

Complex Networks Orientation

2018.11.28(Thu)

Complex Networks

- Instructor: Tsuyoshi Murata
(murata@c.titech.ac.jp)
- Goal: acquire knowledge for understanding and analyzing networks (graphs)
- Score : based on quizzes and assignments
- Classes: Monday & Thursday (10:45-12:15)
- Teaching materials : available at Tokyo Tech OCW (and www.net.c.titech.ac.jp/lecture/cn)

Schedule

- Nov.29(Thu) today
- Dec.3(Mon)
- Dec.6(Thu)
- Dec.10(Mon)
- Dec.13(Thu) canceled
- Dec.17(Mon)
- Dec.20(Thu)
- Dec.24(Mon) class on Christmas Eve ! (blame Tokyo Tech)
- Jan.7(Mon)
- Jan.10(Thu)
- Jan.17(Thu)
- Jan.21(Mon)
- Jan.24(Thu)
- Jan.28(Mon)
- Jan.31(Thu)
- Feb.4(Mon)

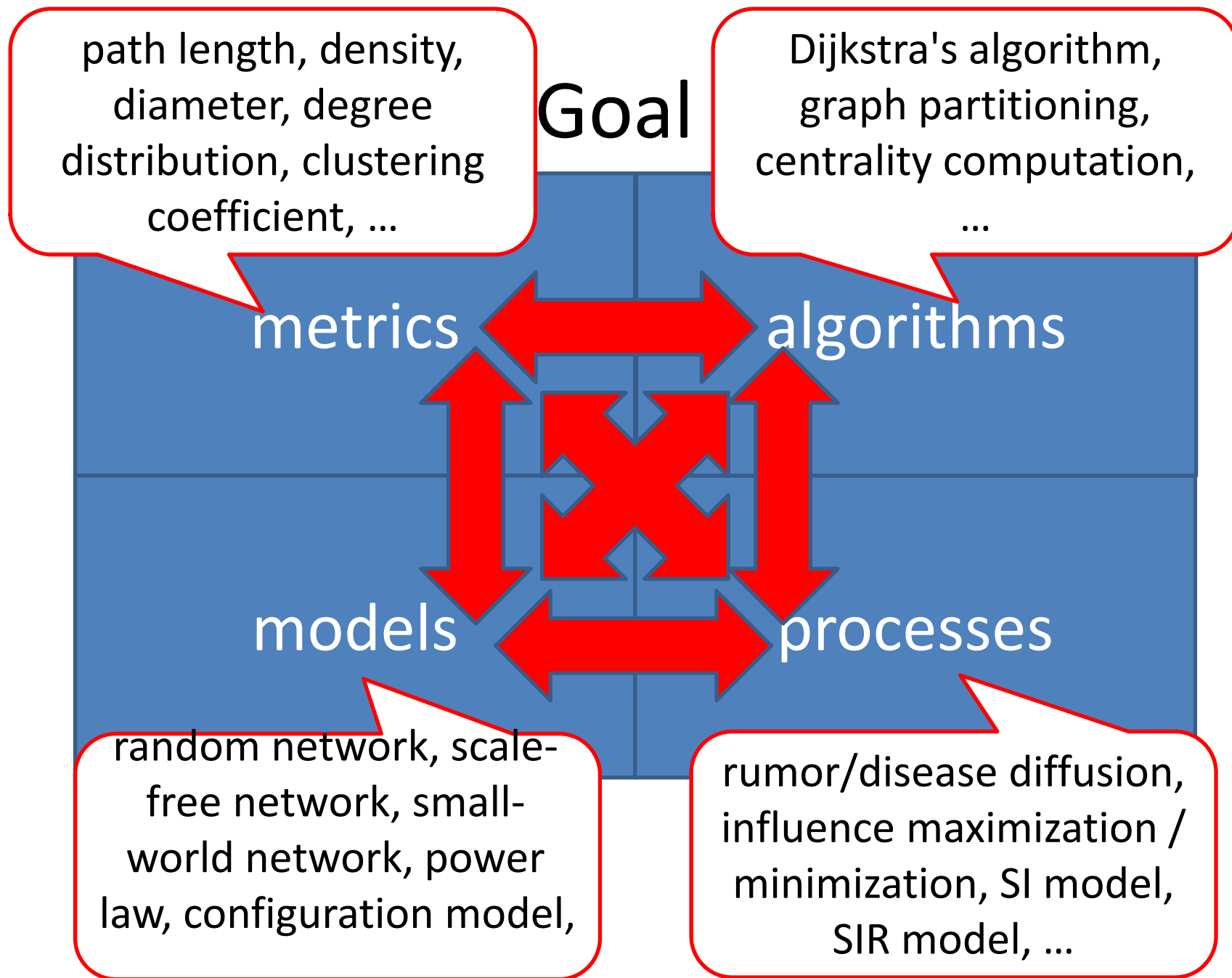
Goal

metrics

algorithms

models

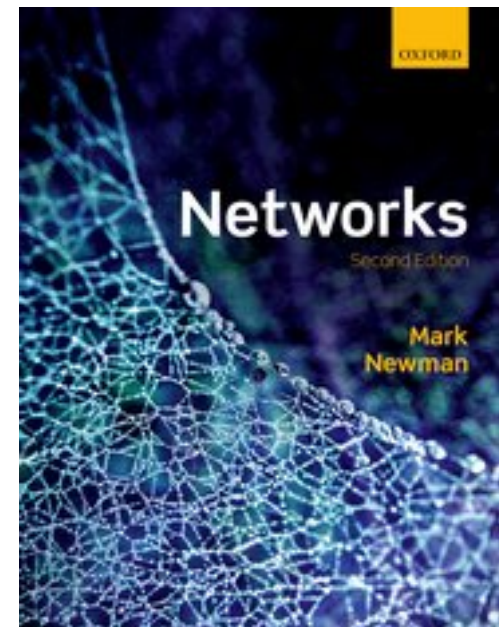
processes



textbook

- Networks (second edition), Mark Newman, Oxford University Press, 2018.

<https://global.oup.com/academic/product/networks-9780198805090>



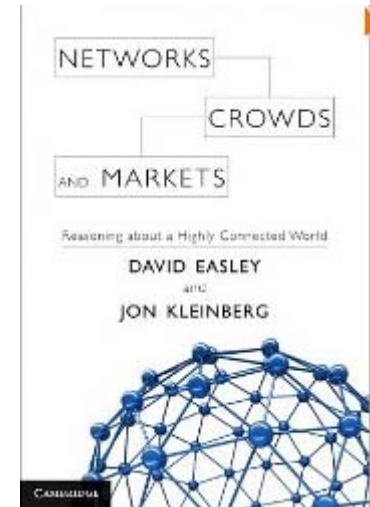
references

- 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/>

- Networks: A Very Short Introduction, Oxford University Press, 2012.

