GRAND : GRAPH RECONSTRUCTION FROM POTENTIAL PARTIAL ADJACENCY AND NEIGHBORHOOD DATA

Does **collaboration** to analyze distributed graphs reveal **sensitive information** about **private subgraphs** ?

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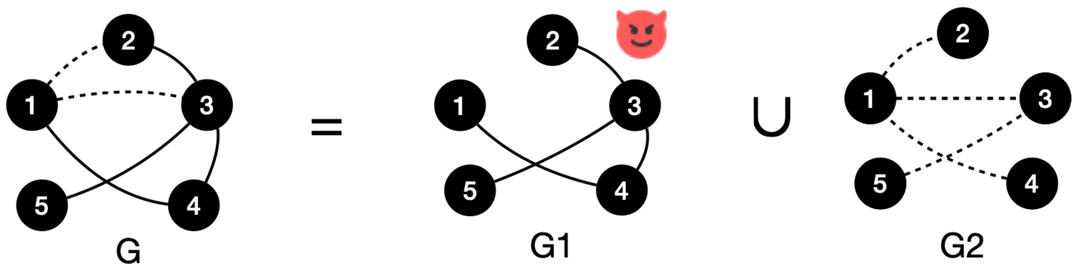
1.CONTEXT

Consider two social media platforms owning graphs that represent user friendships.

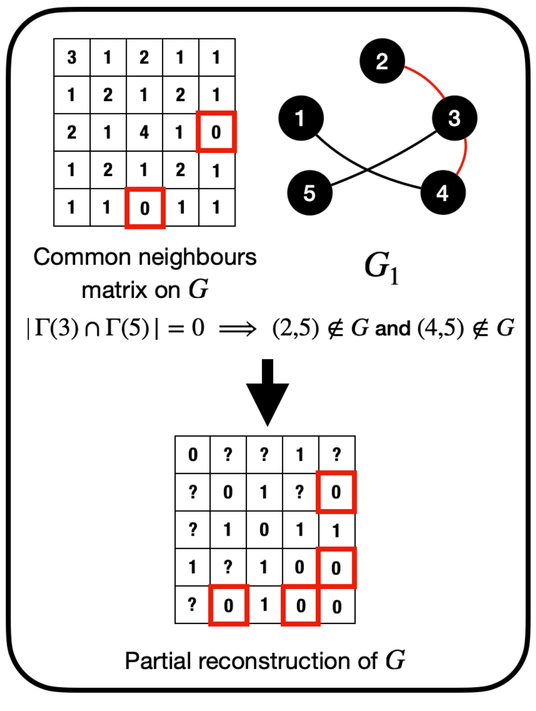
- All users (nodes) belong to both graphs
- Each agency has its own friendship network between users (i.e. the edges are distributed between the two graphs such that each edge belongs to the first, the second or both)



2.OBJECTIVES

- How accurately can the dishonest party **reconstruct the union graph** based on the common neighbors matrix and the partial graph ?
- More generally, how can an adversary reconstruct a graph from its common neighbors matrix and partial graph knowledge ?

31.STRUCTURE-BASED RECONSTRUCTION



REFERENCES

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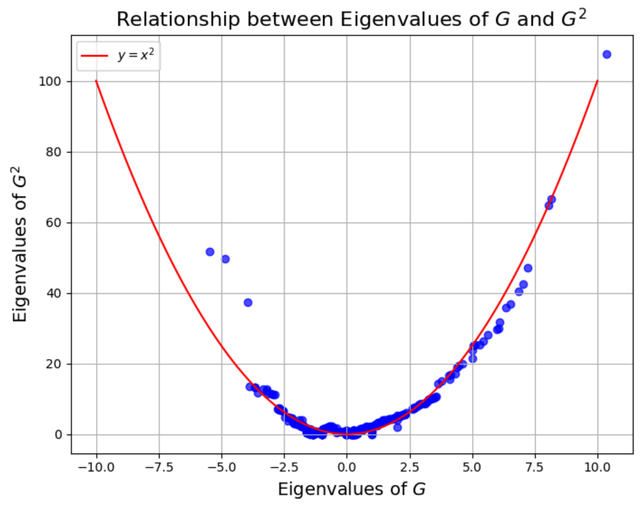
[2] Didem Demirag, Mina Namazi, Erman Ayday, and Jeremy Clark (2023). Privacy-Preserving Link Prediction. In Data Privacy Management, Cryptocurrencies and Blockchain Technology.

[3] Dora Erdös, Rainer Gemulla Evimaria Terzi (2012). Reconstructing Graphs from Neighborhood Data. In 2012 IEEE 12th International Conference on Data Mining.

3.2. SPECTRUM-BASED RECONSTRUCTION

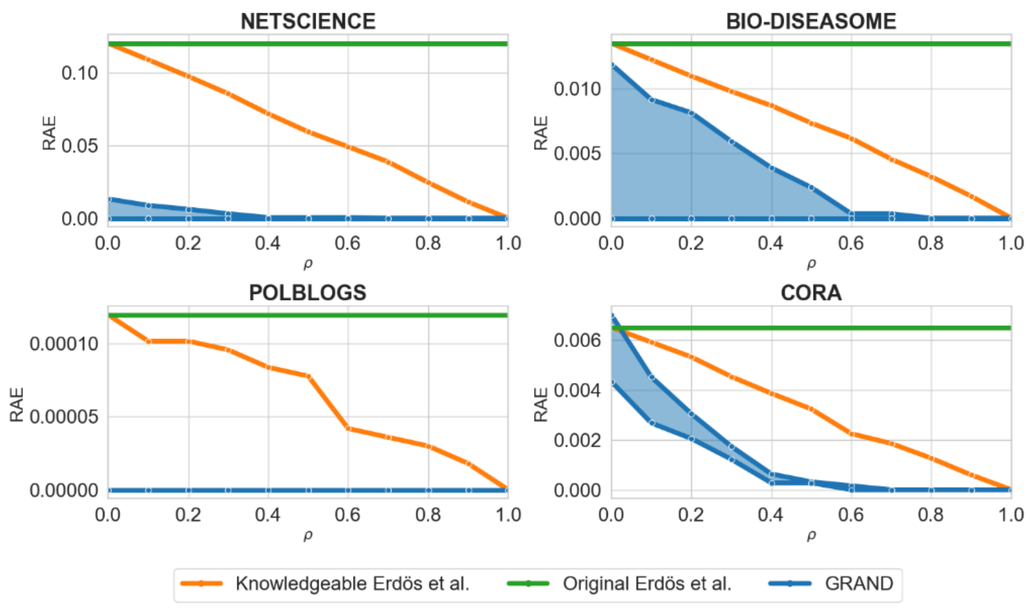


The eigen values of the common neighbors matrix are the squares of the eigenvalues of the initial matrix.

G has eigenvalues which :

- squared, are the eigenvalues of the common neighbors matrix
- Make the graph close to the known partial information

4. ANALYSIS



5.CONCLUSION

- Common neighbors matrix does leak a lot of information about the initial graph
- Partial knowledge further improves graph reconstruction
- Different graphs can have the same common neighbors matrix !