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The University of Georgia

Department of Statistics

big data analytics Lab

Subsampling in Large Graphs Using Ricci Curvature

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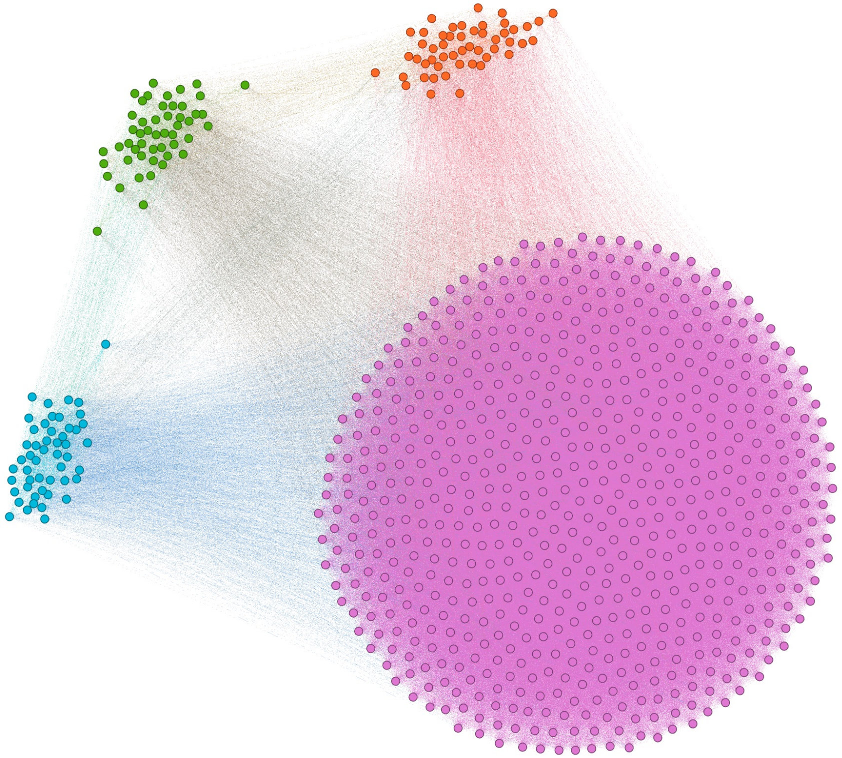
Challenges

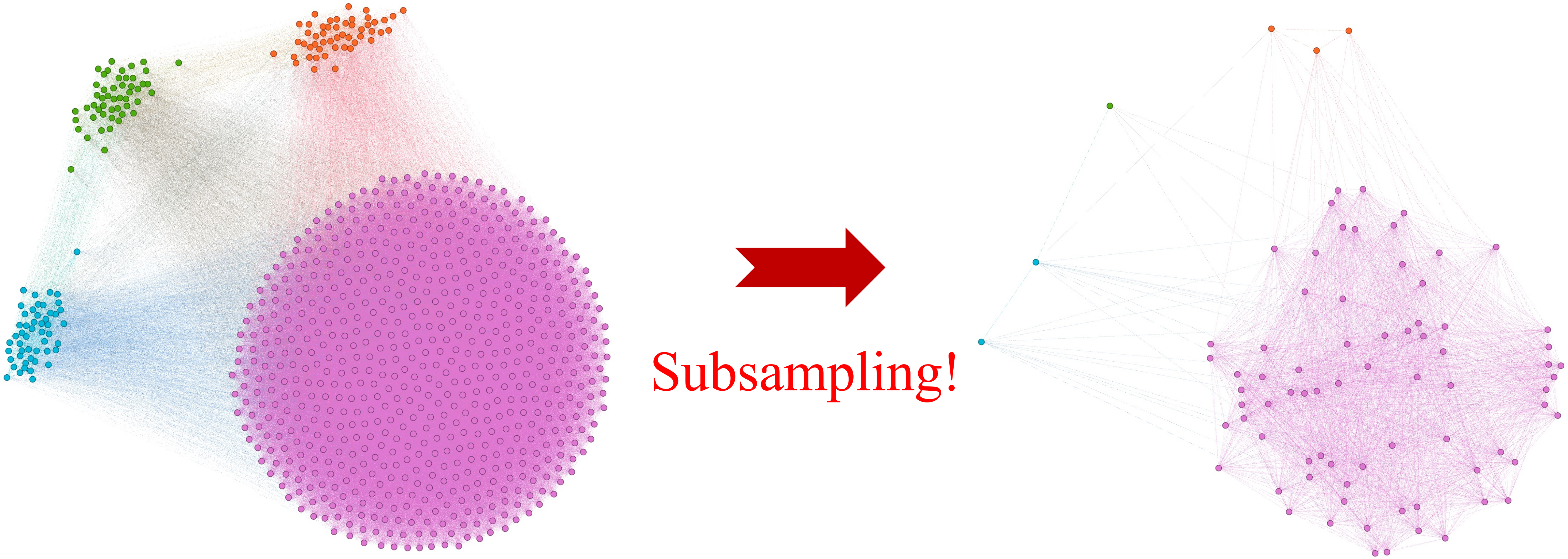
How to tackle huge networks?



