http://arcs.di.unito.it

http://www.di.unito.it/~ruffo

giancarlo.ruffo@unito.it

@giaruffo

Giancarlo Ruffo *- Università degli Studi di Torino (Italy)*

The Science of (Fighting) Fake News

Using network science to model, analyze, and mitigate misinformation diffusion in social media

June 14-18th, 2021

What I do (and don't....)

- Academic and industrial research
- Data and network analysis
- Models of diffusion processes
- Social media and data as a resource
  - the interplay between 'segregation' and 'polarization'
  - rational motivations

- I don't debunk, I am not a journalist
- I don't look for automatic identification of true and false news
- I do not target social media as evil
  - I don't believe in censorship or freedom of speech limitations
  - I don't look for simple explanations to complex problems (e.g., gullible people is also stupid!)

Course overview

- June 15th:
  - Problem definition and basic terminology
  - Introduction to Network Science
  - Understanding the structure of an information/ misinformation network
- June 16th:
  - Introduction to dynamical processes on Networks
  - Social influence, the emergence of echo chambers and the interplay between segregation and polarization
  - Studying the impact of fact-checking
- June 17th:
  - The role of social bots
  - Open Problems and Trends

Introduction and Terminology

Terminology

Misinformation

Malinformation

Fake-News

Disinformation

Unverified Information

Propaganda

Conspiracy Theories

Urban Legend

Rumors

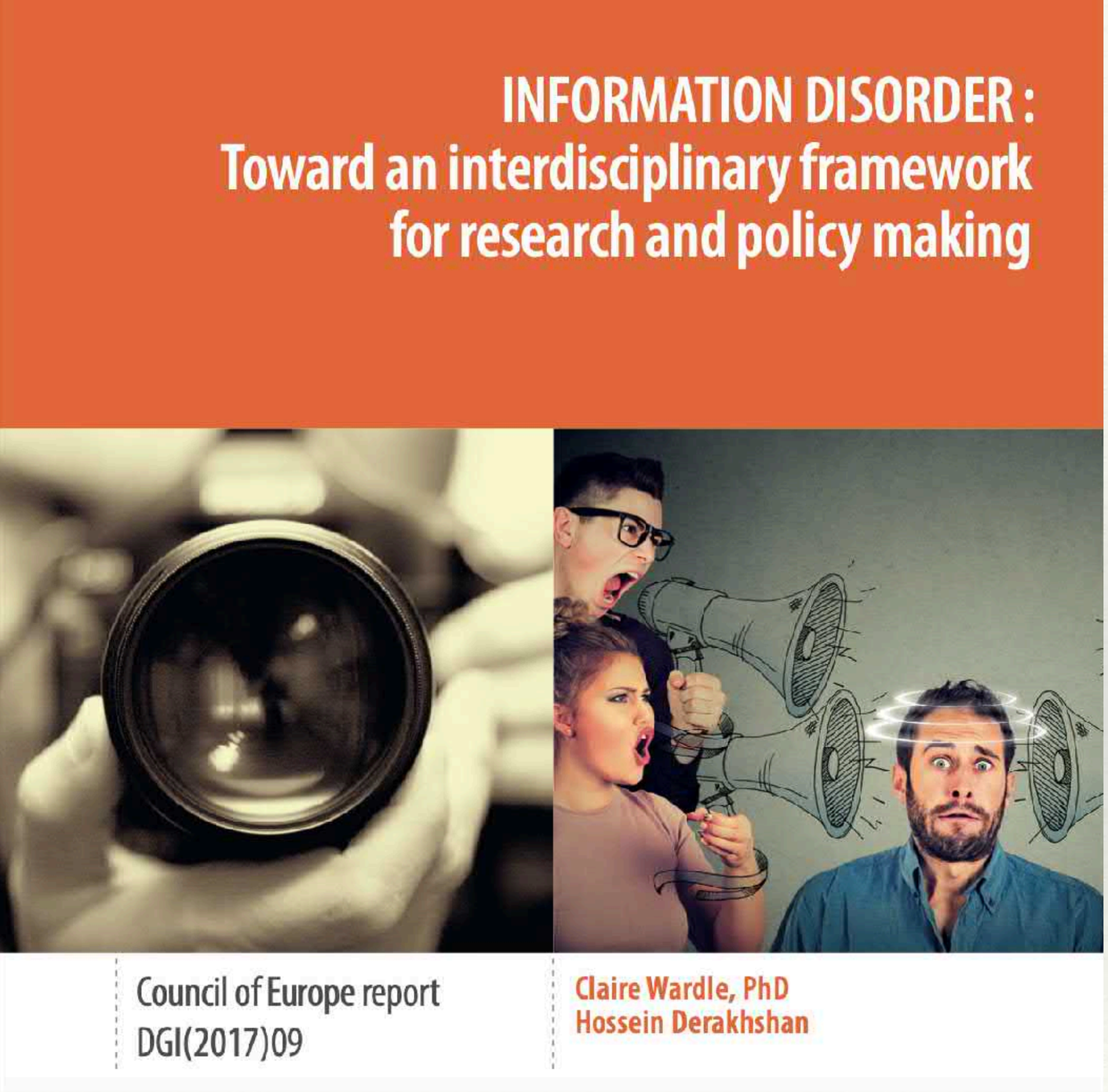
Astroturf

Spam

Troll

Hate Speech

Cyberbullying



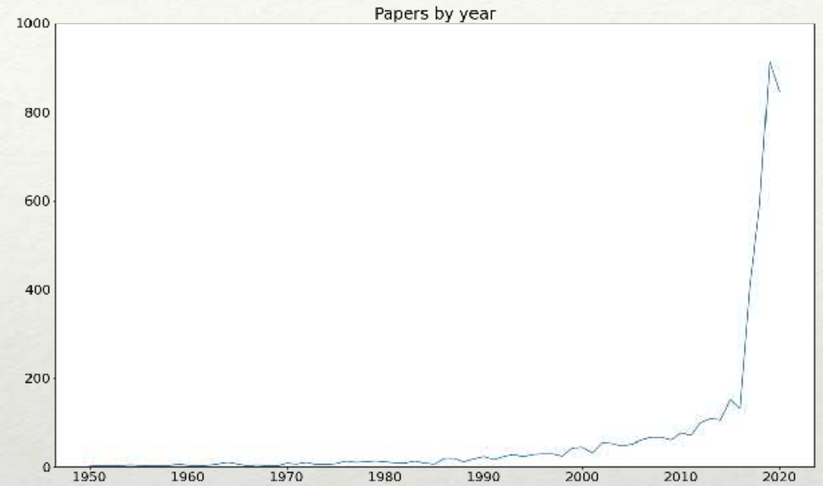
Open fronts:

- defining a language to capture the complexity of the phenomenon
- implications for democracy?
- role of television?
- implications of weakened local media?
- micro-targeting
- computational amplification
- filter bubbles and echo chambers
- declining trust in evidence

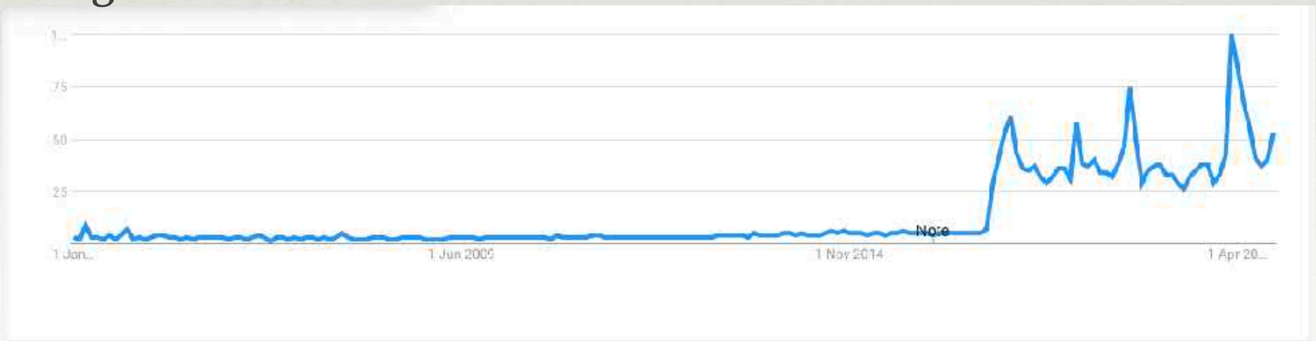
https://rm.coe.int/information-disorder-toward-an-interdisciplinary-framework-for-researc/168076277c

