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

Probabilistic Models for Data Analysis

Lecturer:

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Teaching Assistant:

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Course No.: 3575  
Course Type: Elective  
Weekly Hours: 3  
Credit: 3

Course Requirements:

Final Exam

Group Code: 221357500

Language:

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
77 - Algorithms
109 - Introduction To Probability
417 - Introduction To Computer Science

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Course Description

**Probabilistic graphical models (PGMs):**

- Modeling data using a multivariate probability distribution.
- Conditional independence and its role in modeling
- Representing independence in directed and undirected graphs (Bayesian networks and Markov fields)

**Inference problems and algorithms:**

- MAP – Maximum a-posteriori probability estimate
- Likelihood estimation
- Graph elimination algorithms for trees and general graphs

**Learning models from data:**

- Maximum likelihood parameter estimation
- The Expectation-Maximization (EM) algorithm
- Bayesian estimation and sampling approaches – Gibbs sampling, Markov-chain Monte Carlo (MCMC)

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Course Goals

The course introduces probabilistic graphical models (PGMs), their use in modeling complex processes and data sets, and algorithms for inference and learning. The main objective of the course is to cover the fundamental theory behind PGMs and some common practices.

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Grading

- 40% homework assignments (5 assignments total)
Learning Outcomes

- Using graphical models to describe data
- Describing dependencies using directed and undirected graphs
- Algorithms for inference on trees and general graphs
- Accurate and approximate inference
- Learning models from data – likelihood vs. Bayesian learning

Lecturer Office Hours
Thursday, 17:00 @ C.127, or by appointment

Tutor Office Hours
N/A

Reading List

- Pattern Recognition and Machine Learning (Information Science and Statistics). Christopher M. Bishop (Author), Springer.