EE/ISE 556: Stochastic Systems
Fall 2013

Lecture Time & Venue: 11:00-12:20pm on Tue and Thu, KAP 166

Office Hours: 12:30-1:30pm

Course page: http://www-bcf.usc.edu/~rahuljai/Teaching.html

Instructor: Prof. Rahul Jain, EEB 328, (213) 740-2246, rahul.jain@usc.edu

Course Description:

This course will primarily focus on stochastic control systems. The emphasis shall be on discrete-time stochastic control theory, and depending on time, some continuous-time stochastic control may be covered. Topics to be covered on discrete-time control include state space models, linear stochastic systems, controlled Markov chains, stochastic dynamic programming, estimation and control for linear systems, infinite-horizon dynamic programming, systems identification and adaptive control. The last one-third of the course shall cover some of: multi-armed bandit models, approximate dynamic programming methods such as reinforcement learning, actor-critic methods, etc., PAC learning for MDPs, Model-Predictive Control and related methods, etc. Some applications in Electrical Engineering, Operations Research and Finance will be illustrated.

The expected audience is graduate students in engineering who want to equip themselves with stochastic control theory for their research, as well as students who seek to pursue studies in financial engineering.

Pre-requisites:

Students are expected to be familiar with probability theory at the level of EE 464/465/503. EE 441 pre-req will be waived if you have taken one of the above. Please contact the instructor for D clearance. The course evaluation will be through class participation, home works, a final exam and/or a project (depending on class size).

Grading: Class-participation (10%), Home-works (20%), Mid-term (35%), Project (35%)

Text:

P. R. Kumar and P. Varaiya, *Stochastic Systems*, 1986
D. Bertsekas, *Dynamic Programming and Optimal Control (Vol. I & II), 3rd ed.*, 2007

Optional References:
S. Ross, *Introduction to Stochastic Dynamic Programming*, 1983
K. Astrom, *Introduction to Stochastic Control Theory*, 1970
M. Puterman, *Markov Decision Processes*, 1994
E. Wong and B. Hajek, *Stochastic Processes in Engineering Systems*, Springer-Verlag, 1985.

Tentative Topics:

(1) State space models
(2) Linear stochastic systems

(3) Controlled Markov Chains
(4) Deterministic Systems
(5) Deterministic continuous-time optimal control
(6) Stochastic Dynamic Programming
(7) Linear Systems: Estimation & Control
(8) Infinite-horizon Dynamic Programming
(9) System Identification
(10) Adaptive Control
(11) Non-Bayesian MAB models
(12) Approximate dynamic programming
(13) Reinforcement learning
(14) Simulation methods for MDPs and PAC Learning
(15) Model Predictive Control
(16) Stochastic Games

Projects: There is going to be a research project. You will be expected to read a few papers and do something creative. Work done will have to summarized in a project report.

Statement for Students with Disabilities:
Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Statement on Academic Integrity:
USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. Scampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A:http://www.usc.edu/dept/publications/SCAMPUS/gov/. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: http://www.usc.edu/student-affairs/SJACS/.