# Graphs in Machine Learning

## Natural Graphs Examples

Biological, Information, and Utility Networks

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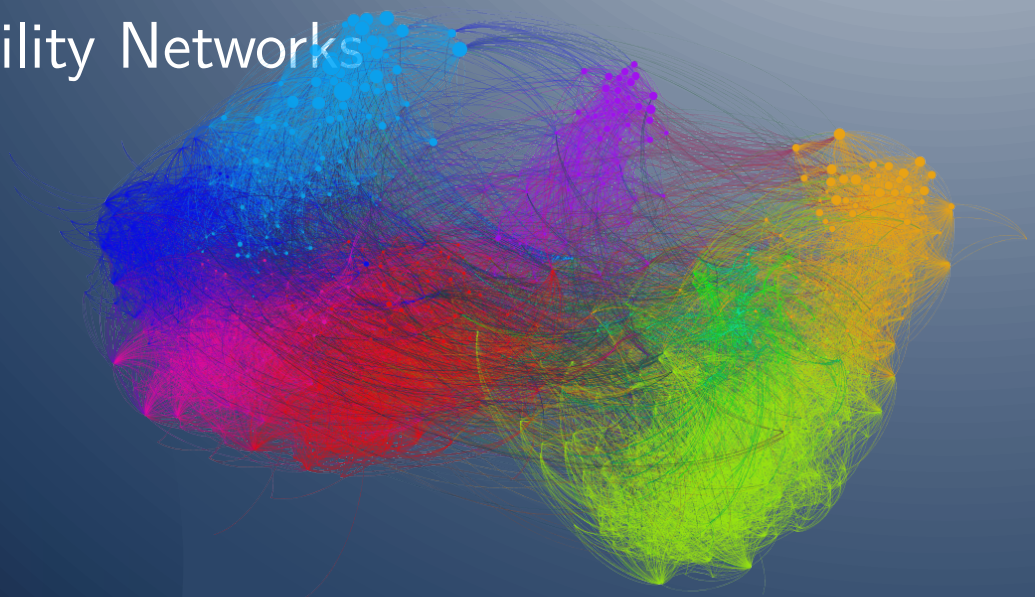
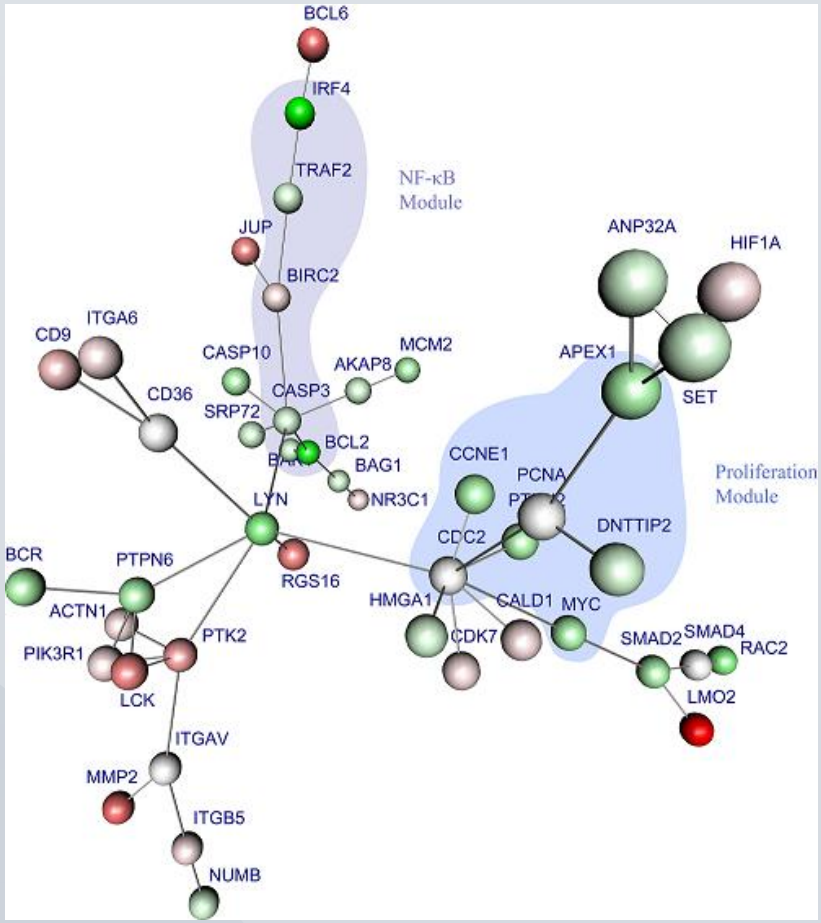
Partially based on material by: Andreas Krause, Branislav Kveton, Michael Kearns



