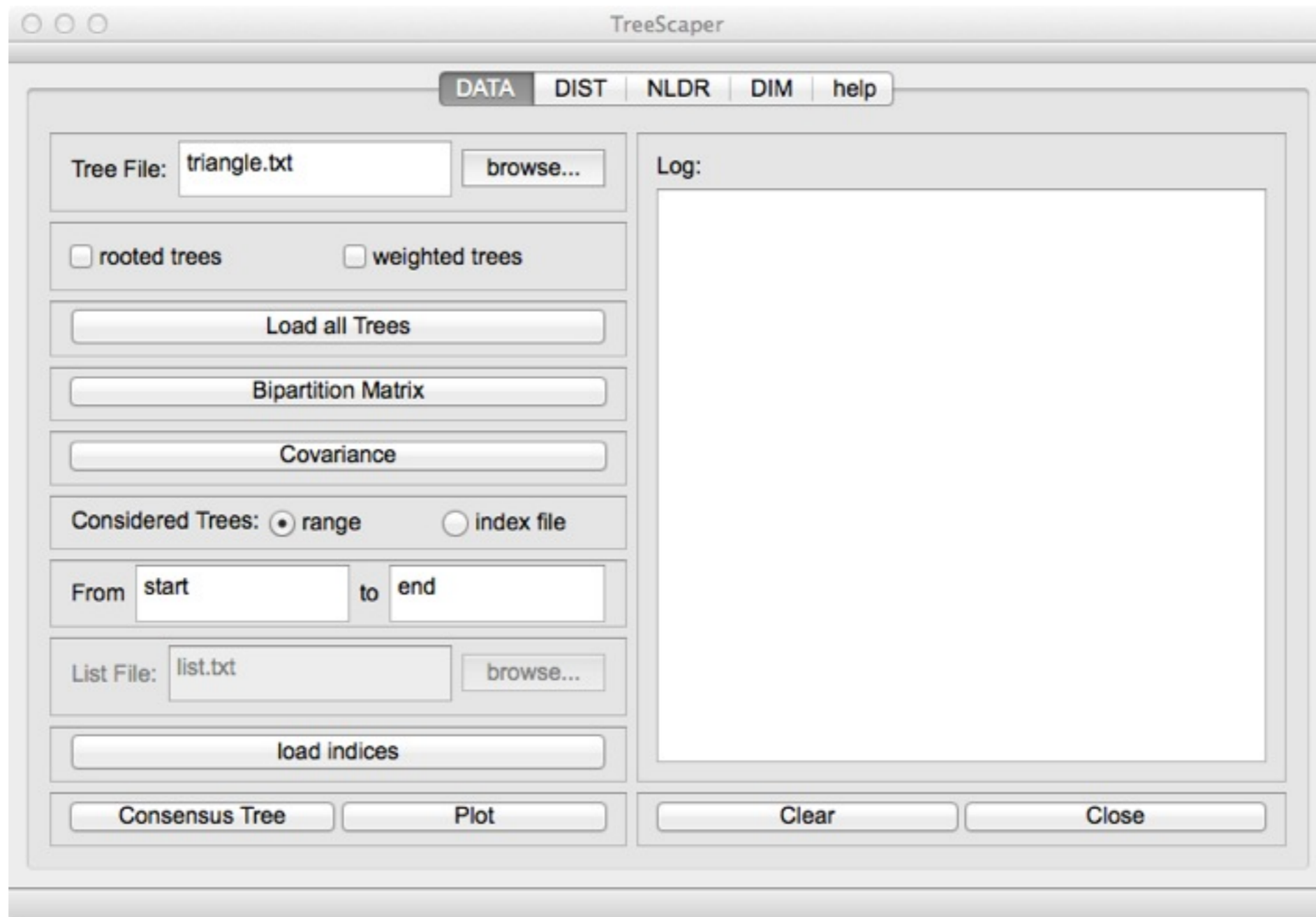
Our Approaches

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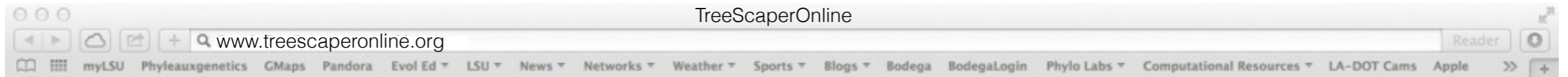
TreeScaper



Wen Huang. Tuesday morning iEvoBio Lightning Talk.

