

networks, networks everywhere!

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slides are available online

- ▶ html notes: ericmjl.github.io/big-data-boston-2016
- ▶ slides: ericmjl.github.io/big-data-boston-2016/slides.pdf
- ▶ source: github.com/ericmjl/big-data-boston-2016

about myself

- ▶ doctoral candidate, MIT biological engineering
- ▶ self-taught pythonista
- ▶ using networks to solve problems in infectious disease ecology, evolution & biochemistry

outline

1. what are networks?
2. example 1: recommendation systems
3. example 2: panama papers
4. example 3: influenza ecology & evolution
5. example 4: neural networks on networks

what are networks

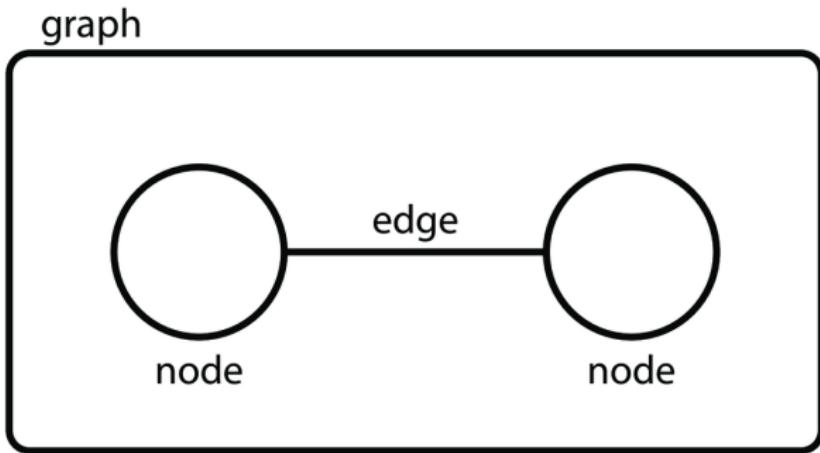


Figure 1: networks, a.k.a. **graphs**, are composed of **nodes** (circles) and **edges** (lines)

example 1: recommendation systems

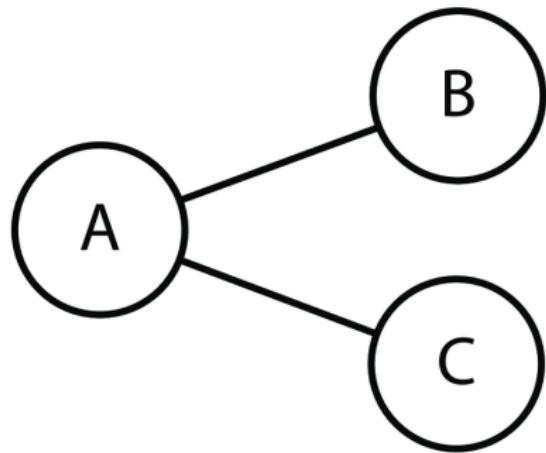


Figure 2: if A is connected to B and C, but B and C are not connected, then maybe they should be!

example 1: recommendation systems

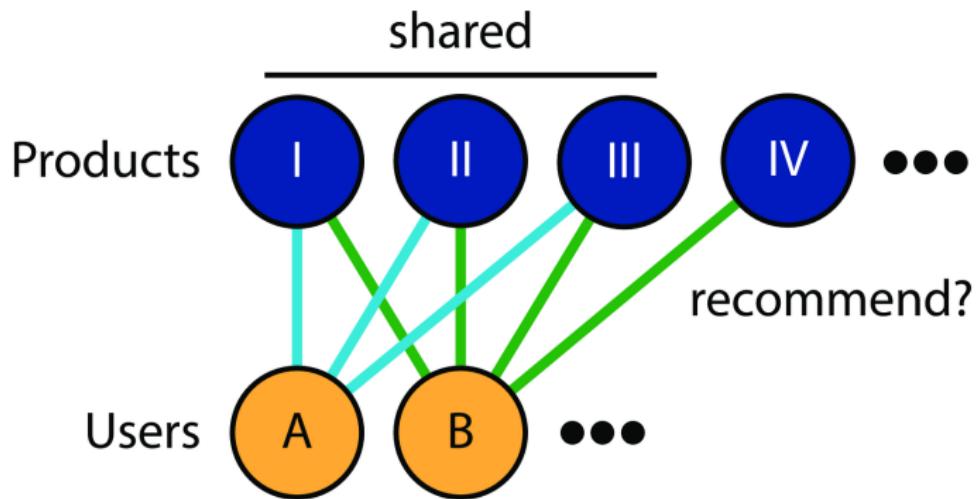


Figure 3: if A and B share overlapping interests, then maybe some of B's interests can be recommended to A.²