# Natural graphs from biological networks

- protein-protein interactions
- gene regulatory networks
- typical ML tasks
  - discover unexplored interactions
  - learn or reconstruct the structure




Diffuse large B-cell lymphomas - Dittrich et al. (2008)

# Sources of Real Networks

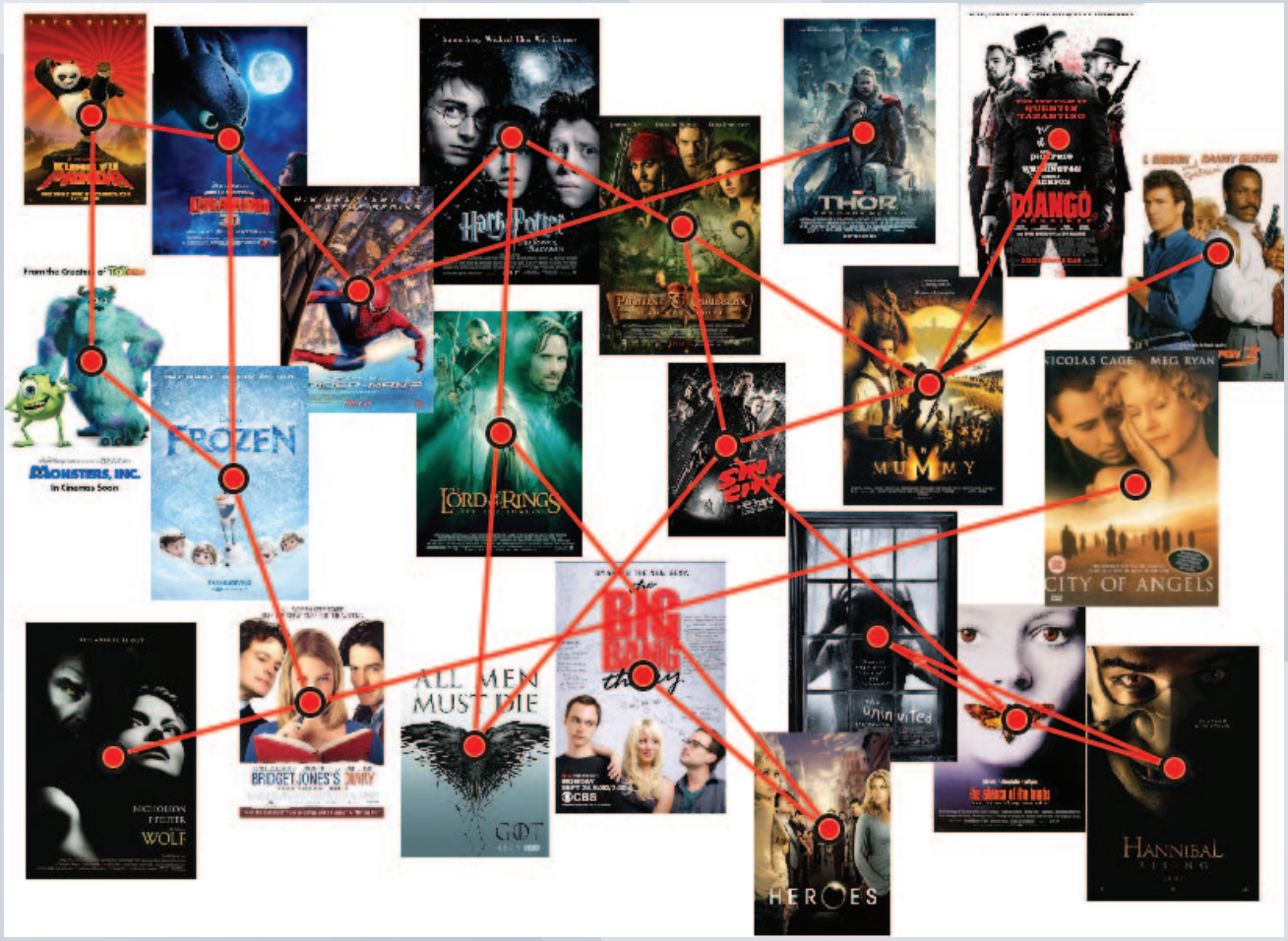
- https://ogb.stanford.edu/
- http://snap.stanford.edu/data/
- http://www-personal.umich.edu/~mejn/netdata/
- http://proj.ise.bgu.ac.il/sns/datasets.html
- http://www.cise.ufl.edu/research/sparse/matrices/
- http://vlado.fmf.uni-lj.si/pub/networks/data/default.htm

