

networks, networks everywhere!

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slides are available online

- ▶ html notes: [ericmjl.github.io/big-data-boston-2016](http://ericmjl.github.io/big-data-boston-2016)
- ▶ slides: [ericmjl.github.io/big-data-boston-2016/slides.pdf](http://ericmjl.github.io/big-data-boston-2016/slides.pdf)
- ▶ source: [github.com/ericmjl/big-data-boston-2016](https://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

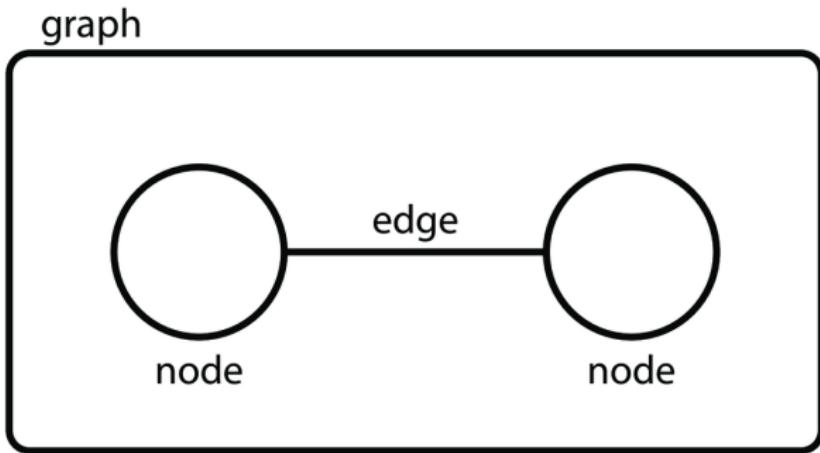


Figure 1: networks, a.k.a. **graphs**, are composed of **nodes** (circles) and **edges** (lines)

## example 1: recommendation systems

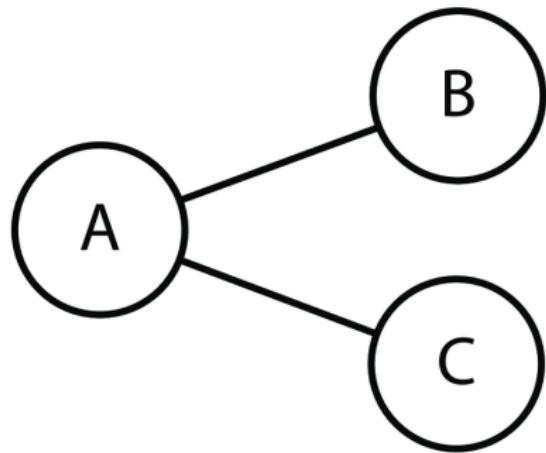


Figure 2: if A is connected to B and C, but B and C are not connected, then maybe they should be!

## example 1: recommendation systems

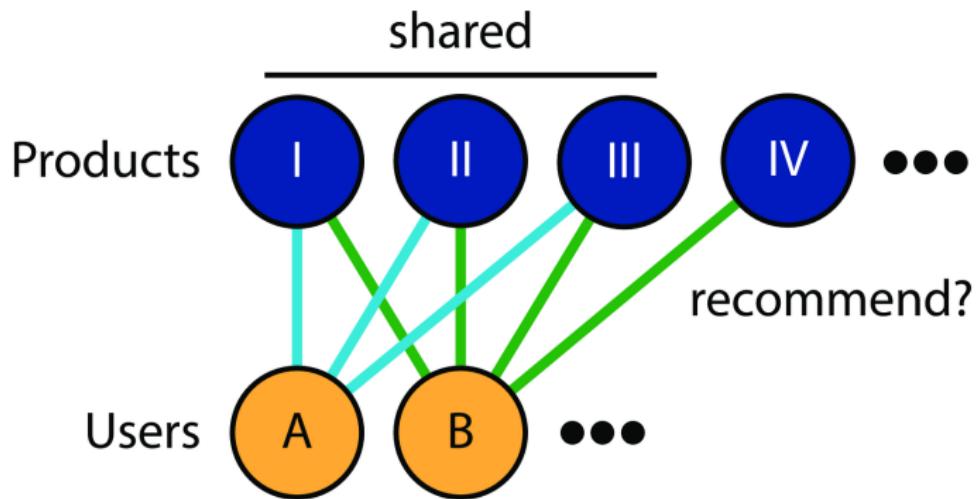


Figure 3: if A and B share overlapping interests, then maybe some of B's interests can be recommended to A.<sup>2</sup>

