STATISTICAL PHYSICS OF GRAPHS AND NETWORKS INTRO

Complex networks

Paradigm for complex systems

- Many constituents (nodes / vertices)
- Heterogeneous interactions (links / edges)

Aims

- Mathematical & algorithmic framework for analyzing complex networks
- Based on a graph theory, stat phys, discrete math

Literature
mostly
Phase 2.

- MEJ Neuman : Networks - An introduction. Oxford UP 2010
- AK Hartmann & M. Weigt : Phase transitions in combinatorial optimization problems, Wiley VCH 2005.

Structure

1 - graph theory : definitions, problems, algorithms
2 - Models of graphs and networks.
   → Random graphs
   → Small - world networks
   → growing scale - free networks
3 - Models on graphs / networks
   → Ising model
   → Optimization over graphs
   → Epidemics on networks
4 - Inference of graphs / networks
   → Correlation networks
   → Bayesian networks
   → Maximum - entropy models
   "Inverse stat physics"

Stat mech: by mm estimates of avgs that we can't compute, eg with monte carlo or build ham & compute observables

inverse: try to find model that fits data instead of data that fits to model.

No written examination : there is a project.

→ Analytical part with computations

→ Numerical part (simulations)