# Constructed graphs from similarity networks

**graph is not naturally given**

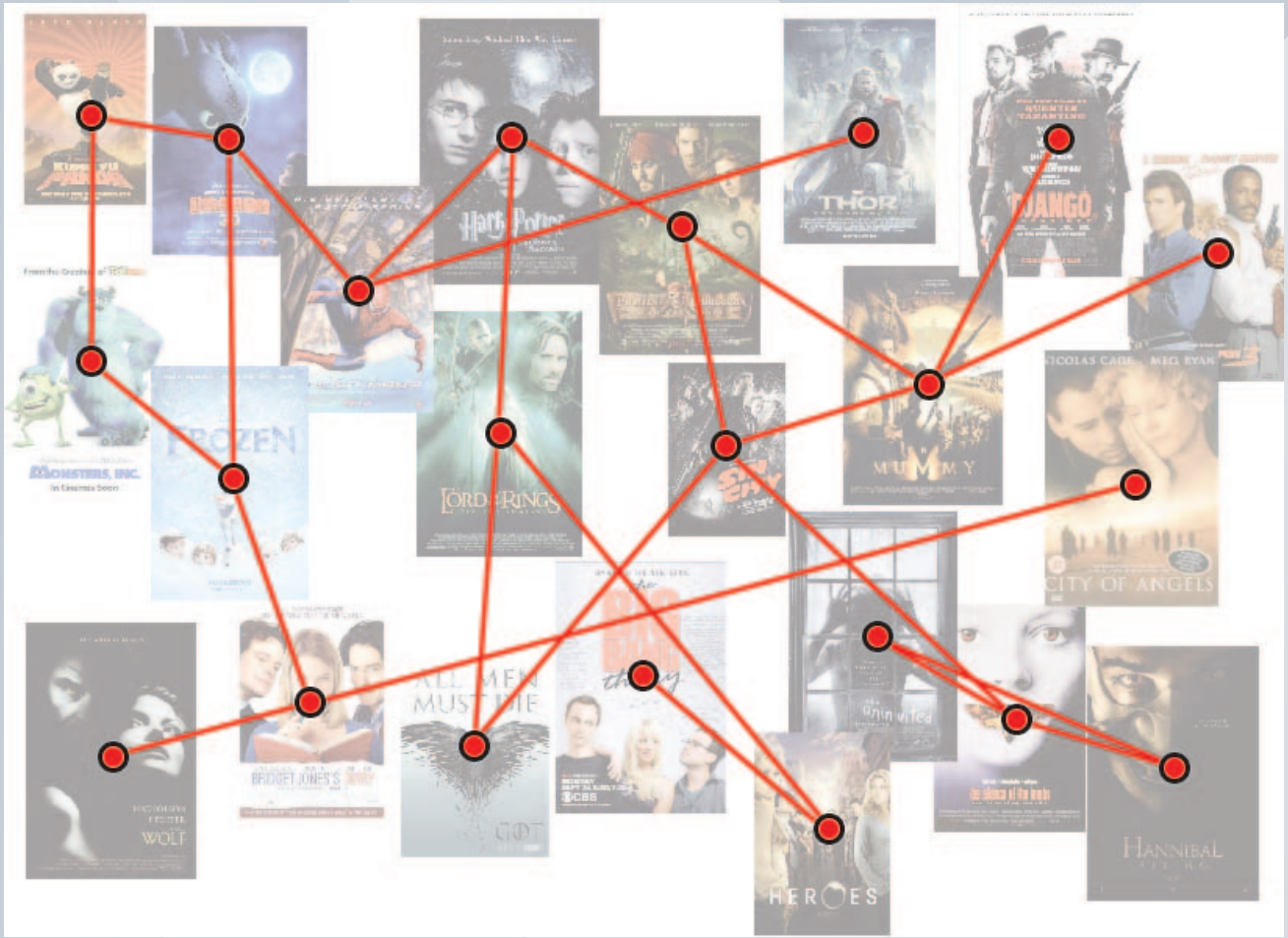
# Constructed graphs from similarity networks

