Complex Networks Orientation

2017.12.4(Mon)

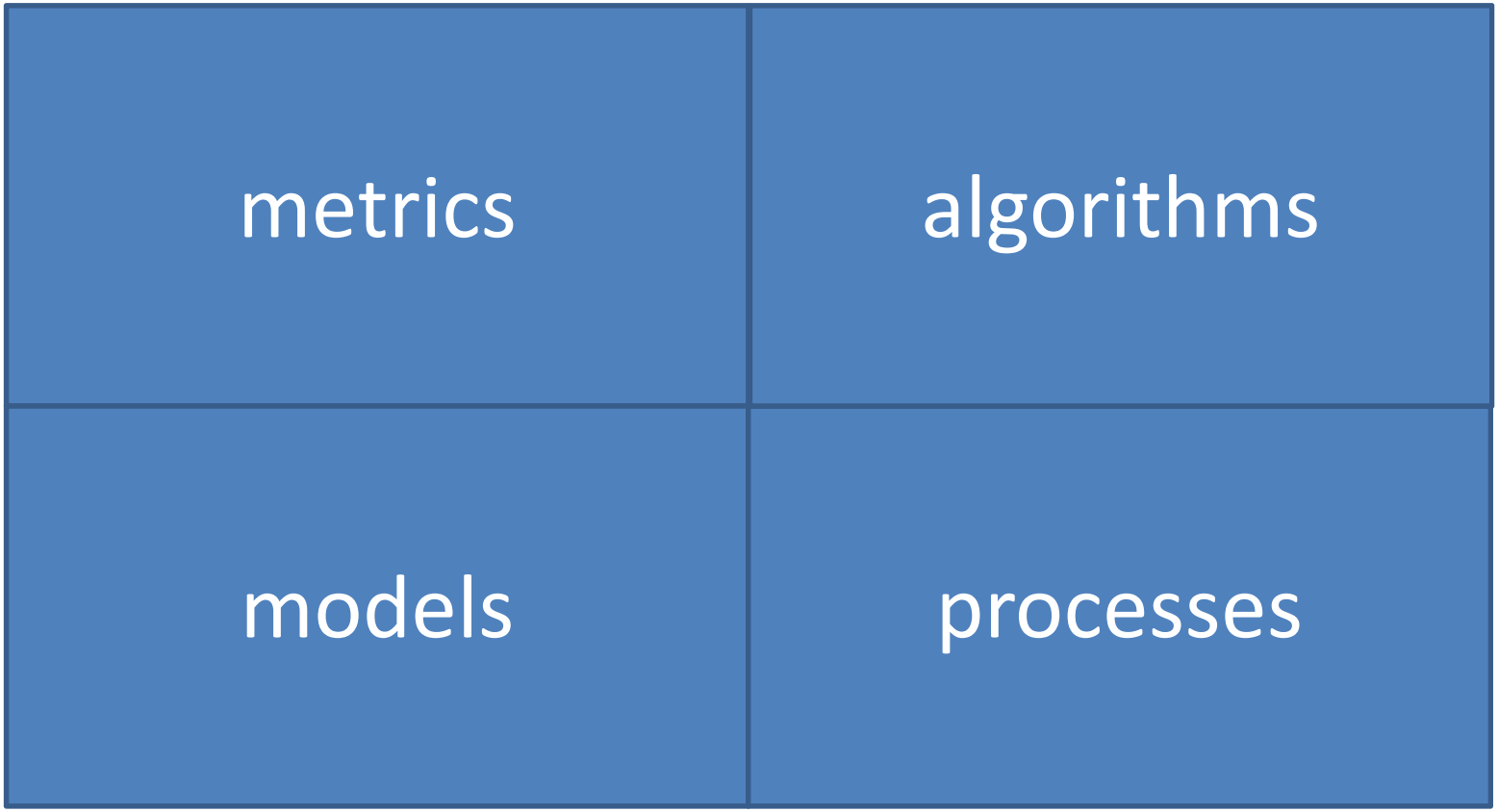
Complex Networks

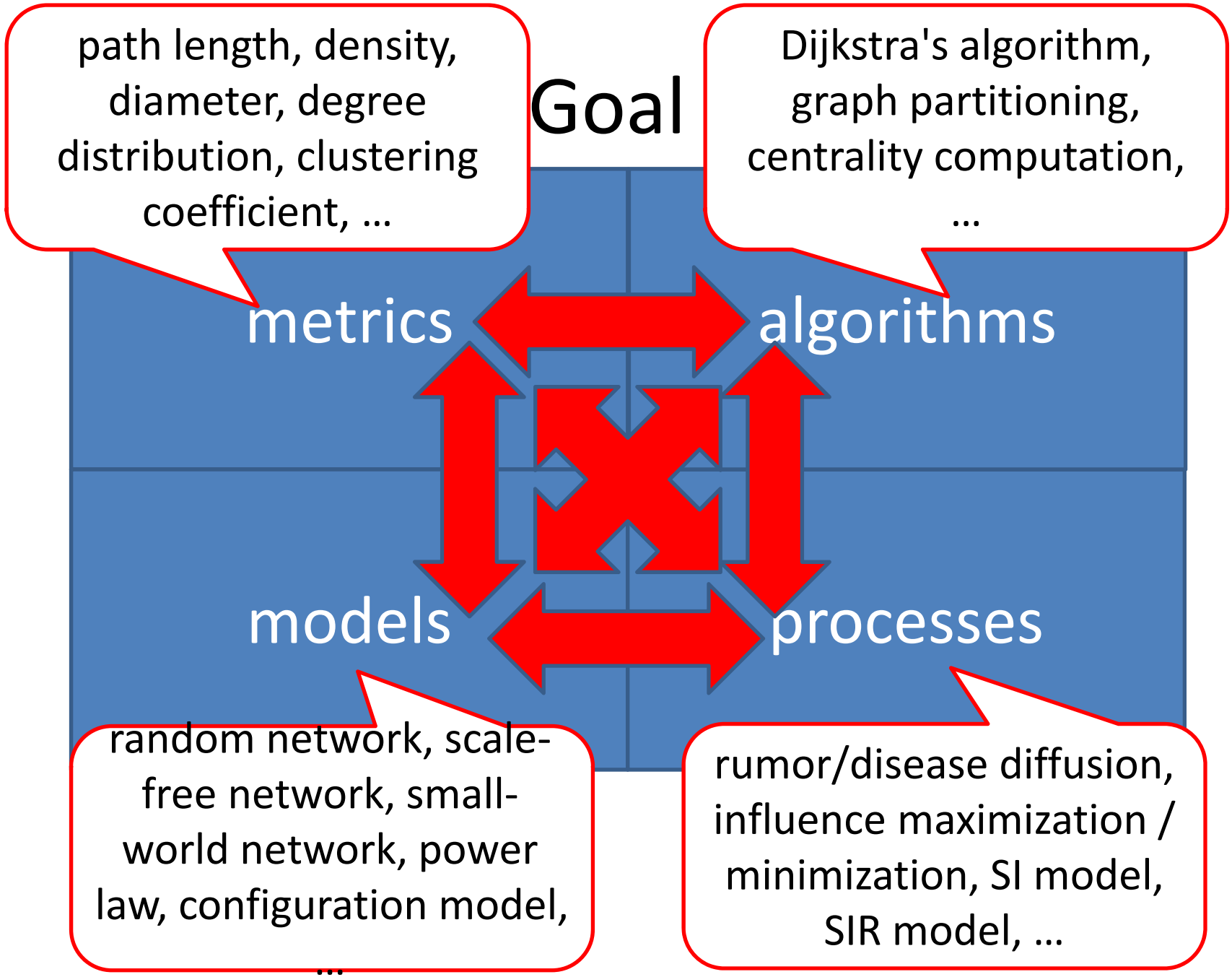
- Instructors: Murata (me), Prof. Terano, Prof. Konagaya, Prof. Ishii, and Prof. Takayasu.
- Goal: acquire knowledge for understanding and analyzing networks (graphs)
- Score : based on assignments from each professor
- Classes: Monday & Thursday (10:45-12:15)
- Teaching materials : available at Tokyo Tech OCW and www.net.c.titech.ac.jp/lecture/cn