<sup>2</sup>Collaborative filtering

## example 2: panama papers

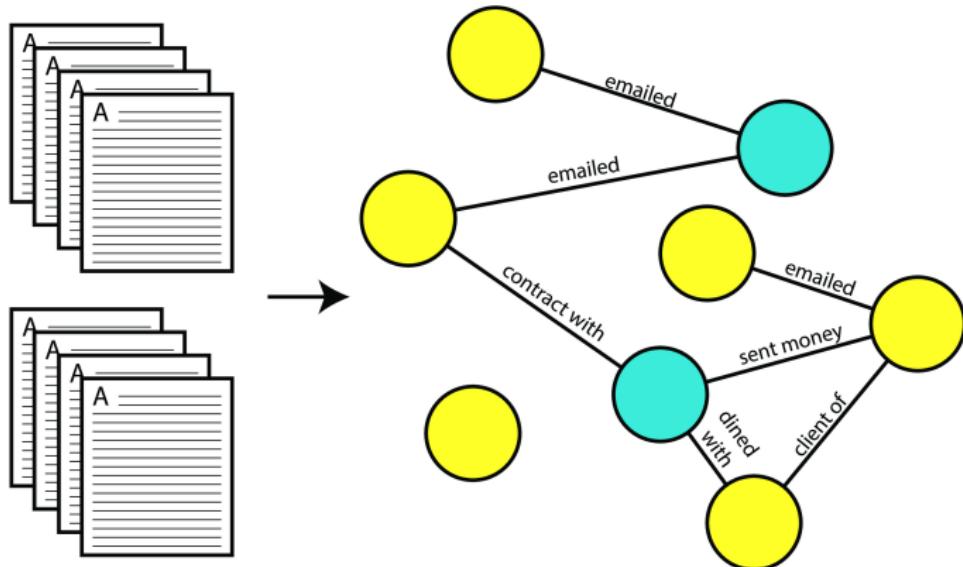


Figure 4: graph databases were used to show how the rich hide their money.<sup>4</sup>

<sup>4</sup>International Consortium of Investigative Journalists (ICIJ) and Neo4j unravel the panama papers.

## example 3: influenza ecology and evolution

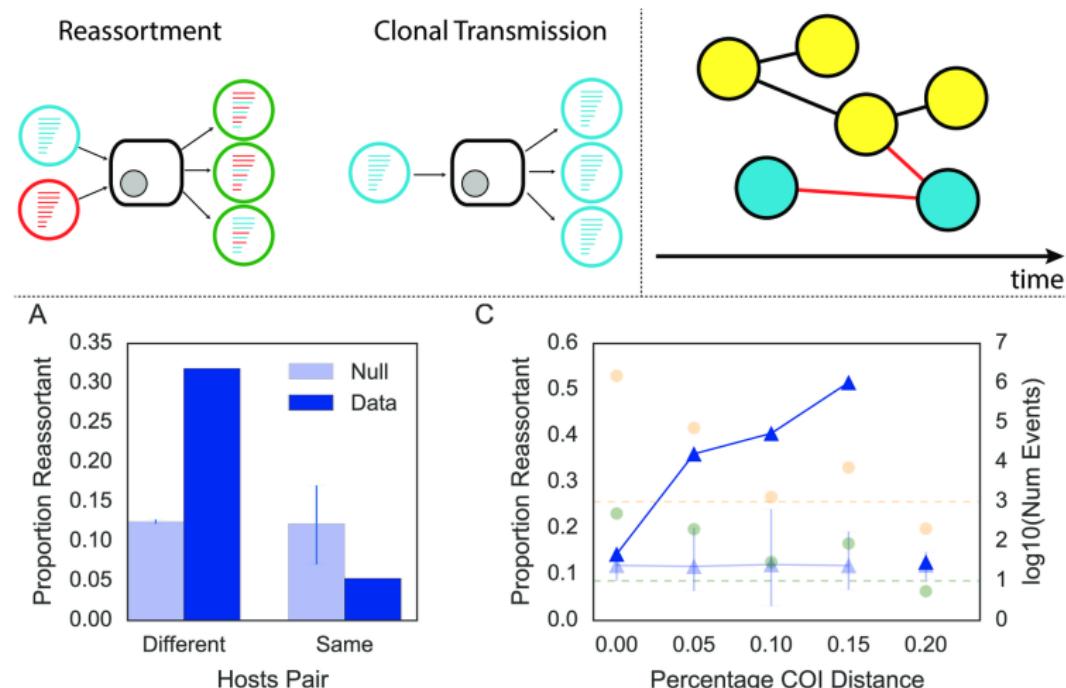


Figure 5: for influenza, gene shuffling probably helps in host switching.<sup>5</sup>

<sup>5</sup>Reticulate evolution is favoured in influenza niche switching.