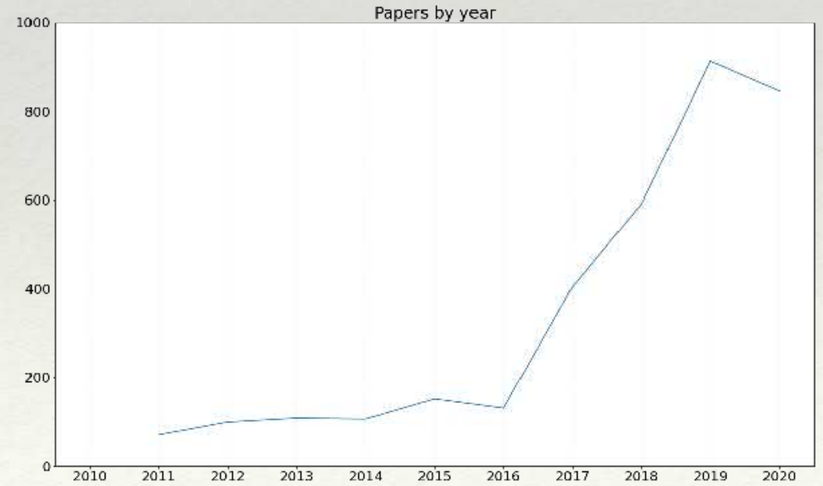
Scientific papers

- How many papers have been published with "fake news" (or related) in the title?
- We built a dataset from Microsoft Academic, and followed citations
- **40,971** papers (and still counting…)
- Explosive growth after 2016