<https://www.oupjapan.co.jp/en/node/13481>

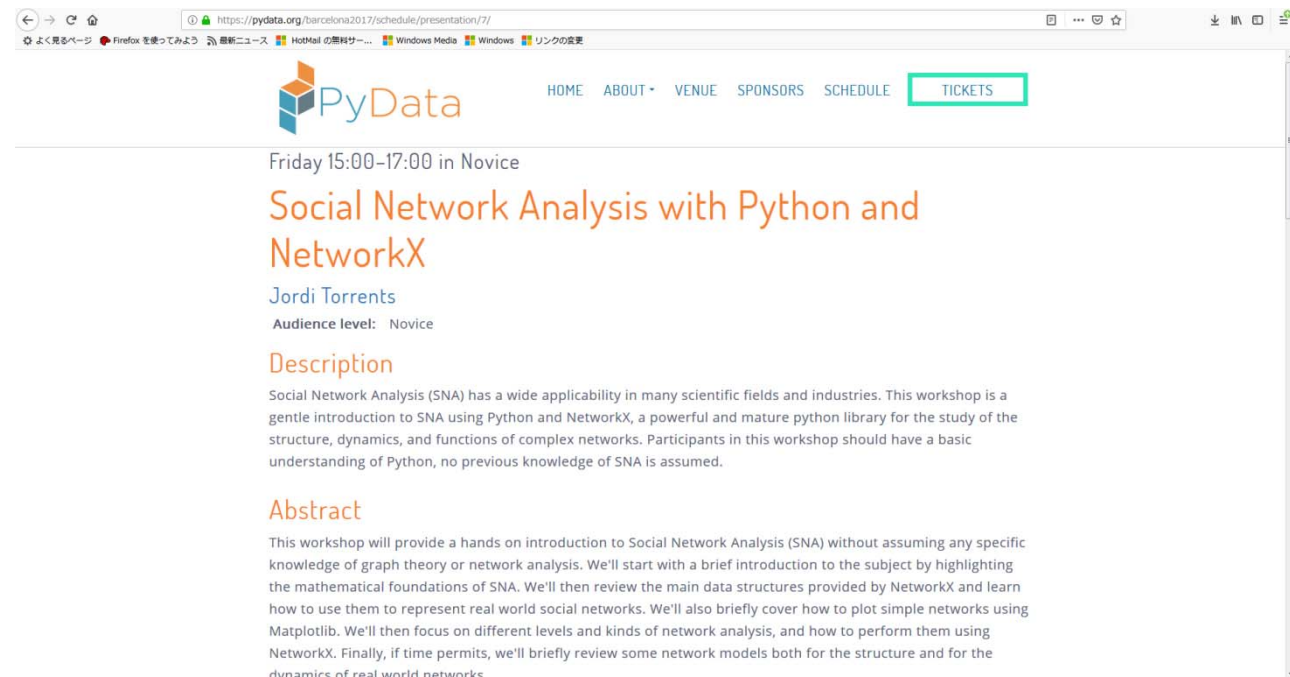


online resources

- Social Network Analysis with Python and NetworkX

- <https://pydata.org/barcelona2017/schedule/presentation/7/>

- https://github.com/jtorrents/pydata_bcn_NetworkX



The screenshot shows a web browser displaying the PyData Barcelona 2017 workshop page. The page features the PyData logo at the top, followed by navigation links: HOME, ABOUT, VENUE, SPONSORS, SCHEDULE, and TICKETS. The main content area is titled "Friday 15:00-17:00 in Novice" and "Social Network Analysis with Python and NetworkX" by Jordi Torrents. It specifies the audience level as "Novice" and includes a "Description" and "Abstract" section. The description states that the workshop is a gentle introduction to SNA using Python and NetworkX, covering the mathematical foundations, data structures, and network analysis techniques. The abstract mentions that the workshop will provide a hands-on introduction to SNA without assuming prior knowledge of graph theory or network analysis, and will cover topics like plotting with Matplotlib and reviewing network models.

PyData

HOME ABOUT VENUE SPONSORS SCHEDULE TICKETS

Friday 15:00-17:00 in Novice

Social Network Analysis with Python and NetworkX

Jordi Torrents

Audience level: Novice

Description

Social Network Analysis (SNA) has a wide applicability in many scientific fields and industries. This workshop is a gentle introduction to SNA using Python and NetworkX, a powerful and mature python library for the study of the structure, dynamics, and functions of complex networks. Participants in this workshop should have a basic understanding of Python, no previous knowledge of SNA is assumed.

Abstract

This workshop will provide a hands on introduction to Social Network Analysis (SNA) without assuming any specific knowledge of graph theory or network analysis. We'll start with a brief introduction to the subject by highlighting the mathematical foundations of SNA. We'll then review the main data structures provided by NetworkX and learn how to use them to represent real world social networks. We'll also briefly cover how to plot simple networks using Matplotlib. We'll then focus on different levels and kinds of network analysis, and how to perform them using NetworkX. Finally, if time permits, we'll briefly review some network models both for the structure and for the dynamics of real world networks.

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)

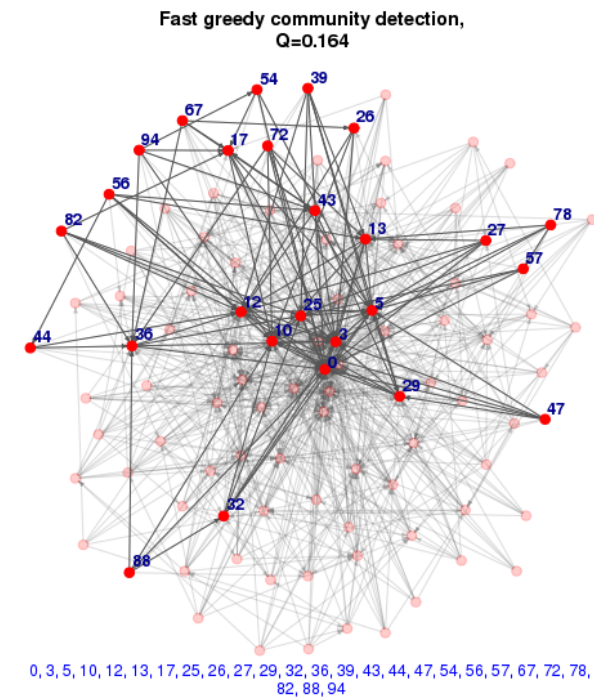
- 7. network algorithms (2) matrix algorithms
- 8. network algorithms (3) graph partitioning
- 9. network models (1) random graphs
- 10. network models (2) network formation
- 11. network models (3) small-world model
- 12. processes on networks (1) percolation
- 13. processes on networks (2) epidemics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

