

A Simulated Annealing Approach to Social Network Anonymization

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Motivation

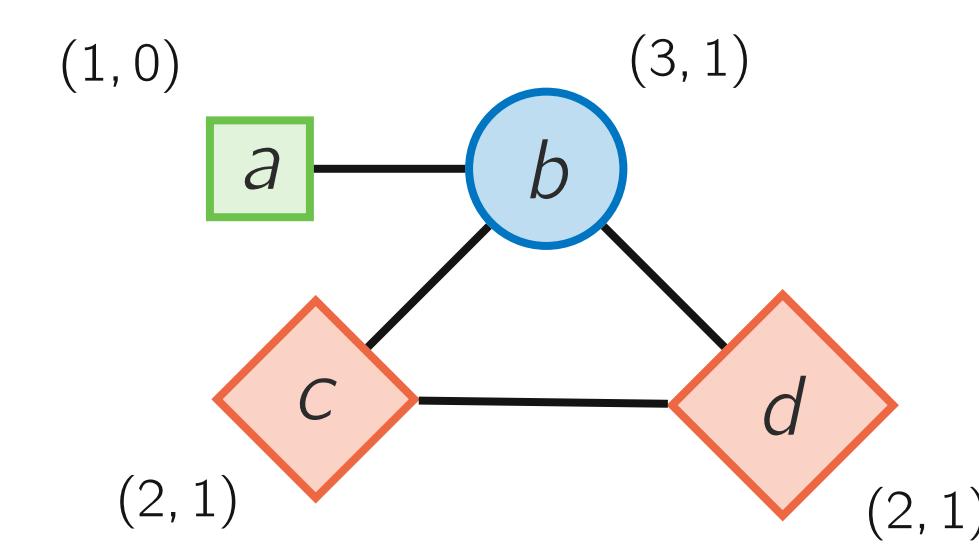
- Share social network, preserve privacy.
- Pseudonymization \neq privacy.
- Vulnerable to attacks based on structure.
- Anonymize with minimal edge deletions.

(n, m)-Anonymity

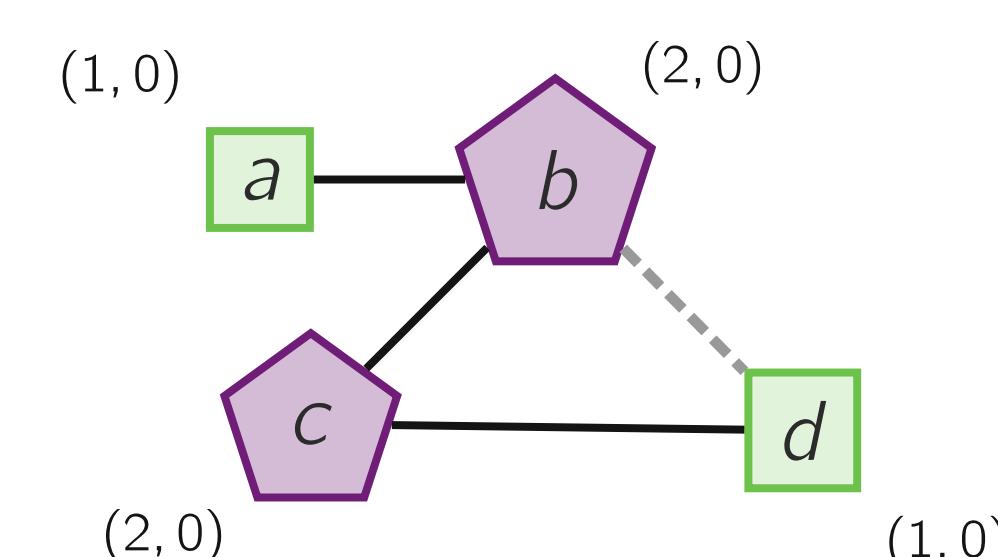
n: degree; m: number of incident triangles.

Each node has an (n, m) signature.

2-anonymity: no signature is unique.