Computational cost of network cross validation:

$$O(n^3)$$

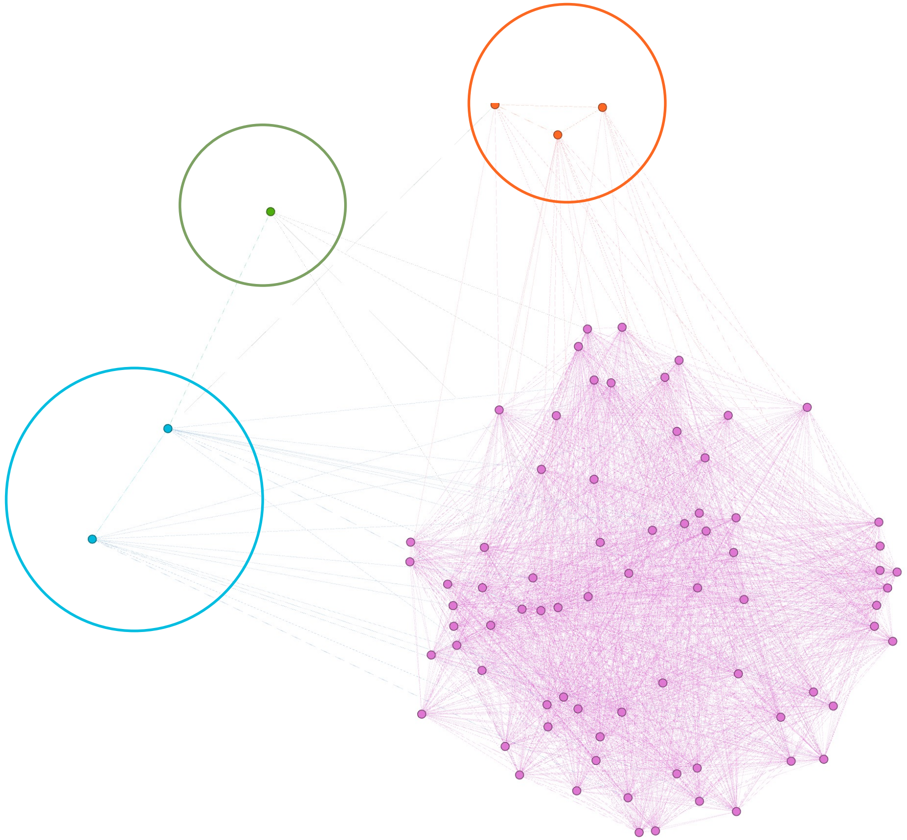
Solution



Subsampling!