Schedule

- Dec.4(Mon) Murata
- Dec.7(Thu) Murata
- Dec.11(Mon) Murata
- Dec.14(Thu) Murata
- Dec.18(Mon) Murata
- Dec.21(Thu) Murata
- Dec.25(Mon)
- Jan.11(Thu)
- Jan.15(Mon)
- Jan.18(Thu)
- Jan.22(Mon)
- Jan.25(Thu)
- Jan.29(Mon)
- Feb.1(Thu)

Goal



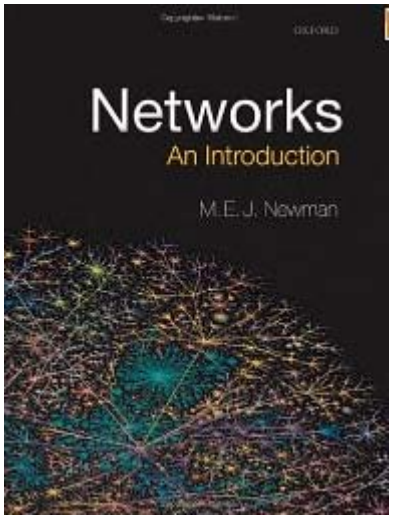

Goal
path length, density, diameter, degree distribution, clustering coefficient, …
Dijkstra's algorithm, graph partitioning, centrality computation, …
metrics
algorithms
models
processes
random network, scale-free network, small-world network, power law, configuration model, …
rumor/disease diffusion, influence maximization / minimization, SI model, SIR model, …

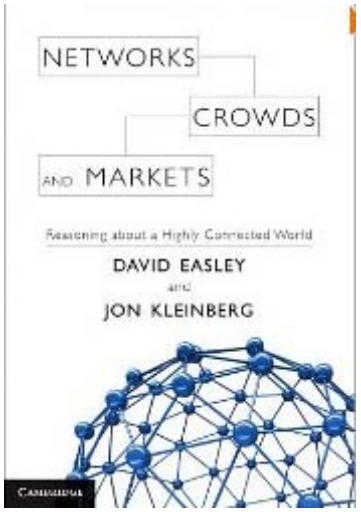
textbook / reference

- Networks: An Introduction, Mark Newman, Oxford University Press, 2010.

  http://www-personal.umich.edu/~mejn/networks-an-introduction/
- Networks, Crowds, and Markets: Reasoning About a Highly Connected World, David Easley and Jon Kleinberg, Cambridge University Press, 2010.

  http://www.cs.cornell.edu/home/kleinber/networks-book/





Japanese books

- 「複雑ネットワーク」とは何か, 増田直紀 今野紀雄著, 講談社ブルーバックス, 2006.
- Rで学ぶデータサイエンス 8 ネットワーク分析(第2版), 鈴木努著, 共立出版, 2017.

contents of this course

- Basic knowledge for understanding/analyzing networks
  - fundamentals of network
  - network algorithms
  - network models
  - processes on networks

  - tools for analyzing and visualizing networks

topics (1)

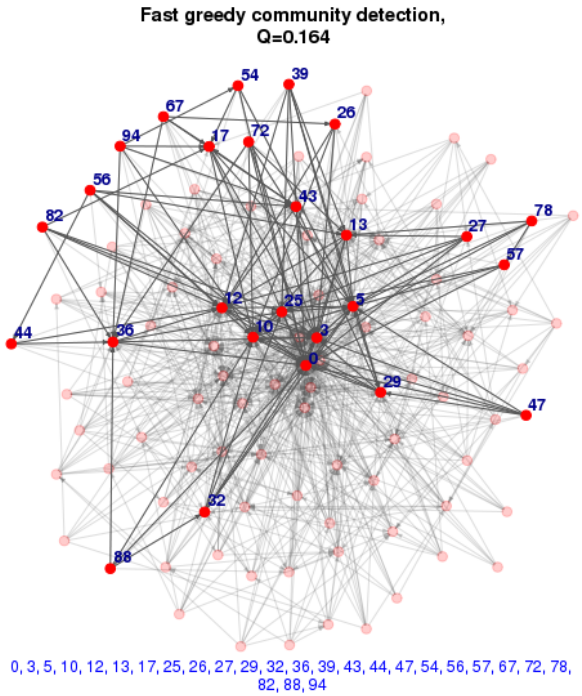
- 1. introduction
- 2. tools for analyzing networks
- 3. fundamentals (1) mathematics of networks
- 4. fundamentals (2) measures and metrics
- 5. fundamentals (3) the large-scale structure of networks
- 6. network algorithms (1) representation

topics (2)