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. But all students are graded based on the same evaluation criteria.
- Copying the assignments of other students is strictly prohibited. “Similar” assignments will be rejected.

tools : igraph

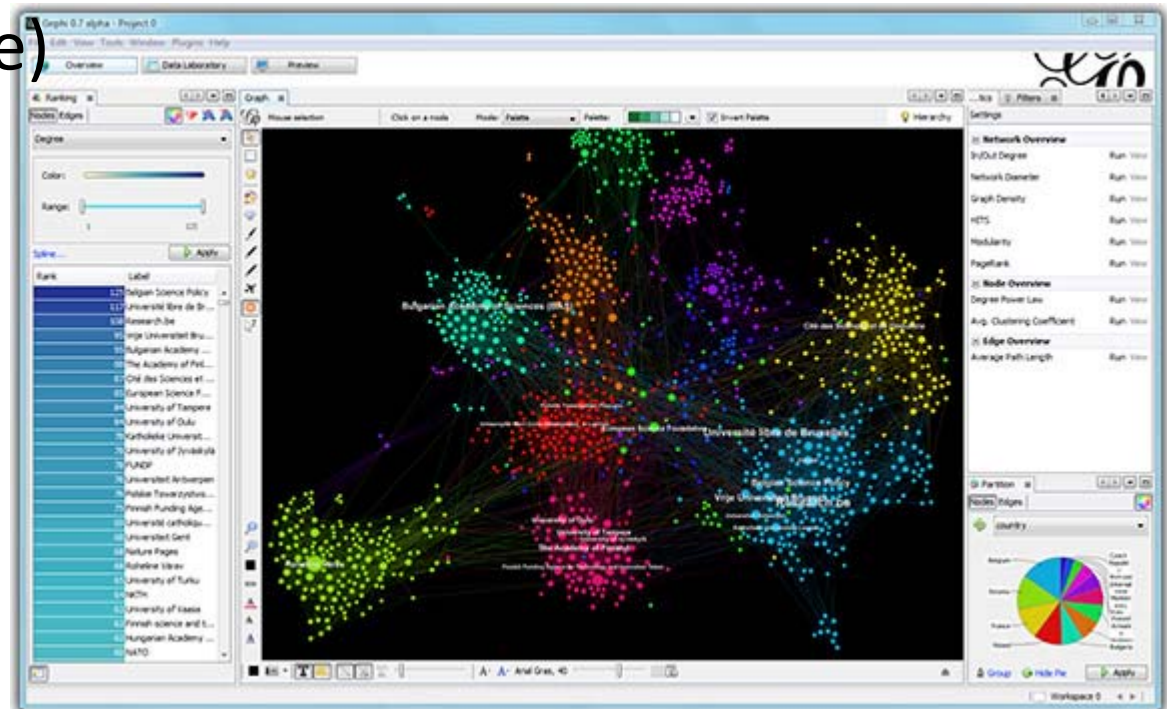
- software for analyzing networks
 - A rich set of functions calculating various structural properties
 - <http://igraph.org/>