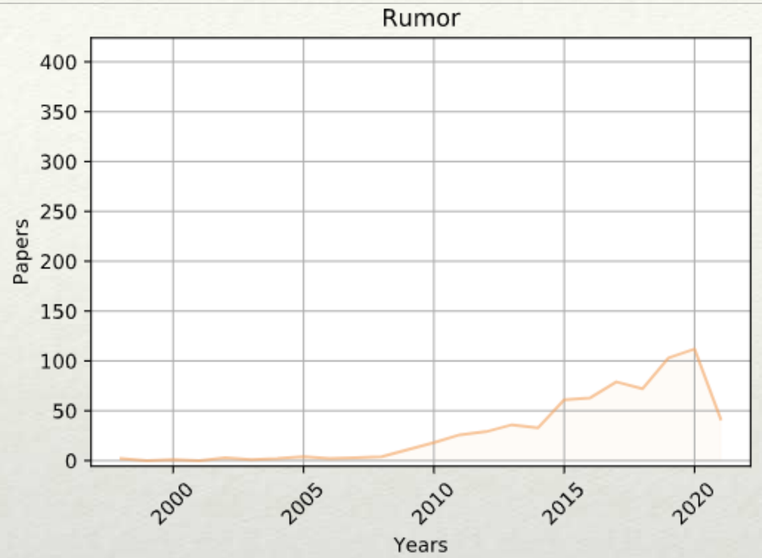


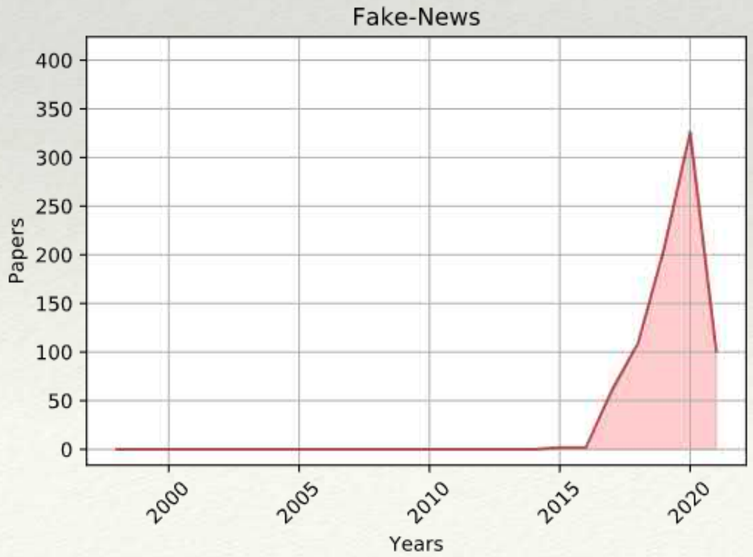
Google Trends

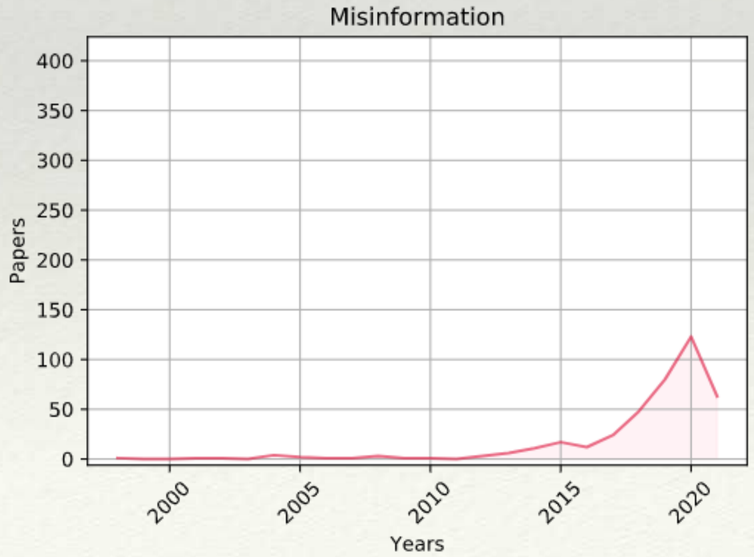


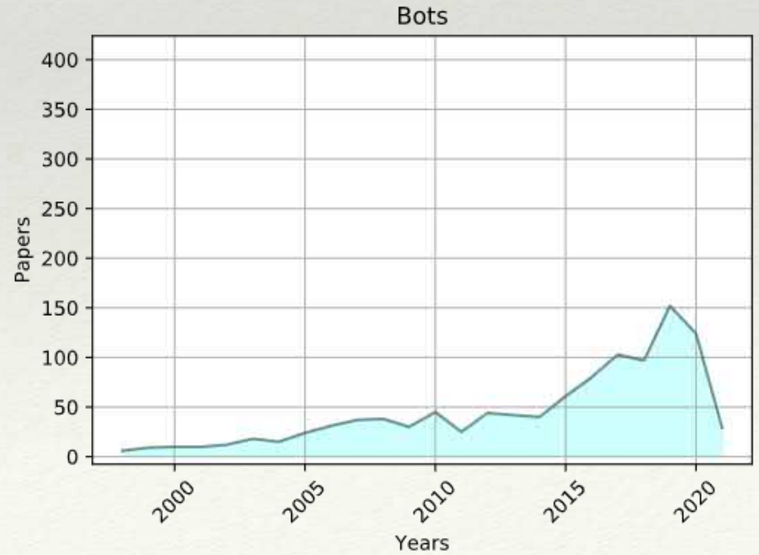


Focusing on DBLP only









Fast growing literature problem

- Although the problem is considered "new", the literature is huge (and very multidisciplinary)
- Difficult to find an objective and general point of view
- This introductory course is necessarily subjective; however we tried to 'discover hidden gems' with a partially automatic search of relevant and potentially influential scientific contributions

FakeNews Research PROJECT | US ARC²S di.unito.it

Alfonso Semeraro

40832 PAPERS

Search among thousands of works about the disinformation problem

1518348 REFERENCES

Don't stop to the most popular papers: find the hidden gems!

ALWAYS UPDATED

We update FakenewsResearch each two weeks. Don't miss the latest out!

Search in title...

