Syllabus - Fall2020

Course CSCI-6250/4250 4cr: Frontier of Network Science
Monday - Thursday 12:20-14:00, ON-LINE
Office Hours: Tuesday 11 AM – noon, Friday 10 AM -11 AM ONLINE

Class Web-site

http://www.cs.rpi.edu/~szymansk/fns.20/index.php

Instructor

Prof. Boleslaw K. Szymanski, e-mail: szymansk@cs.rpi.edu, ON-LINE

Textbooks

Albert Laszlo Barabasi ***Network Science,***
Cambridge University Press, 2016
On-line version is available at http://barabasi.com/networksciencebook/
In addition, class notes will be used.

Course Description

This course offers the introduction to network science and review of current research in this field. Classes will interchangeably present chapters from the textbook and the related current research. The emphasis will be on mathematical background of network science: graphs and networks; random networks and various types of scale-free networks; network properties such as assortatitivity, mobility, and robustness; social networks and communities; and dynamics of processes on networks.

Prerequisites

CSCI-2300; a 4000 level algorithms-based CSCI (e.g. 4020, 4050, 4260, 4800), or MATH (4100, 4150, 4200, 4210, 4800) course; junior or senior level standing; some familiarity with probability theory, linear algebra, and calculus; or permission of the instructor.

Course Content

- Mathematical background of network science: graphs and networks.
- Random networks and their properties.
- Scale-free networks, small world networks and Barabasi-Alert model.
- Mobility and networks
- Network robustness
- Social networks and communities
- Assortativity of networks
- Dynamic processes

Grading Criteria

Undergraduates: one individual project (50%), followed by one individual homework assignment (40%), and questions and participation in discussion for at least two graduate students presentations (10%) are due throughout the semester. The project will be handed out approximately after the end of the 5th week, while the assignment in the 9th week of the course. The project requires using network analysis tools (or programming) and analysis of the results obtained for the real and synthetic networks. Graded projects/homework will be returned to undergraduate approximately one week after they are handed in; students will have these grades as their means to determine progress in the course by mid-semester.

Graduates: Students will choose a topic for research and presentation either from the list of topics associated with textbook or seminal papers, or from their own current work, if approved by the instructor. Around 4th week of the course, the research plan will be due of 3-5 pages defining project part of presentation, and short presentation (20 min) on the material on which research will be based (40%), and the 40 min presentation will be due in November/December time frame (50%). The remaining 10% of the grade will be assigned based on participation in discussions of the presentations.

Attendance in the live webex presentation during class hours is not required by recommended due to the material presented in classes includes topics beyond the textbook. Attendance and active participation is required for at least two research of grad presentation is needed to receive score for active participation.

Grade ranges: A 96. A- 91, B 85, B- 80, C 70, C- 60, F <60.

Student Learning Outcomes

Upon completion of this course, all students will be able to:

1. Apply fundamental network science ideas to create models and understand dynamics of networked systems;
2. Compare, contrast, and describe the similarities and differences of different kinds of networks and processes modeled on networks;
3. Critique the strengths and weaknesses of each of the models and types of networks based on them and these network types performance in diverse network science applications;
4. Understand the principles of applying network science to disciplinary science and design and set up basic models for some specific applications.

Additionally, graduate students, will also be able to:

5. Read, analyze, and critique published literature in the field of network science and social networks;
6. Assess novelty of network science research projects and their relation to the state of the art in the field.

Course Assessment Measures

The student performance will be measured using three different methods: (i) projects for the undergrads and research plans for grads, (ii-u) homework for undergrads, (ii-g) presentation that will include evaluation of slides and research results for graduates, and (iii) contributions to in-class discussions.

The projects and plans will measure the student's ability to apply concepts of network science to network analysis. The slides and research results will measure student's ability to prepare summary material based on fundamental scientific concepts and basic research. The presentation will measure student's ability to communicate the concept and notions related to the research projects in which the student is involved. The discussion in class will measure the student's skills to critically evaluate and objectively assess the presentations of other students.

Academic Integrity

Student-teacher relationships are built on trust. For example, students must trust that teachers have made appropriate decisions about the structure and content of the courses they teach, and teachers must trust that the assignments that students turn in are their own. Acts, which violate this trust, undermine the educational process. The Rensselaer Handbook of Student Rights and Responsibilities defines various forms of Academic Dishonesty and all students should make themselves familiar with these forms to avoid them.

In this class, all assignments that are turned in for a grade must represent the student's own work. Submission of any assignment that is in violation of this policy will result in a penalty of 0 points for assignment and failing of the course in case of repetition.

If you have any question concerning this policy, please ask for clarification before preparing or submitting an assignment or making a presentation.

The penalty for not adhering to these academic integrity rules is a failing grade for the assignment on the first offense, then failing the course and potential disciplinary actions by the Institute on any subsequent offenses.