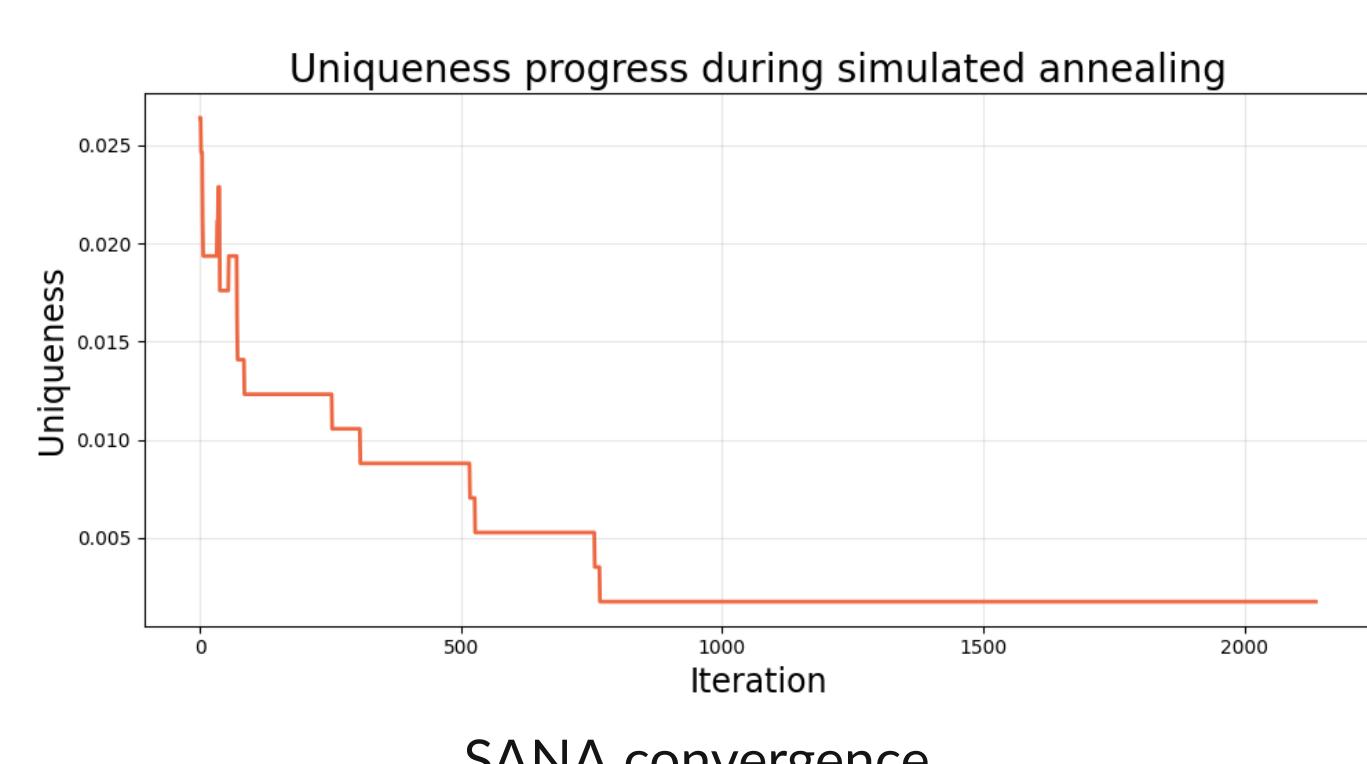


Nodes a and b are unique – high re-identification risk.



Removing edge (b, d) makes the network 2-anonymous.

Simulated Annealing



SANA convergence.

Starts with flexible, exploratory moves,
then converges as the temperature cools.

Networks

Network	V	E	Density
Copnet SMS	568	697	0.004
FB food pages	620	2102	0.011
Copnet FB	800	6429	0.020
CollegeMsg.	1899	13 838	0.008
Ca-GrQc	5242	14 496	0.001
Hamsterster	2426	16 630	0.006
FB ego	4039	88 234	0.011



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Github
code

E.D.Arsene@student.tudelft.nl

<https://github.com/arsenedenisa/Simulated-Annealing-for-Network-Anonymization>

SANA

Simulated
Annealing for
Network
Anonymization

Minimal changes.
Maximal privacy.

