



Graphs in Machine Learning

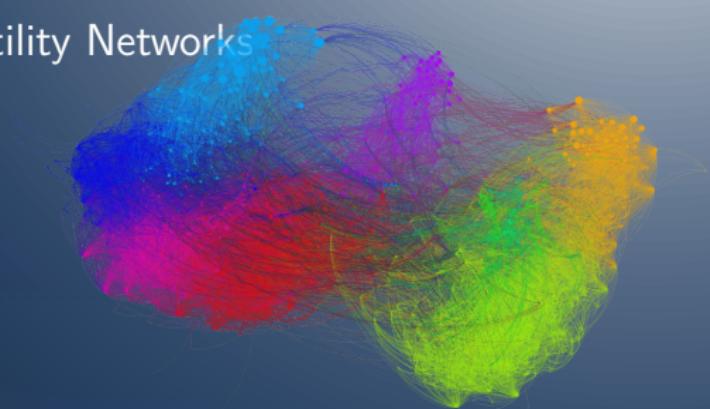
Natural Graphs Examples

Biological, Information, and Utility Networks

Michal Valko

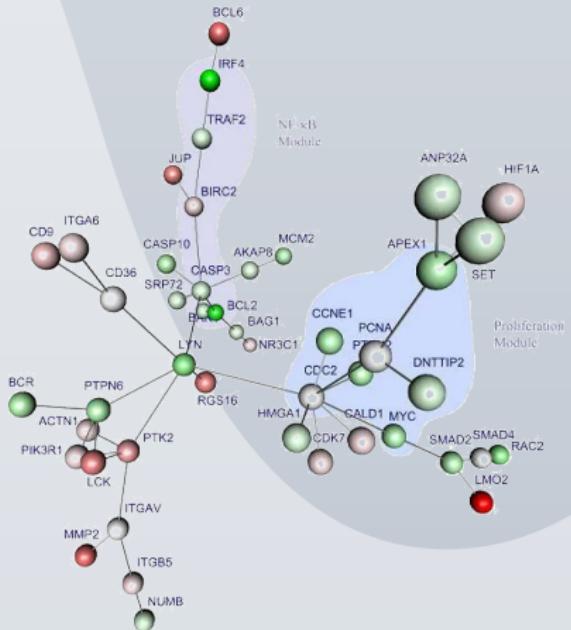
Inria & ENS Paris-Saclay, MVA

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>

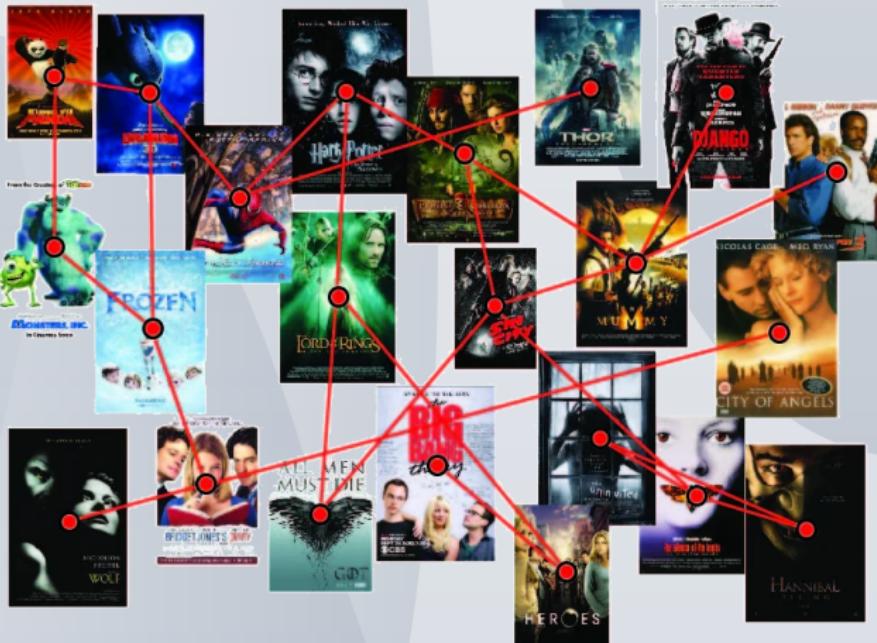
Constructed graphs from similarity networks