tools : Gephi

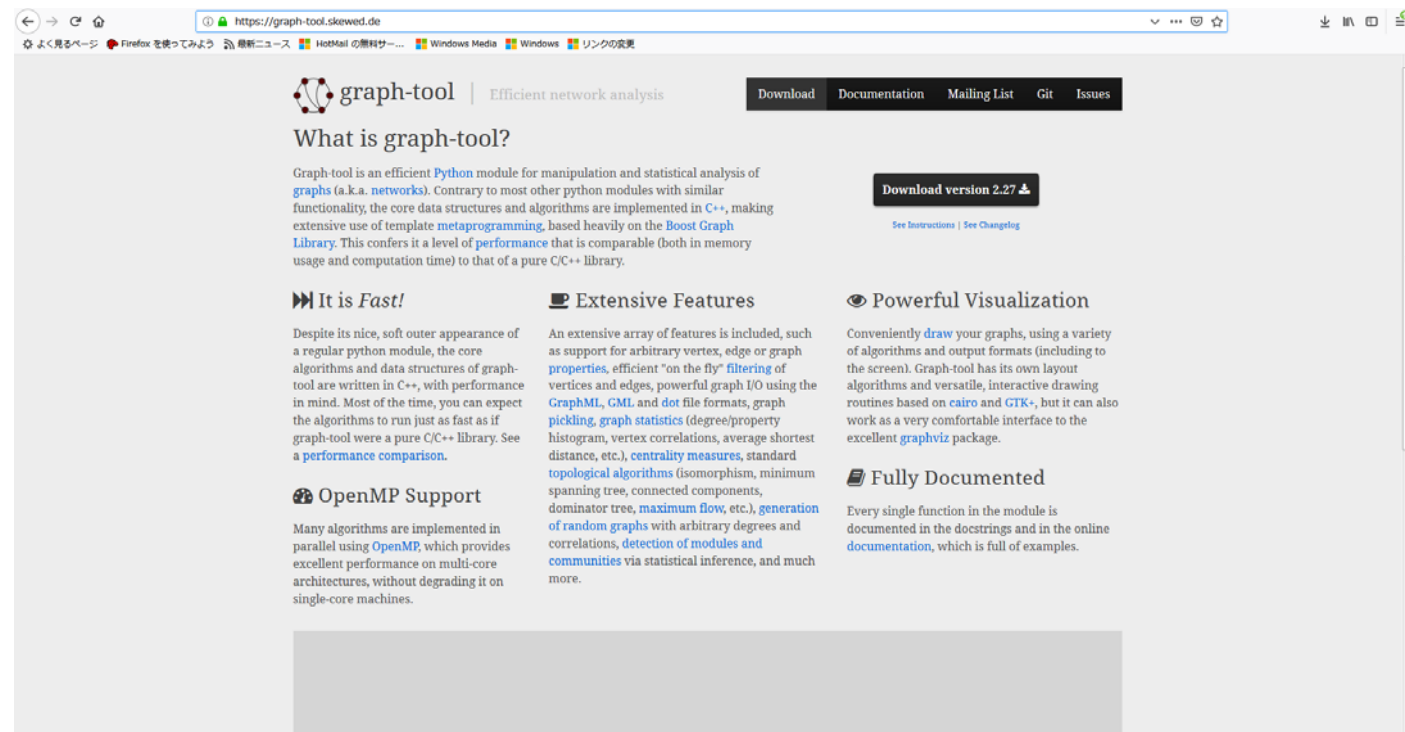
- new software for analyzing networks
 - easy to use, online tutorials available
 - <https://gephi.github.io/> (English)
 - <http://oss.infoscience.co.jp/gephi/gephi.org/index.html> (Japanese)