Motivation Our Approaches Applications Initial Results **Software**

Web Interface (future)



TreeScaper Online

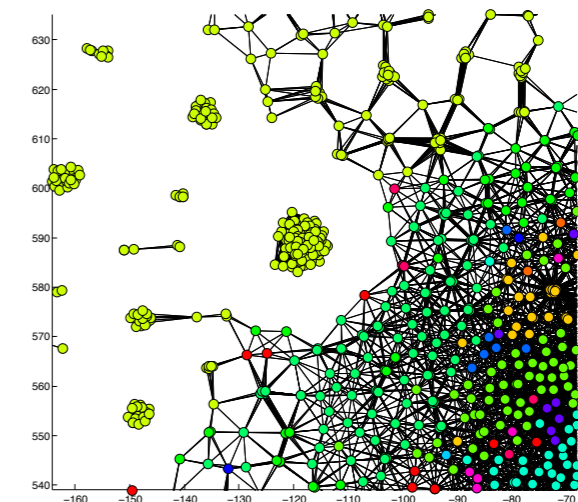
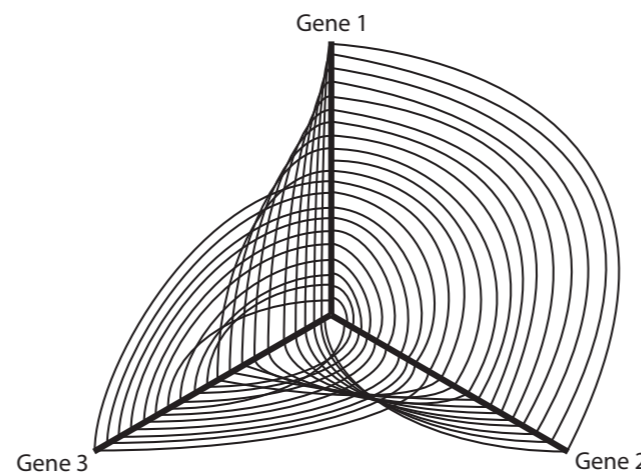
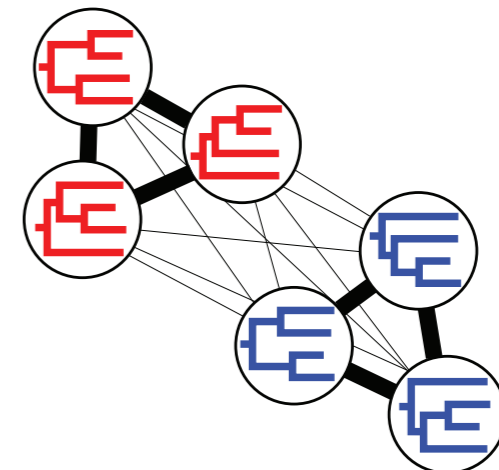
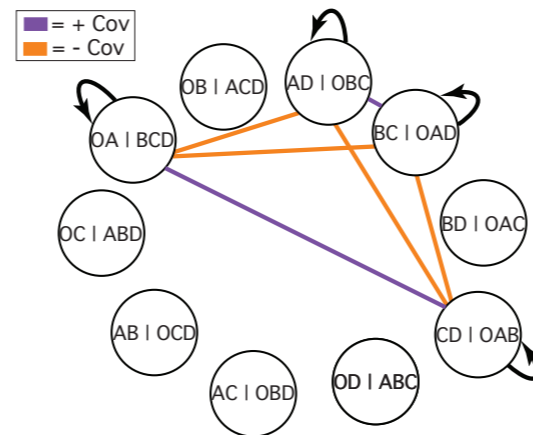
Input

Create Networks

Community Detection

Report Network Stats

Visualizations



Acknowledgements

- Computing support from FSU's Research Computing Center and HPC@LSU
- Financial support from NSF (DBI 1262571)