graph is not naturally given



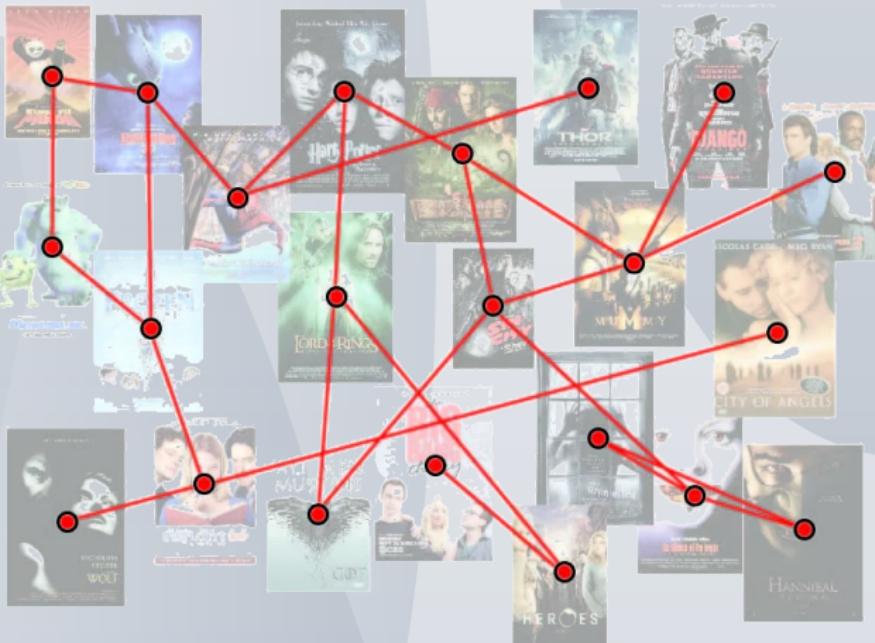
Constructed graphs from similarity networks

but we can construct it



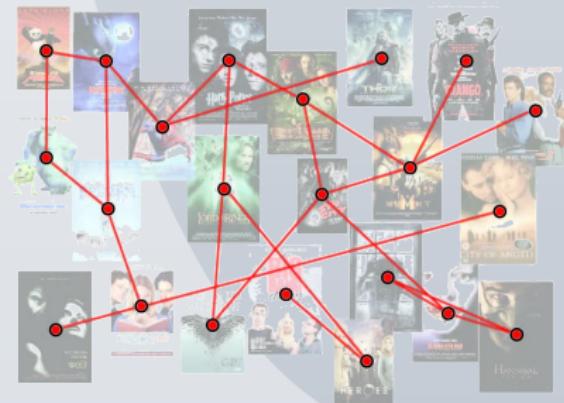
Constructed graphs from similarity networks

and use it as an abstraction



Constructed graphs from similarity networks

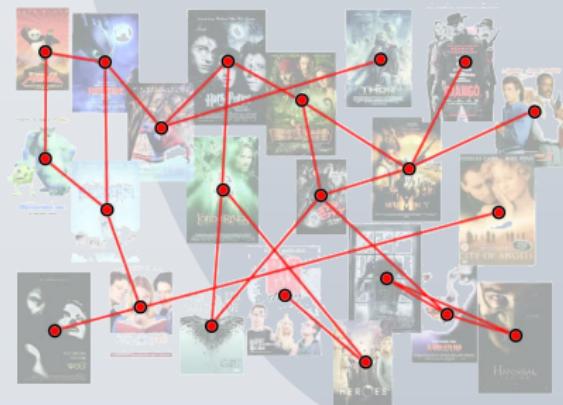
- vision
- audio
- text



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`