

Network Application Diagnostics B2M32DSAA

(Diagnostika síťových aplikací)

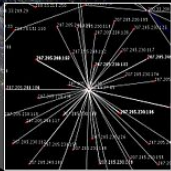
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[Bri95]



Synopsis

- Introduction to graph theory
- Introduction to complex network structures.
- Network characteristics identification.
- Recognition of both structural static and dynamic patterns
- Anomaly detection.
- Diagnostic process automation.
- Examples dealing with digital network application issues.

Prerequisites

- Knowledge of linear algebra, algorithms.
- Knowledge of network application and protocol fundamentals.
- Some skills in programming (Python)

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Outline of Lectures

- 1 Introduction to diagnostics, testing, and verification of network applications.
- 2 Graph theory
- 3 Fundamental characteristics of networks, models of random graphs.
- 4 Power distribution and preferential linking.
- 5 Network structure identification.
- 6 Community detection.
- 7 Ties prediction and network inference.
- 8 Network dynamics and dynamic network processes.
- 9 Basics of artificial intelligence and deep learning
- 10 Graph neural networks
- 11 Checking sequence of finite state machines.
- 12 Finite state machine behavior identification.
- 13 Tools for network testing and diagnostics, automation of processes.



Tentative Outline of Seminars

- 1 Student teams creation, development framework setting, basic libraries tutorial.
- 2 an APSP path searching assignment.
- 3 Variety type graph generation.
- 4 Rich club network nodes identification.
- 5 Computer communication network reconstruction.
- 6 Network partitioning and community detection.
- 7 Communication patterns detection
- 8 Sensor network dynamic assessment.
- 9 Simple deep learning classification.
- 10 Graph neural network application.
- 11 State determination using special sequence of finite machines.
- 12 Finite machine reconstruction using active learning.
- 13 Test case design for multilayer network.
- 14 Seminar evaluation.



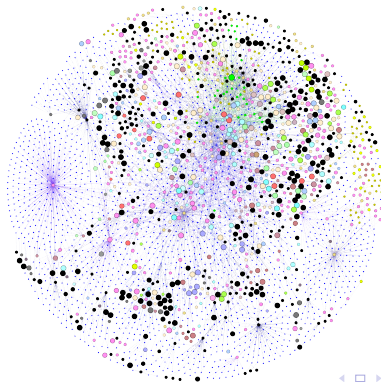
Course Rules

- <https://moodle.fel.cvut.cz/course/view.php?id=2318>
... Moodle, a redirection to CW
- <https://cw.fel.cvut.cz/wiki/courses/b2m32dsa/start>
... CourseWare (CW), BRUTE/Upload
- Seminars (max. 40 points)
- Examination (max. 60 points)
 - a written part, 24 points, 2 problems, 1 hour, accessible resources
 - a written part, 24 points, 4 questions, 1 hour, resources not accessible
 - an oral defense, 12 points

CW Lectures

- [EK10] Networks, Crowds, and Markets: Reasoning about a Highly Connected World, Easley, D., Kleinberg, J.; Cambridge University Press, 2010
- [New10] Networks: An Introduction, M. E. J. Newman, Oxford University Press (2010)

- Ancient Egypt society analysis - algorithms
- Complex network analysis applied to telecommunication networks
- Complex network analysis in telecommunication - educative problems preparation
- Large language model applications.



References I

- [Bri95] [Matt Britt](#). Partial map of the internet 1995, accessed 28.1.2014.
http://en.wikipedia.org/wiki/Wikipedia:Featured_picture_candidates/Internet_Map, 1995.
- [EK10] [David Easley and Jon Kleinberg](#). *Networks, Crowds, and Markets. Reasoning About a Highly Connected World*. Cambridge University Press, July 2010.
- [New10] [M. Newman](#). *Networks: an introduction*. Oxford University Press, Inc., 2010.