Related Work

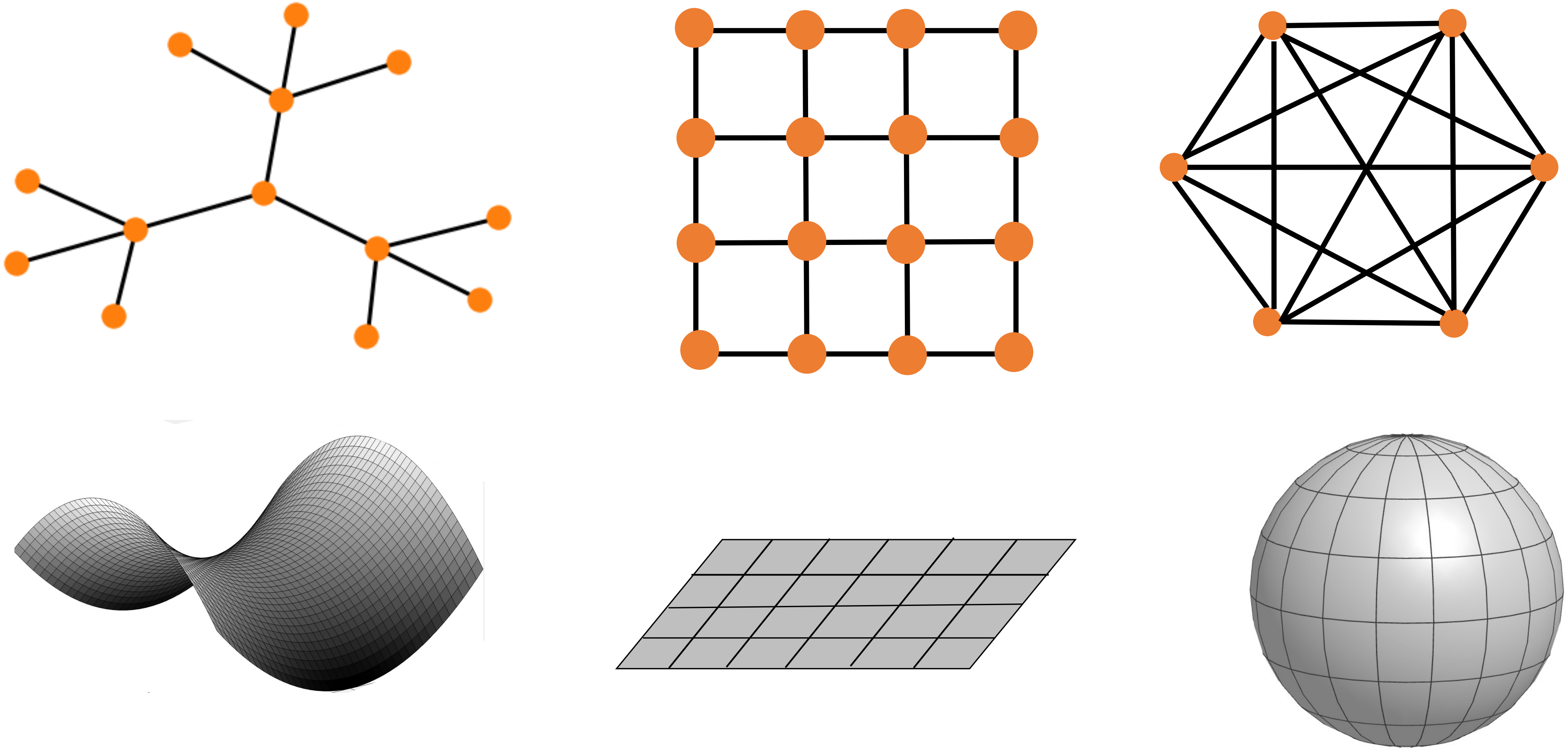
- ➢Node sampling
- ➢Edge sampling
- ➢Exploration sampling



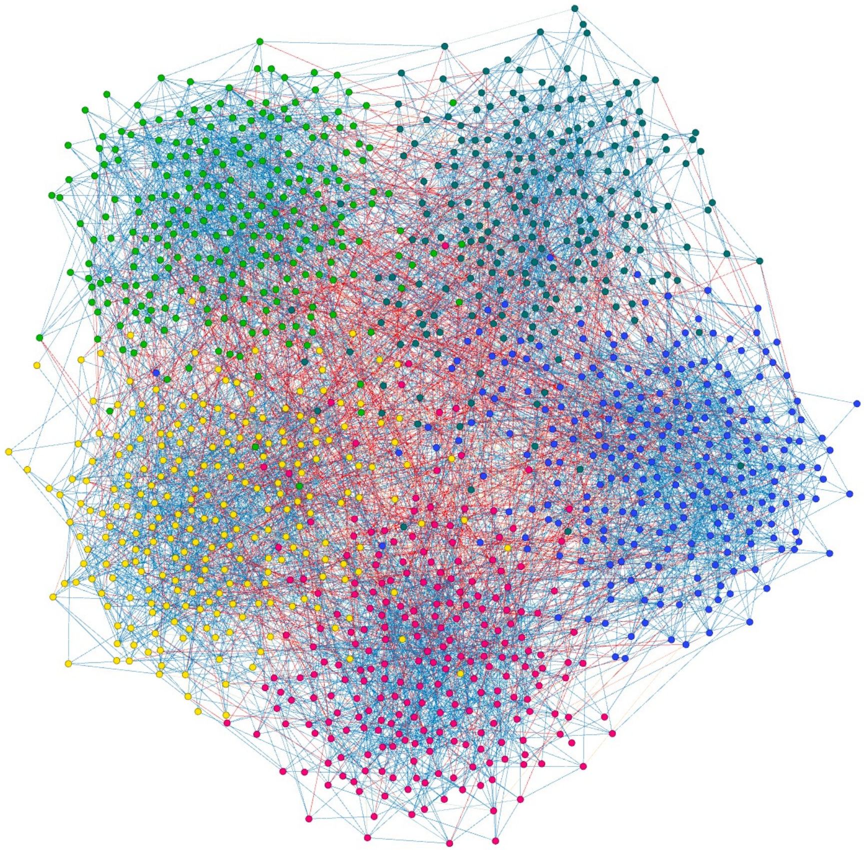
Underestimate *K* !