Up to 18 \times more
anonymized nodes.
Same speed.
Same data utility.



Preprint
paper



Github
code

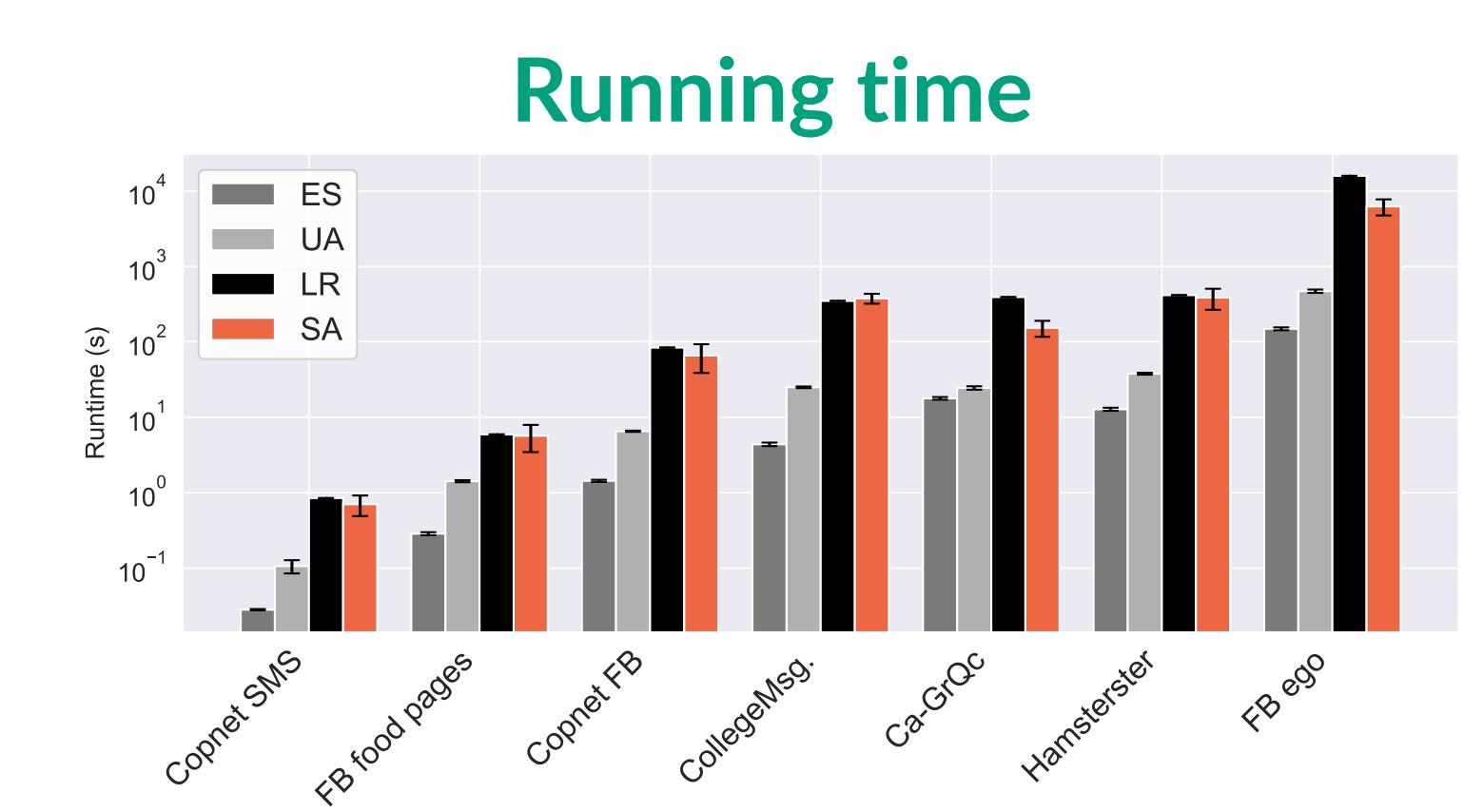
