Course Information

Description

Probability is a mathematical discipline that allows one to reason about uncertainty: it helps us to predict uncertain events, to make better decisions under uncertainty, and to design and build systems. Throughout the course, we will teach you the fundamental ideas of probability and random processes along with the labs. The hands-on assignments are carefully designed so that they demonstrate how the mathematical concepts can be used to design and build modern systems in many engineering and scientific fields including communication systems and networks, machine learning, signal processing, computational biology, and control systems.

Prerequisites

Knowledge of probability at the level of CS 70 or STAT 134. Familiarity with linear algebra.

Textbooks

- (BT) Dimitris P. Bertsekas and John N. Tsitsiklis, Introduction to Probability, 2nd Edition, Athena Scientific, 2008.
- (W) Jean Walrand, Probability in Electrical Engineering and Computer Science: An Application-Driven Course, Amazon, 2014. (e-book available)

Course Outline

(Order subject to changes)

1. M1: Fundamentals of Probability / 4 weeks / Main Reference: BT
    - Review: Discrete and Continuous Probability
    - Conditioning, Convolution, Transforms
    - Bounds, Convergence of Random Variables, Information Theory and Coding
    - Labs: Introduction/ Fountain Codes/ Auctions/ Huffman Codes
2. M2: Random Processes / 4.5 weeks / Main References: BT & W
    - Markov Chains (Discrete and Continuous Time), Queueing
    - Poisson Processes
    - Random Graphs
    - Labs: Sampling, Random Graphs
3. M3: Inference, Estimation, Learning / 4 weeks / Main References: BT & W
    - MLE/MAP, Detection, Communication, Hypothesis Testing
    - Estimation, Kalman Filter
    - Hidden Markov Models, Expectation Maximization & Clustering
    - Labs: Project, Kalman Filter, Viterbi Algorithm, EM Algorithm

Discussion Forum

We will be using Piazza for class discussion only. Rather than emailing questions to the GSIs, we encourage you to post your questions on Piazza. Find our class page here.

Grading

The grading breakdown is as follows -

- Homework(10%)
- Lab(5%)
- Project(5%)
- Midterm 1(20%)
- Midterm 2(20%)
- Final (40%)

Exams

- Midterm 1: Tuesday, Feb 19, 8-10pm
- Midterm 2: Tuesday, April 9, 8-10pm
- Final: Thursday, May 16, 3-6pm

Homework and Lab Schedule

1. Weekly homeworks will be assigned every Thursday, and must be submitted by **11.59p.m. of the following Wednesday**, as **a PDF file on Gradescope**. Lab assignments will released on Friday and will be due on **the following Friday at 11.59p.m.**, and both PDF and IPYNB files are submitted to Gradescope. It is your responsibility to ensure that all assignments are submitted on Gradescope by the deadline. We will not accept late assignments due to technological issues, so please submit two hours earlier than the official deadline to give yourself time to resolve these issues.
2. Homeworks, labs, solutions, and general announcements will be posted on the course website.
3. A link to a self-grading Google form will be provided in the solutions (for homeworks and labs). Each homework and lab should be self-graded and the self-grade form should be submitted online **by 11.59p.m. of the following Monday**. For detailed description of self-grading policies, please see the section on Homework and Lab Policies.
4. No late submission or self-graded score will be accepted. Any homework that is illegible or too difficult to read will get a 0.

Homework and Lab Policies

Collaboration

Discussions about homeworks are allowed and encouraged, but each student is expected to write his/her own solutions.

Self Grading

You can earn one of 4 possible scores for a problem: 0, 1, 2, and 3. If your solution is entirely correct, you get 3 points. If your solution is more than 66% correct on a single-part problem, or if you solve at least two-thirds of the parts entirely correctly for a multi-part problem, you get 2 points. If your solution is more than 33% correct on a single-part problem, or if you solve at least one-third of the parts entirely correctly for a multi-part problem, you get 1 point. Otherwise you get 0 points for the problem.

We sample and grade the submitted copies and check for inconsistencies with the self-graded scores. Please note the department policy on academic dishonesty

Drops

- Homework: Your two lowest homework scores will dropped.
- Lab: Your lowest lab score will dropped.