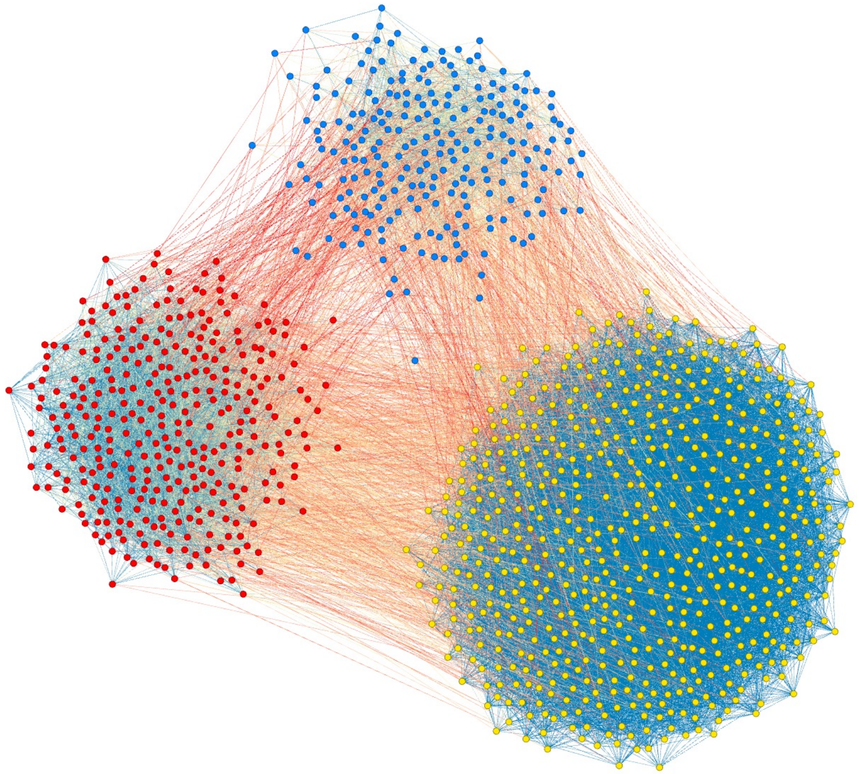
How to exploit community information?