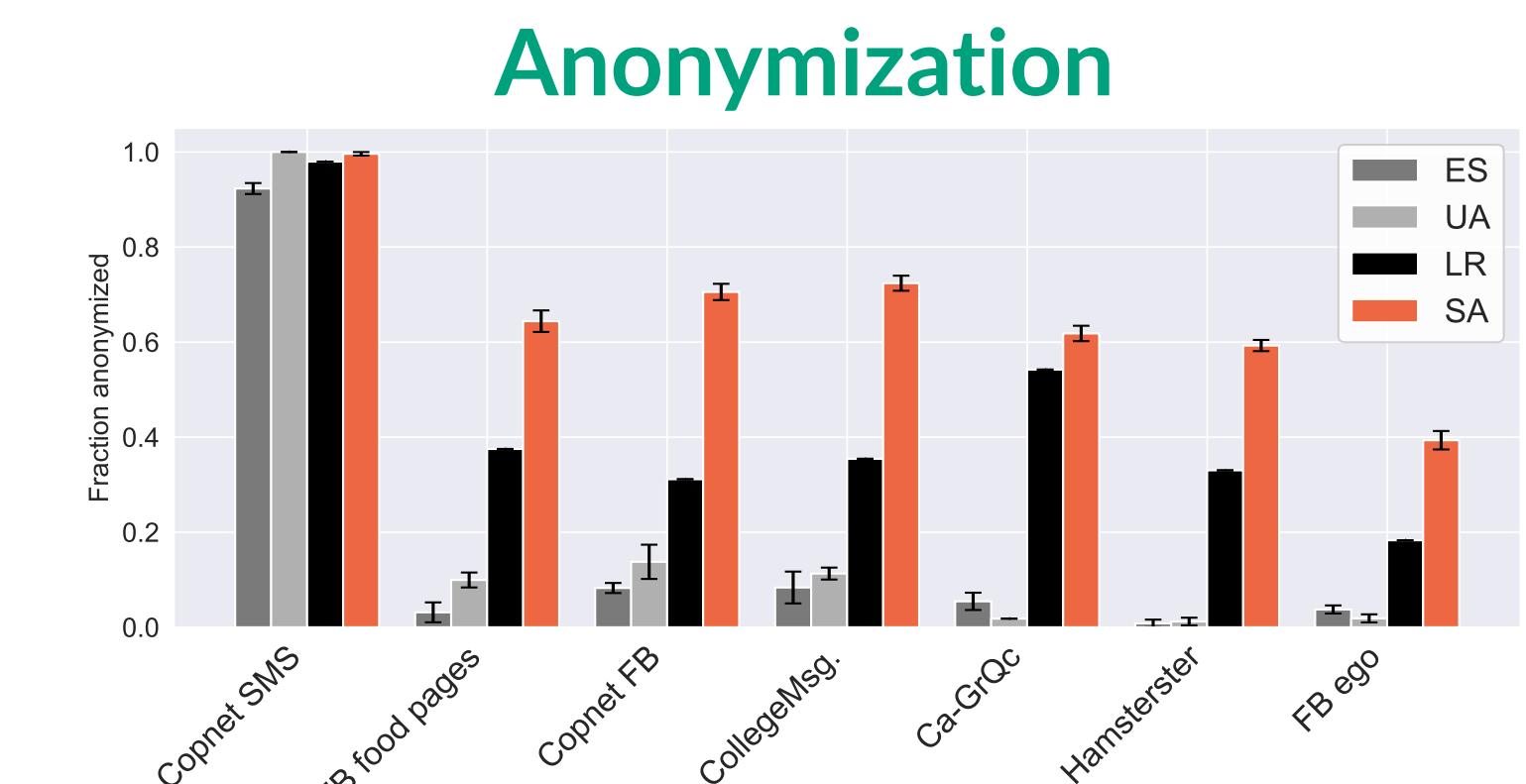
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Network-Anonymization