+ Advanced Search

Search

http://fakenewsresearch.net

2018 Manifesto

POLICY FORUM | SOCIAL SCIENCE

The science of fake news

David M. J. Lazer, Matthew A. Baum, Yochai Benkler, Adam J. Berinsky, Kelly M. Greenhill, Filippo Menczer, Miriam J. Metzger, Brendan Nyhan, Gordon Pennycook, David Rothschild, Michael Schudson, Steven A. Sloman, Cass R. Sunstein, Emily A. Thorson, Duncan J. Watts, Jonathan L. Zittrain

The list of author affiliations is provided in the supplementary materials.

Email: d.lazer@northeastern.edu
– Hide authors and affiliations

Science 09 Mar 2018:
Vol. 359, Issue 6380, pp. 1094-1096
DOI: 10.1126/science.aao2998

"… much remains unknown regarding the vulnerabilities of individuals, institutions, and society to manipulations by malicious actors."

Prevalence and impact

- ***How common is fake news, and what is its impact on individuals?***
- On average, an American encountered from 1 to 3 stories from fake news publishers before the 2016 elections - H. Allcott, M. Gentzkow, J. Econ. Perspect. 31, 211 (2017)
- False information on Twitter is typically **retweeted by many more people**, and far more rapidly, than true information, especially when the topic is politics - S. Vosoughi et al., Science 359, 1146 (2018)
- By liking, sharing, and searching for information, **social bots** can magnify the spread of fake news by orders of magnitude
  - Identification of bots is a moving target and will therefore remain major ongoing research challenge
- Evaluations of the **medium-to-long–run impact** on political behavior of exposure to fake news are essentially nonexistent in the literature.

Potential interventions

- *How can we empower individuals?*
  - **fact-checking**, whose efficacy is disputed
  - **education**, to improve individual evaluation of the quality of information
- *Ho can we prevent individuals' exposure to fake news?*
  - **adjusting social media business models** to increase emphasis on quality information
  - reducing **personalization** and '**echo-chambers**' effects
  - removing accounts associated to **bots**, when they are found
- Content curation decisions are subject to many **ethical considerations**

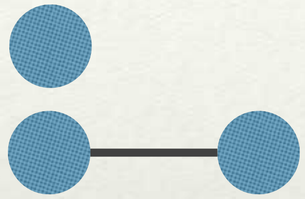
Main questions

- Can we find a language and a framework that is able to capture the complexity of the phenomenon?
- Which are the basic mechanisms that lead to the formation of echo-chambers?
- To which extent an account controlled by a human is vulnerable and manipulable by malicious actors and bots?
- How can we mitigate information spreading?

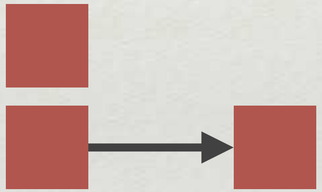
Introduction to Network Science

Networks are "everywhere"