²Collaborative filtering

example 2: panama papers

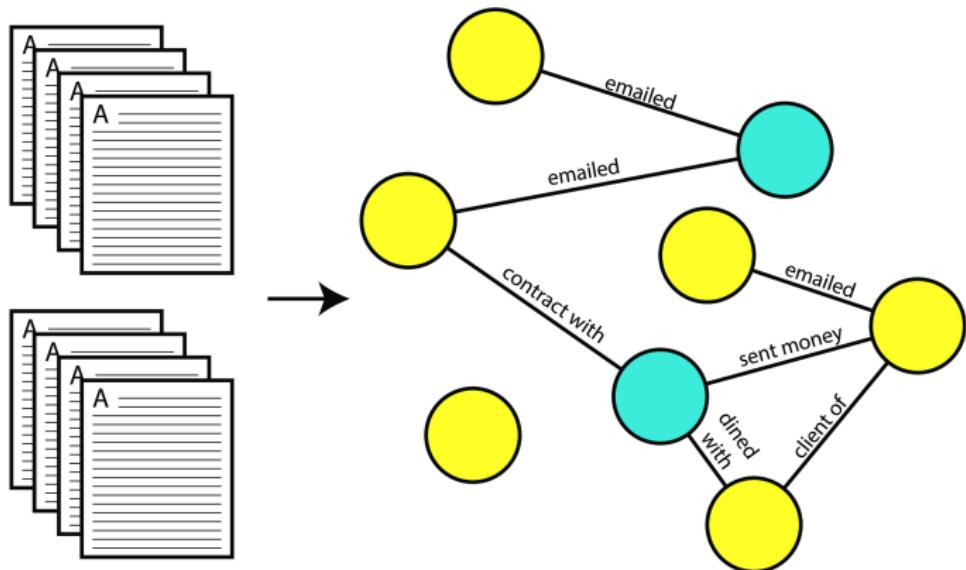


Figure 4: graph databases were used to show how the rich hide their money.⁴

⁴ICIJ and Neo4j unravel the panama papers.

example 3: influenza ecology and evolution

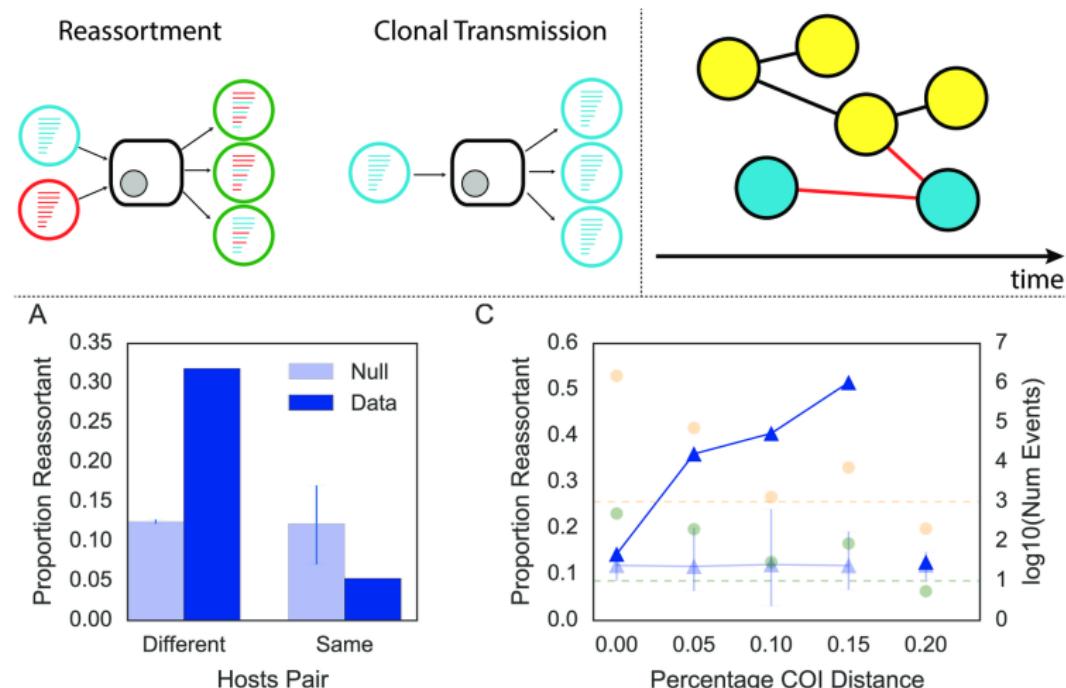


Figure 5: for influenza, gene shuffling probably helps in host switching.⁵

⁵Reticulate evolution is favoured in influenza niche switching.