model environment



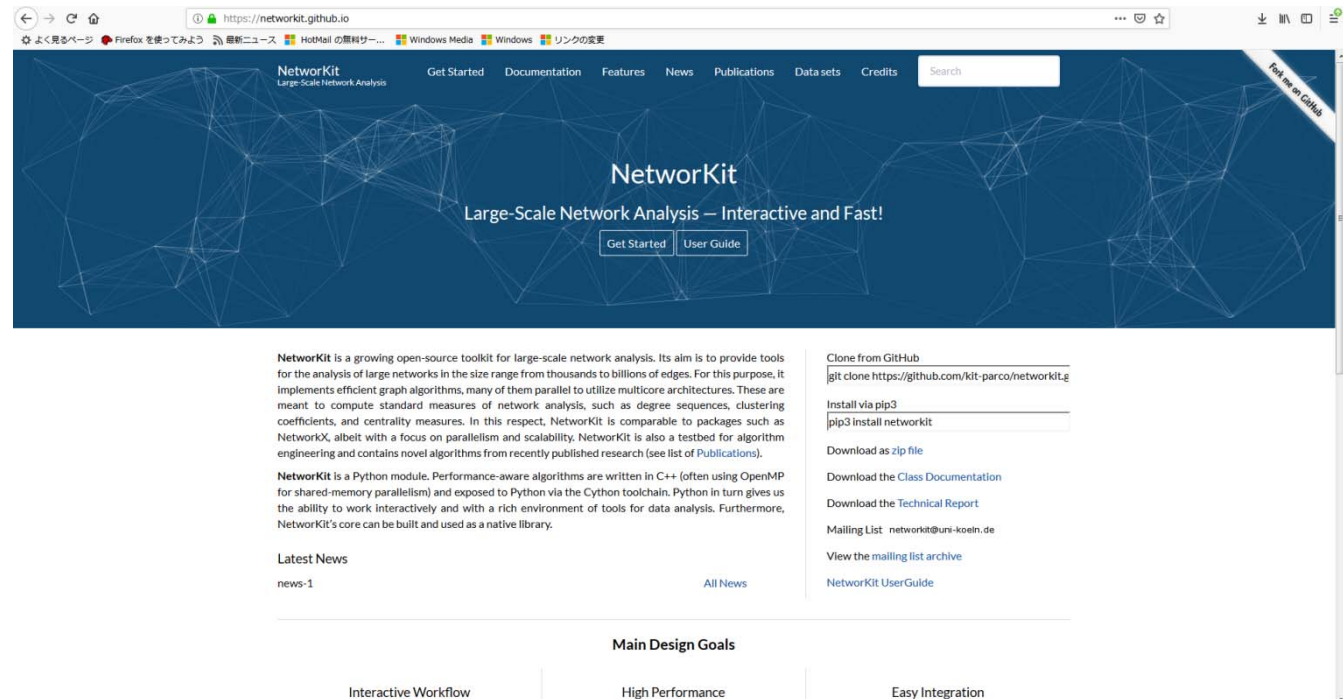
tools: graph-tool

- Python + C++ (fast)
- Support parallelism (OpenMP)
- <https://graph-tool.skewed.de/>



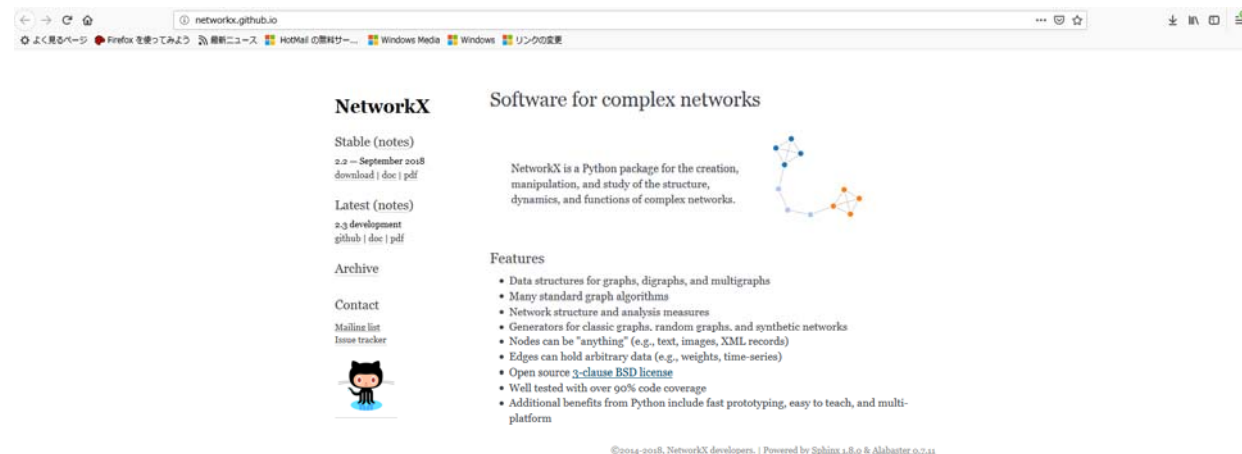
tools : NetworkKit

- focuses on performance and integration (with Python, Jupyter Notebook, Gephi and pandas)
- <https://networkkit.github.io/>



