



# Graphs in Machine Learning

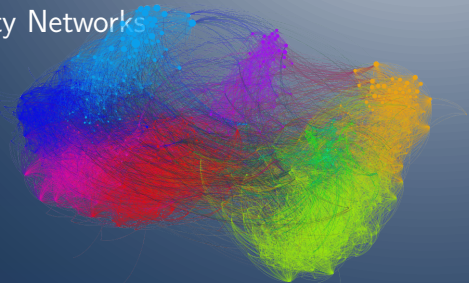
## Natural Graphs Examples

Biological, Information, and Utility Networks

Michal Valko

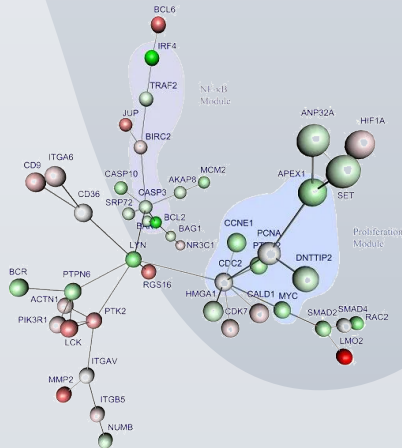
*Inria & ENS Paris-Saclay, MVA*

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



Source: Basso et al. (2005) 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

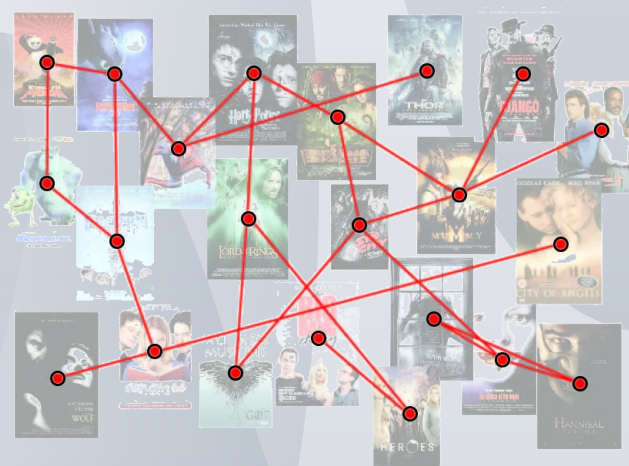
graph is not naturally given





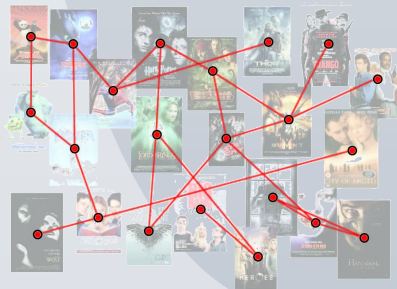
## Constructed graphs from similarity networks

and use it as an abstraction



## Constructed graphs from similarity networks

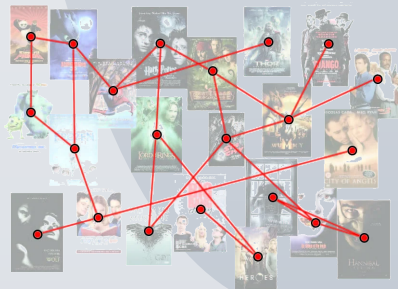
- vision
- audio
- text



## 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`

