TEXAS A&M UNIVERSITY

BayReL: Bayesian Relational Learning for Multi-omics Data Integration

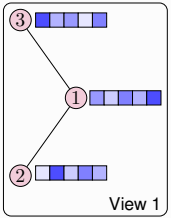
Ehsan Hajiramezanali, Arman Hasanzadeh, Nick Duffield, Krishna Narayanan, and Xiaoning Qian

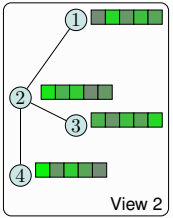
34th Conference on Neural Information Processing Systems (NeurIPS 2020)

Proposed method

BayReL is a novel Bayesian relational learning method

- Integrating high-dimensional multi-omics data
- Taking advantage of *a priori* known relationships
  - modeled as a graph at each corresponding view
- Inferring the relational interactions as a bipartite graph
  - no need to have any pre-known interactions across views
- Exploiting non-linear and deep transformations of data
- Enabling Bayesian interpretation

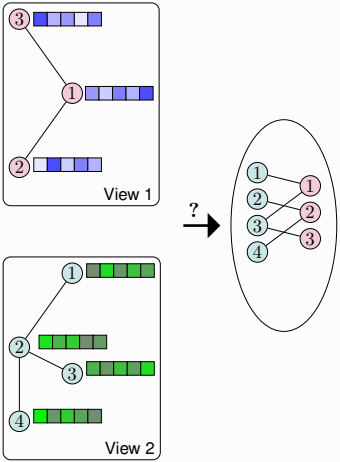




Proposed method

BayReL is a novel Bayesian relational learning method

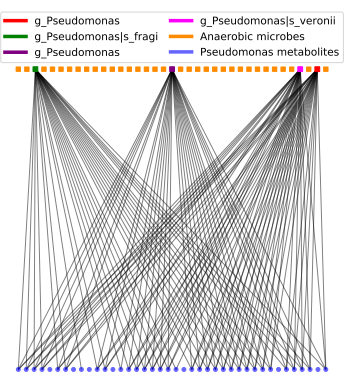
- Integrating high-dimensional multi-omics data
- Taking advantage of *a priori* known relationships
  - modeled as a graph at each corresponding view
- Inferring the relational interactions as a bipartite graph
  - no need to have any pre-known interactions across views
- Exploiting non-linear and deep transformations of data
- Enabling Bayesian interpretation



Experiments

BayReL capturing meaningful inter-relations across views:

- microbiome-metabolome interactions in cystic fibrosis
- miRNA-mRNA interactions in breast cancer
- precision medicine in acute myeloid leukemia (AML)



Experiments

TEXAS A&M UNIVERSITY

BayReL capturing meaningful inter-relations across views:

- microbiome-metabolome interactions in cystic fibrosis
- miRNA-mRNA interactions in breast cancer
- precision medicine in acute myeloid leukemia (AML)

BayReL substantially outperforms competing methods:

- prediction sensitivity
- robustness and consistency

Avg. deg.	SRCA	BCCA	BayReL
0.2	17.58	21.08 ± 0.0	$\mathbf{34.06} \pm 2.5$
0.3	28.26	31.18 ± 0.7	$\mathbf{47.46} \pm 2.6$
0.4	37.55	41.12 ± 0.2	$\mathbf{59.50} \pm 3.0$

Thanks!

ehsanr@tamu.edu
https://github.com/ehsanhajiramezanali/BayReL