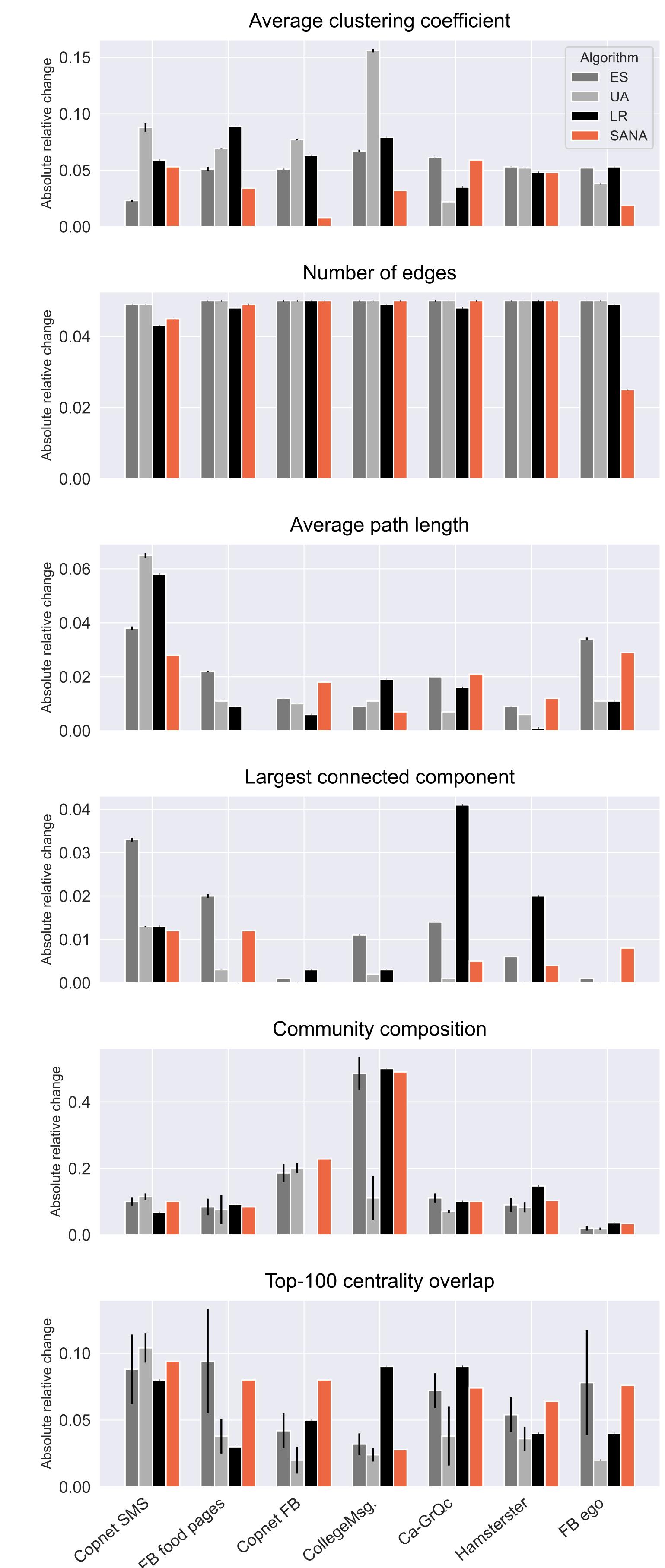
Results

- **Setup:** 7 social networks, 5% edge-deletion budget.
- **Anonymization:** up to 18 \times more nodes anonymized than competitors.
- **Running time:** Similar to Logistic Regression.
- **Utility:** Metrics change by < 9%, except for community.



Data Utility

Smaller absolute relative change indicates better utility preservation.



Takeaway

- SANA: fast and better anonymization.
- Scales better with input size.

Next challenges

- Multi-objective anonymity + utility.
- Dynamic (real-time) anonymization.