## example 4: neural networks on networks

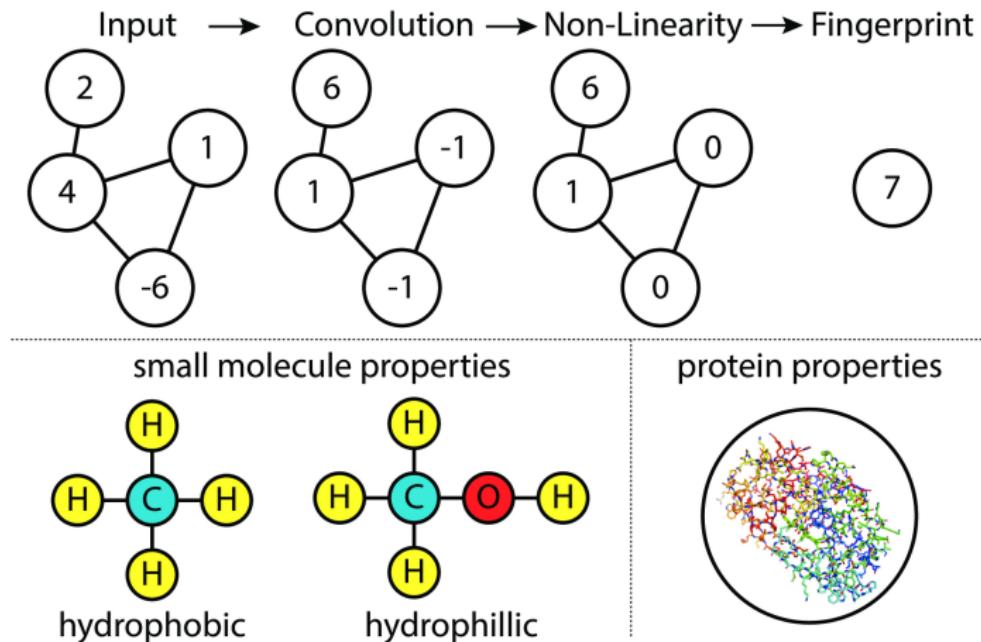


Figure 6: graph convolutions let us do machine learning on graph-structured data.<sup>7</sup>

<sup>7</sup>Convolutional Networks on Graphs for Learning Molecular Fingerprints

# visualize networks rationally

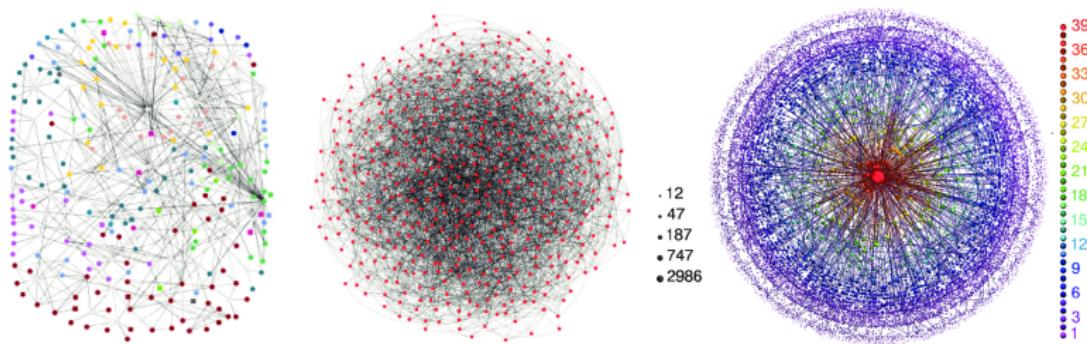


Figure 7: move away from the hairball!

# visualize networks rationally

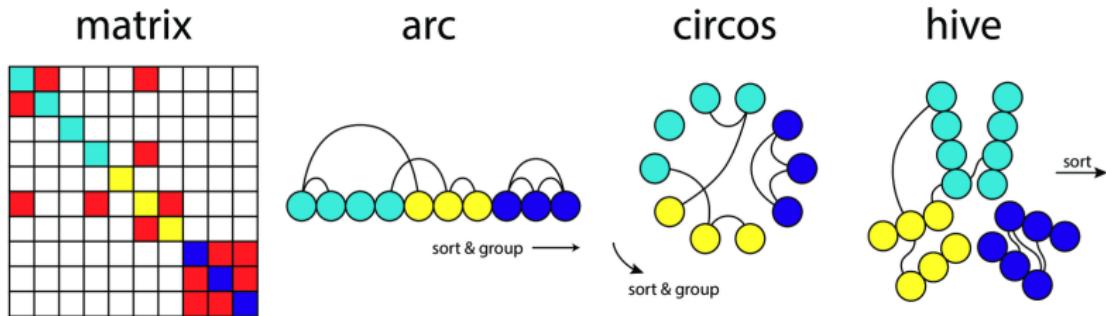


Figure 8: rational network visualizations prioritize placement of nodes

## 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