- Social Networks
  - actors (individuals, also agents)
  - social ties



- Information systems
  - book, web page
  - citation, link, retweet

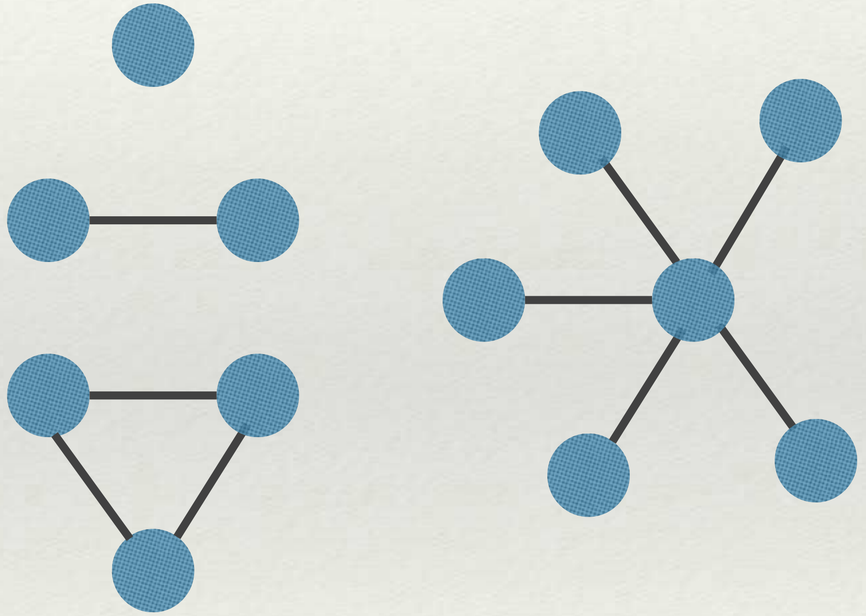


Complex Systems

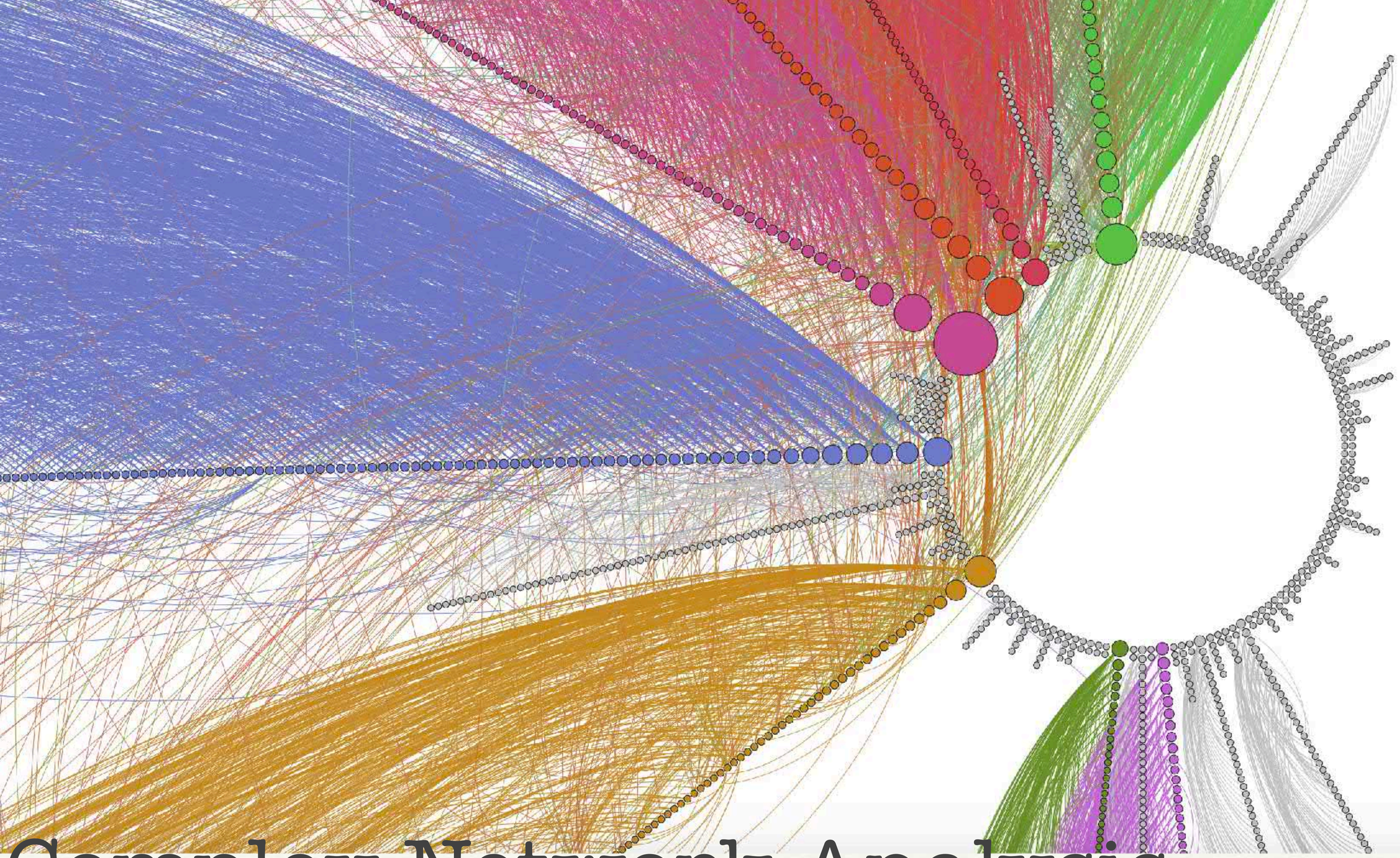
- Complex != Complicated
- composed by many **interacting elements**
- they give rise to emergent **collective phenomena**
- **emergence**: not directly related to individual phenomena
- linearity vs **non linearity**
- **heterogeneous** vs homogeneous