Underling Manifold of Graphs



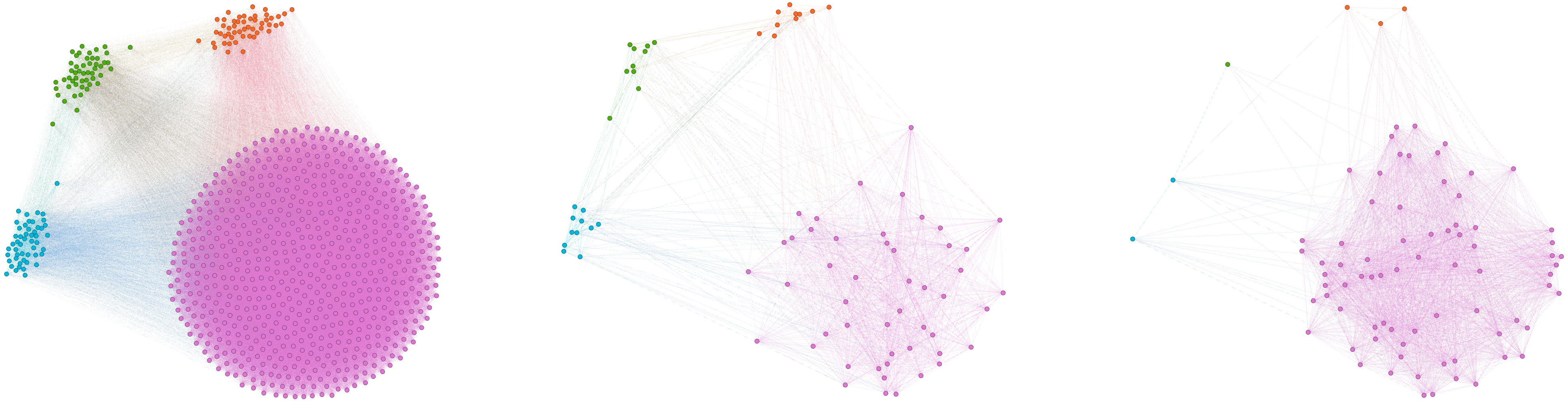
Ollivier Ricci (OR) Curvature





OR Curvature Gradient-based (ORG) Graph Subsampling

$$\left(x^{(i+1)}, y^{(i+1)}\right) = \text{argmax}_{(x,y)\in\Delta\left(\left(x^{(i)},y^{(i)}\right)\right)}\left|\kappa(x,y), \kappa\left(x^{(i+1)}, y^{(i+1)}\right)\right|$$



Given arbitrary community B_i, we have:

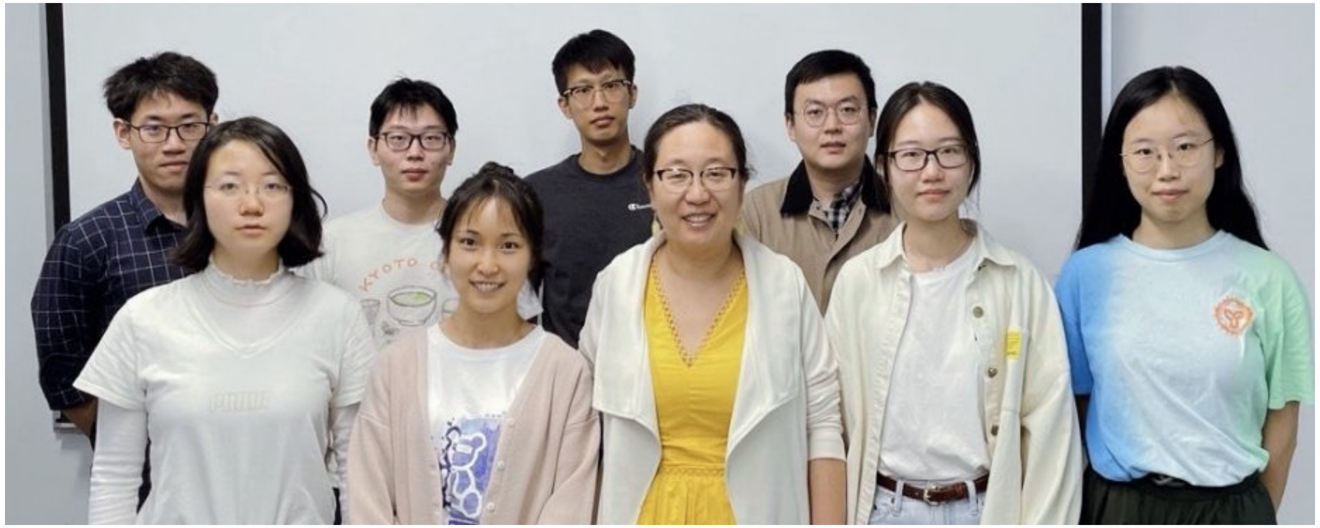
$$P(\exists v_{RW} \in G_{RW}[S]: v_{RW} \in B_i) < P(\exists v_{ORG} \in G_{ORG}[S]: v_{ORG} \in B_i)$$

Experiment Results

Dataset	Prop.	ORG-sub	MHRW	CSE	FFS	Snowball	RW	MDRW
Polbooks (T: 1.88 s)	10%	**0.00** **(T: 0.10 s)**	1.20	0.62	2.68	0.48	0.33	0.00
Polblogs (T: 48.6 s)	5%	**0.00** **(T: 0.23 s)**	1.87	0.90	2.00	0.43	1.03	0.30
PubMed (T: NA)	2%	**0.00** **(T: 4.42 s)**	0.30	0.80	0.40	0.20	1.20	1.80

Time of estimation of M is the much lower than full sample!
Error of estimation of M is the lowest!

Acknowledgement



https://github.com/SavannahWu99/Graph-Subsampling

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