Course program and reading list

Semester 1 Year 2024

School: Efi Arazi School of Computer Science M.Sc.

Information Theory

Lecturer:

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Teaching Assistant:

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Course No.:	Course Type :	Weekly Hours :	Credit:
3798	Elective	3	3

Course Requirements :	Group Code :	Language:
Final Paper	241379800	English

Prerequisites

Prerequisite:

52 - Calculus I
53 - Calculus II
54 - Linear Algebra I
55 - Linear Algebra II
56 - Discrete Mathematics
59 - Data Structures
69 - Logic And Set Theory
109 - Introduction to Probability
417 - Introduction To Computer Science

Course Description

Information theory is the science of quantifying, analyzing, and communicating information, encompassing the study of uncertainty, data compression, reliable communication, and the interplay between randomness and order in diverse systems. It provides a framework for understanding how information is processed, transmitted, and utilized, with applications spanning fields such as telecommunications, cryptography, machine learning, and various other branches of science.

This introductory class in information theory covers fundamental concepts and applications in communication, data compression, and statistics. Starting with the historical context and mathematical foundations, students will explore entropy, lossless compression techniques like Huffman codes, and information theory's role in statistics and machine learning. The course concludes with applications of information theory in training and analyzing language models.

Course Goals

1. Understanding the concept of Shannon's entropy as a measure of information
2. Understanding the applications of information measures in communications
3. Understanding concepts in modeling and compressing stochastic processes
4. Understanding the applications of information measures and stochastic processes in machine learning

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Grading

Grading is based on:

- Home assignments 30%
- Final exam or other final assessment 70%

Lecturer Office Hours

Monday 14:00-15:00

Reading List

- T. M. Cover and J.M. Thomas. 2006. "The elements of information theory". Wiley.
- Y. Polyanskiy and Y. Wu. 2023. Information Theory From Coding to Learning (https://people.lids.mit.edu/yp/homepage/data/itbook-export.pdf)
- Stanford's EE376A https://web.stanford.edu/class/ee376a/