from a local

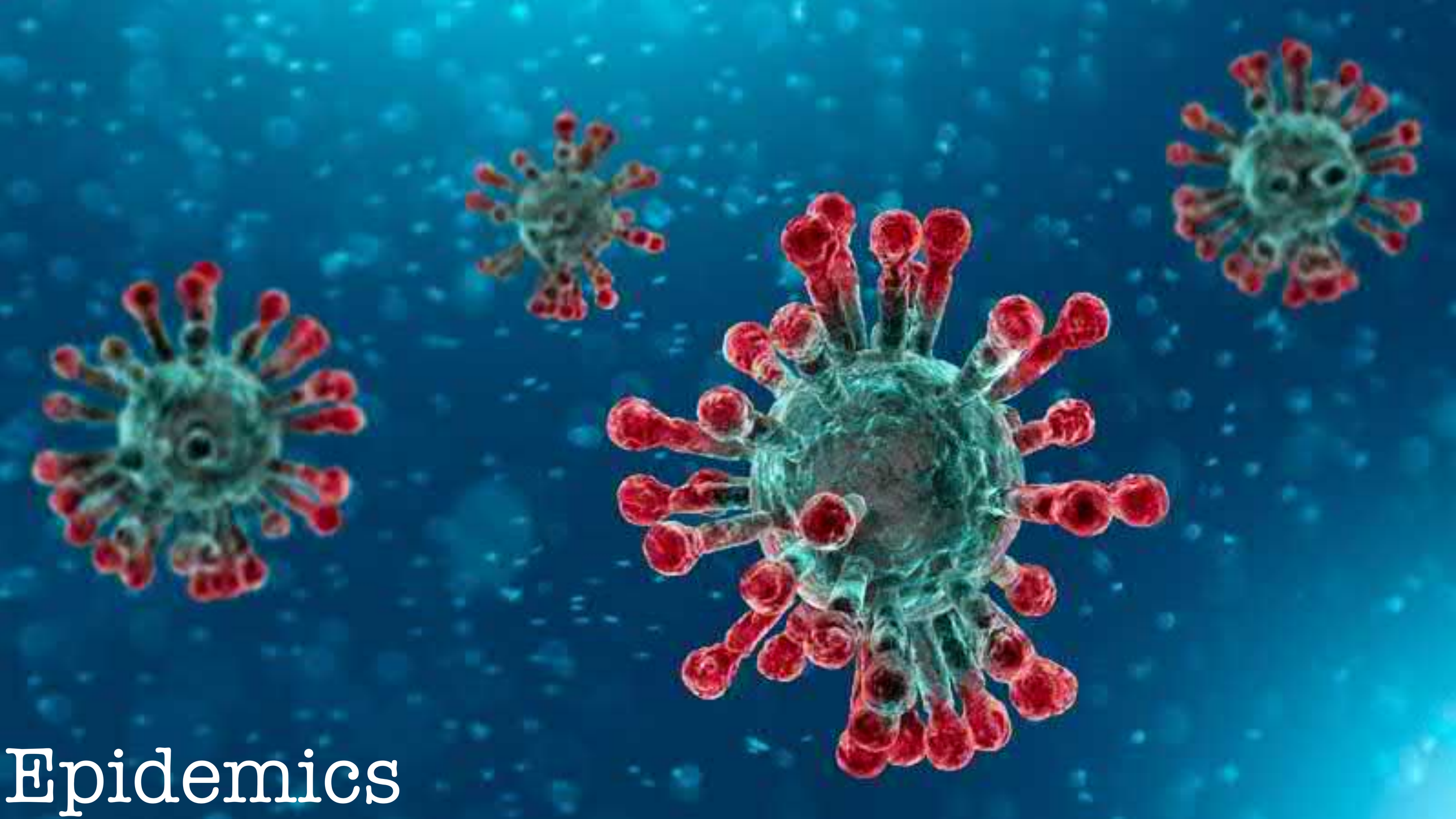
- from the interconnection of small units