- 7. network algorithms (2) matrix algorithms
- 8. network algorithms (3) graph partitioning
- 9. network models (1) random graphs
- 10. network models (2) network formation
- 11. network models (3) small-world model
- 12. processes on networks (1) percolation
- 13. processes on networks (2) epidemics
- 14. summary

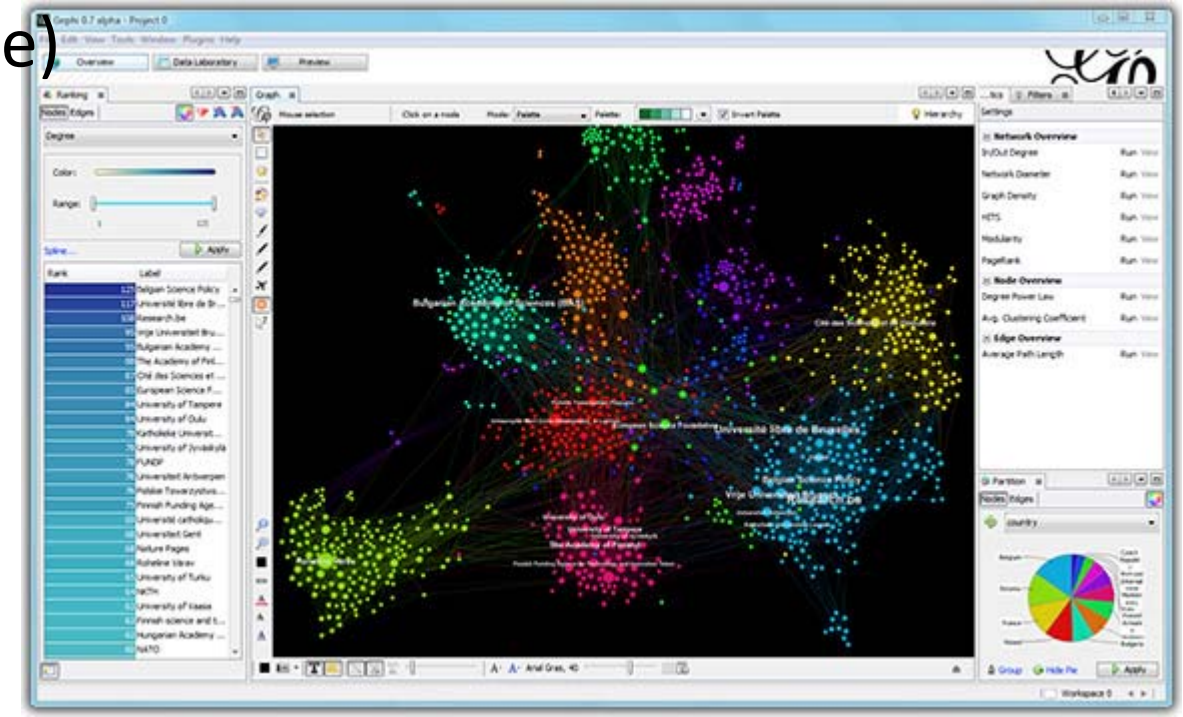
tools : igraph

- software for analyzing networks
  - A rich set of functions calculating various structural properties
  - http://igraph.org/



tools : Gephi

- new software for analyzing networks
  - easy to use, online tutorials available
  - https://gephi.github.io/ (English)
  - http://oss.infoscience.co.jp/gephi/gephi.org/index.html (Japanese)



Remarks

- All lectures, quizzes, assignments will be in English this quarter. I will not accept quizzes & assignments written in Japanese.
- Non-CS students (undergraduate students, YSEP, ACAP, ...) are also welcome. All students are graded based on the same evaluation criteria.
- Copying the assignments of other students is strictly prohibited. “Similar” assignments will be rejected.