example 4: neural networks on networks

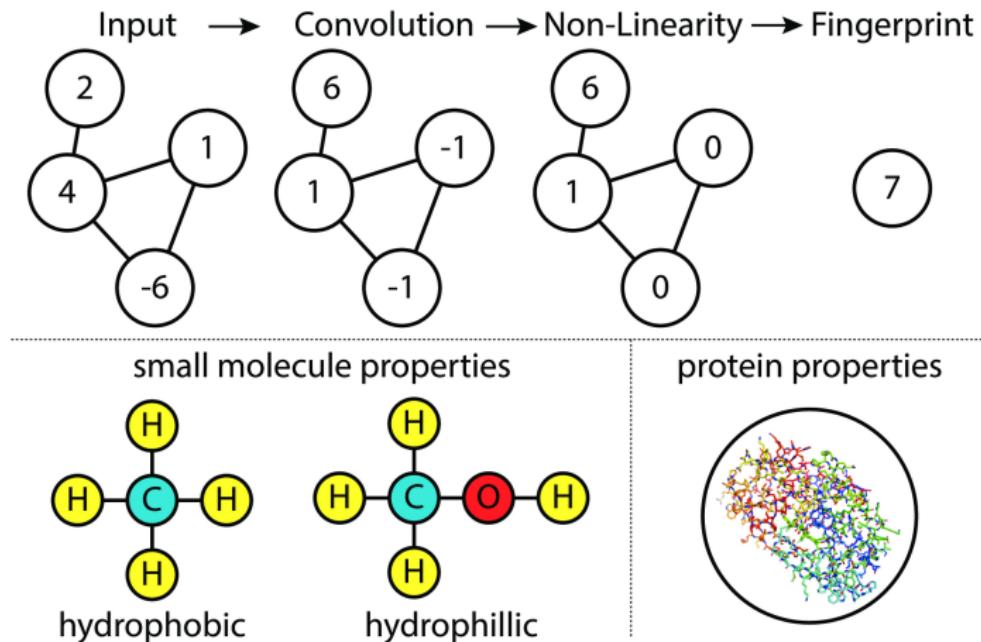


Figure 6: graph convolutions let us do machine learning on graph-structured data.⁷

⁷Convolutional Networks on Graphs for Learning Molecular Fingerprints

visualize networks rationally

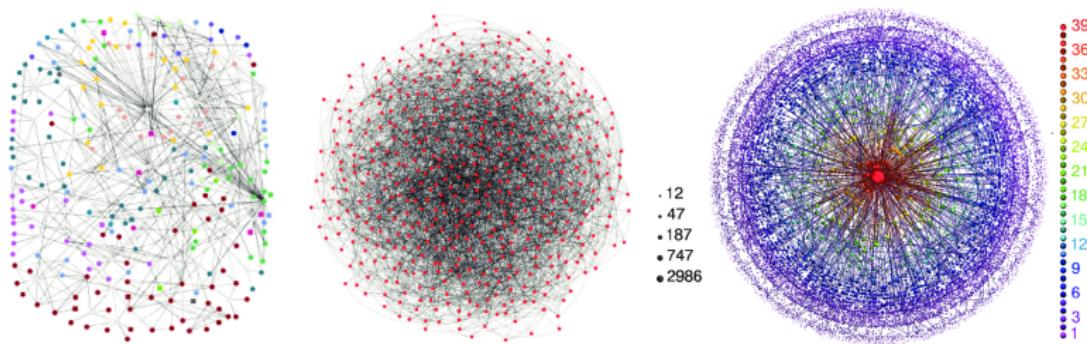


Figure 7: move away from the hairball!

visualize networks rationally

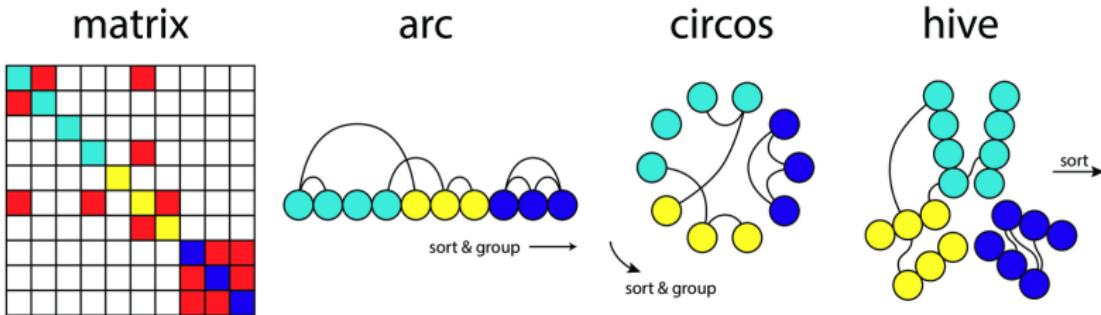


Figure 8: rational network visualizations prioritize placement of nodes

conclusions

- ▶ think relationally
- ▶ networks can be used creatively to solve all sorts of problems

keep in touch

- ▶ personal website: ericmj.com
- ▶ linkedin: linkedin.com/in/ericmj
- ▶ datacamp: network analysis course coming within the next few months!
- ▶ available for training your staff on data analysis and network science