to global level phenomena



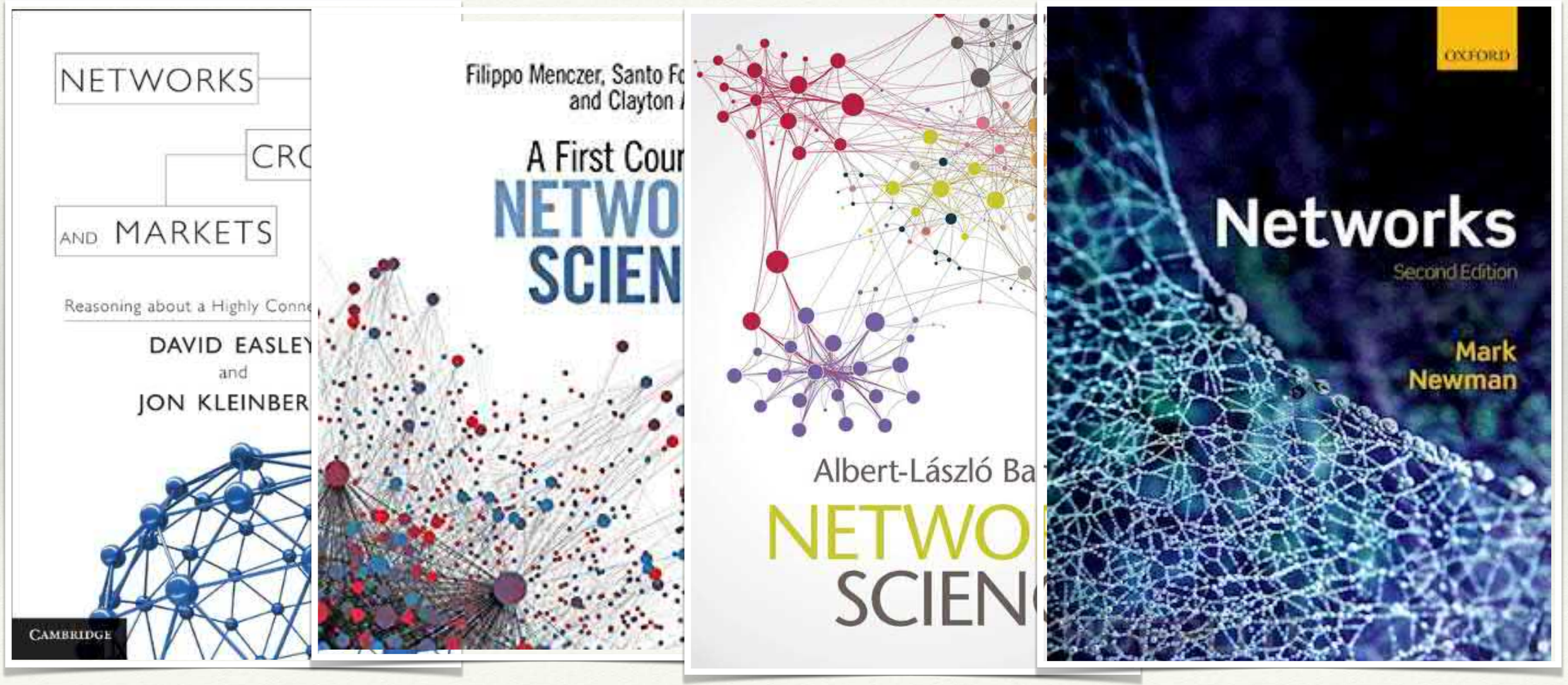
Complex Network Analysis



Epidemics

Social Contagion

Textbooks


NETWORKS
AND MARKETS
Reasoning about a Highly Conne
DAVID EASLEY
and
JON KLEINBER
CAMBRIDGE
Filippo Menczer, Santo Fo
and Clayton
A First Cour
NETWO
SCIEN
Albert-László Ba
NETWO
SCIEN
OXFORD
Networks
Second Edition
Mark
Newman