**but we can construct it**



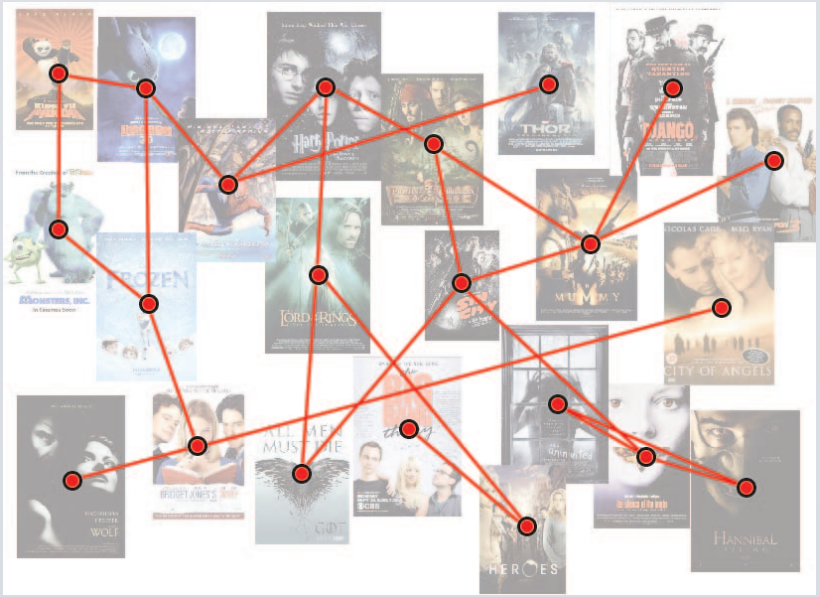
# Constructed graphs from similarity networks

**and use it as an abstraction**



# Constructed graphs from similarity networks

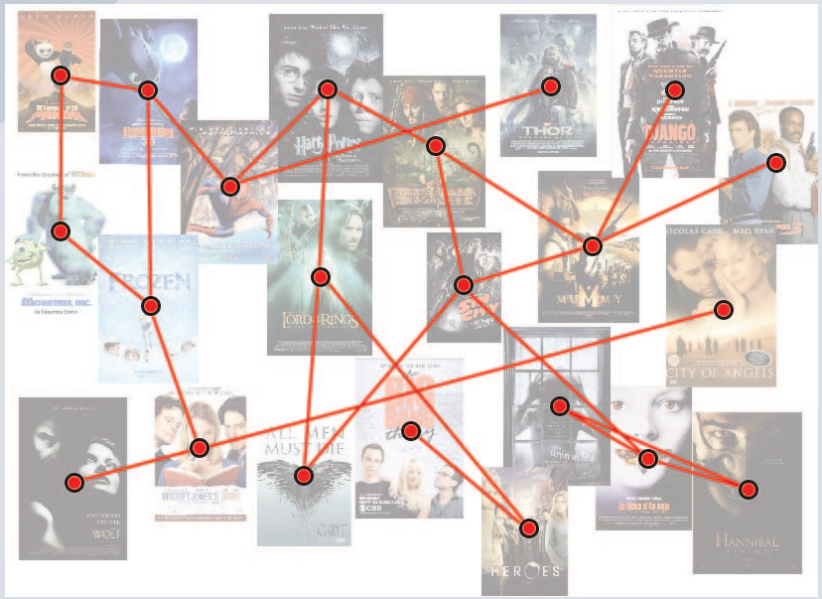
- vision
- audio
- text




movie similarity

# Constructed graphs from similarity networks

- vision
- audio
- text
- typical ML tasks
  - **semi-supervised learning**
  - **spectral clustering**
  - **manifold learning**




movie similarity

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https://misovalko.github.io/mva-ml-graphs.html