Fall 2021 CS 410/510

Foundations of Emerging Technologies

Instructor:	Fang Song
Course Meeting Schedule:	T/R 10 – 11:50 @ Hoff 109.
Email:	fsong@pdx.edu Stat email subject line with "f21-4510-fet"
Course webpage:	https://fangsong.info/teaching/f21_4510_fet/
Office hours:	TBD

Course Description

Emerging technologies, such as machine learning, quantum computing, modern cryptography, and big data analysis, have shown increasing significance of mathematical skills that go beyond a conventional discrete math course. Probability theory and linear algebra are evidently among the most essential. This course synthesizes fundamental theories and tools of probability and linear algebra with a slightly heavier weight on probability theory, and showcases applications in various topics in computer science. It aims to build a stronger foundation to facilitate future exploration in the emerging technologies.

Course Objectives

Upon the successful completion of this class, students will be able to:

1. understand and analyze the combinatorial nature of problems.
2. describe and analyze typical discrete and continuous random variables.
3. understand and conduct computations involving vectors, matrices, eigenvalues, and eigenvectors.
4. apply basic techniques in probability theory and linear algebra to model computational problems and design effective solutions in emerging topics in computer science.
5. describe problems and write proofs with mathematical rigor.

Course Prerequisites

CS 350. This course is theoretical in nature and contains extensive practice on math and analytical problems as well as writing mathematical proofs.

Readings

No required text. We will primarily follow lecture notes. The references below are useful supplements.

- [**AT**] Alex Tsun. Probability & Statistics with Applications to Computing. Link
- [**LLM**] David Lay, Steven Lay, Judi McDonald. Linear Algebra and Its Applications, 5th Edition. Pearson. Link

Grading Policies

- Homework: 50%. Weekly assignments.
- Quizzes: 20%. Biweekly.
- Exam: 25%.
- Participation: 5%.

Homework Policy

- You have a quota of 5 days in total for late submissions of homework or quizzes without penalty. You can use them at your will. Once the quota runs out, no late submissions will be accepted.
- Quizzes must be completed on your own. Collaboration on homework problems is highly encouraged, but you must write up solutions entirely on your own and clearly list who you discussed with for each problem. You must also clearly cite any other source you have referenced other than the text (a person, a book, a research paper, a webpage, etc.).
- All assignments must be submitted in PDF format. It is recommended to type-set your solutions using LaTeX, and you will get extra credit doing so.
- "I'll take 15%" option on homework problems. Your solutions should be as clear and concise as possible. Partial credit will only be given for answers that make significant progress towards correct solutions. If you realize you cannot solve a problem, you may write "I'll take 15%" instead of your answer, so you get 15% for this problem (or part of the problem). But if you do write an answer, you will get 0 if your solution is completely wrong. "I'll take 15%" option does not apply to problems of bonus credits.
- For each assignment, a random subset of problems will be graded.

Course Topics and Tentative Schedule

Check course webpage for details and updates

Week	Topic	Suggested Reading
1 - 2	Intro, combinatorics.	AT 0 – 1
3 – 7	Discrete probability, random variables, continuous random variables, concentration bounds.	AT 2 – 7
8 – 9	Vectors, vector space, matrices, linear transformations, eigenvectors, and eigenvalues.	LLM 2 – 5
10	Applications.	AT 9

PSU Policies & Resources

Academic Integrity

Academic integrity is a vital part of the educational experience at PSU. Please see the PSU Student Code of Conduct for the university's policy on academic dishonesty. A confirmed violation of that Code in this course may result in failure of the course.

Student Services

Disability Access Statement

If you have, or think you may have, a disability that may affect your work in this class and feel you need accommodations, contact the Disability Resource Center to schedule an appointment and initiate a conversation about reasonable accommodations. The DRC is located in 116 Smith Memorial Student Union, 503-725-4150, drc@pdx.edu, https://www.pdx.edu/disability-resource-center/

Safe Campus Statement

Portland State University desires to create a safe campus for our students. As part of that mission, PSU requires all students to take the learning module entitled Creating a Safe Campus: Preventing Gender Discrimination, Sexual Harassment, Sexual Misconduct and Sexual Assault. If you or someone you know has been harassed or assaulted, you can find the appropriate resources on PSU's Enrollment Management & Student Affairs: Sexual Prevention & Response website at http://www.pdx.edu/sexual-assault

Title IX Reporting

As an instructor, one of my responsibilities is to help create a safe learning environment for my students and for the campus as a whole. Please be aware that as a faculty member, I have the responsibility to report any instances of sexual harassment, sexual violence and/or other forms of prohibited discrimination. If you would rather share information about sexual harassment, sexual violence or discrimination to a confidential employee who does not have this reporting responsibility, you can find a list of those individuals on PSU's Enrollment Management & Student Affairs: Sexual Prevention & Response website at http://www.pdx.edu/sexual-assault. For more information about Title IX please complete the required student module "Creating a Safe Campus: Preventing Gender Discrimination, Sexual Harassment, Sexual Misconduct and Sexual Assault" in the "My Courses" section of D2L.

Cultural Resource Centers

The Cultural Resource Centers (CRCs) create a student-centered inclusive environment that enriches the university experience. We honor diversity, explore social justice issues, celebrate cultural traditions, and foster student identities, success, and leadership. Our centers include the Multicultural Student Center, La Casa Latina Student Center, Native American Student & Community Center, Pan African Commons, Pacific Islander, Asian, Asian American Student Center and the Middle Eastern, North African, South Asian program. We provide student leadership, employment, and volunteer opportunities; student resources such as computer labs, event, lounge and study spaces; and extensive programming. All are welcome!