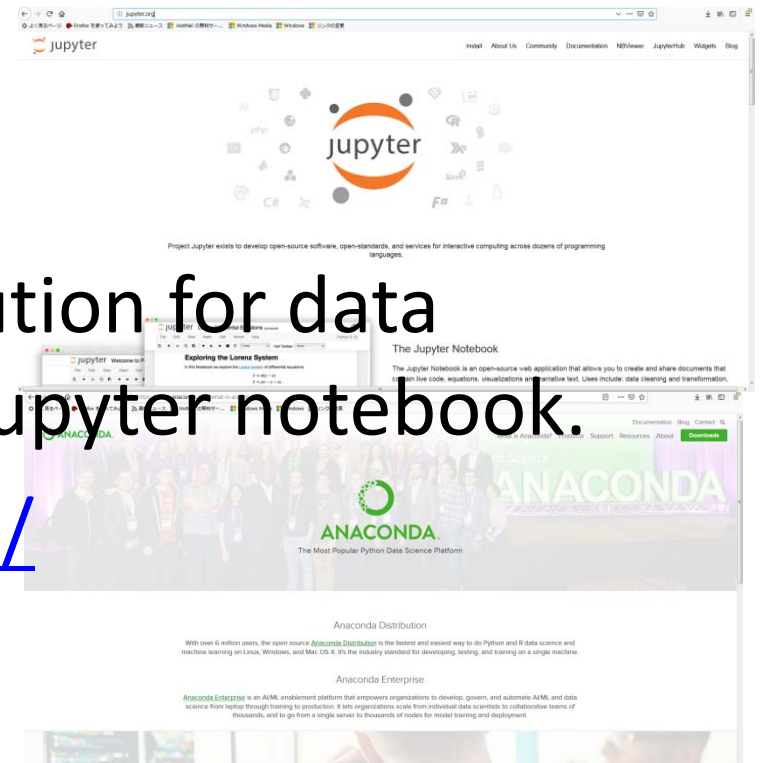
tools : networkX

- Python library for analyzing networks
- easy to install
- <http://networkx.github.io/>



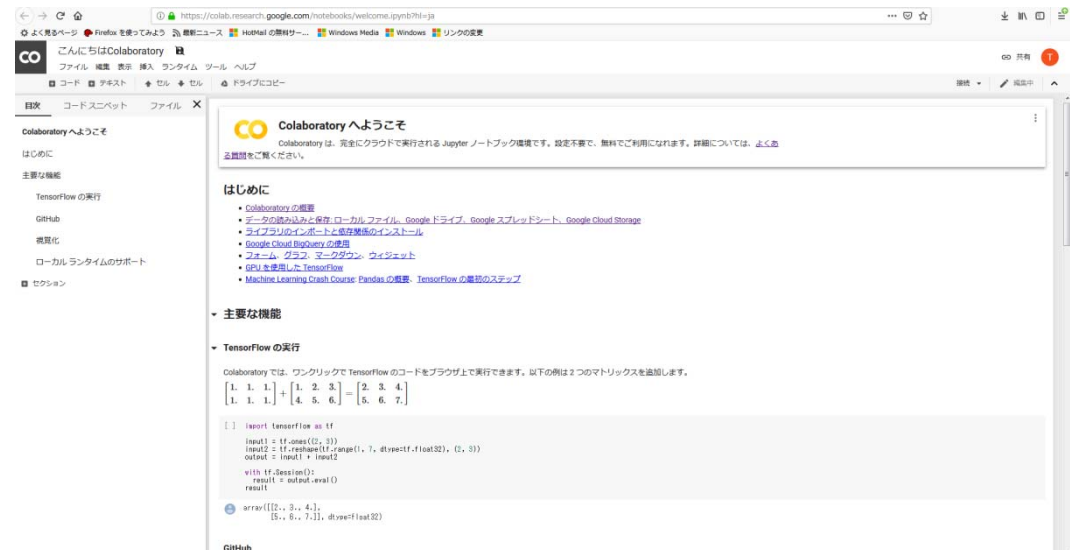
Jupyter notebook

- an open-source web application that allows you to create and share documents that contain live code, equations, visualizations and narrative text.
- <http://jupyter.org/>
- Anaconda (a python distribution for data science platform) contains Jupyter notebook.
- <https://www.anaconda.com/>



Google colaboratory

- Built on top of Jupyter notebook
- Interactive browser-based environment is available (Google account is required)
- <https://colab.research.google.com/>



Google colaboratory for network analysis

- Jupyter notebook (as python environment) + networkX (for network analysis) + matplotlib (for plotting / graph drawing)
- Microsoft also provides similar environments <https://notebooks.azure.com/>

