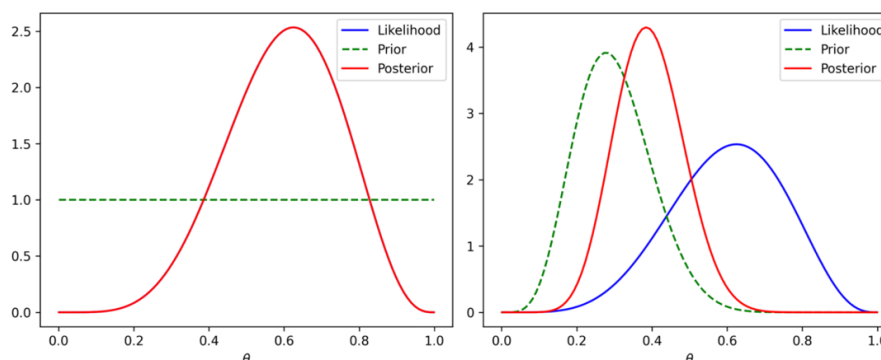


Modern Statistics

Instructor: Dr. Peyman Abbaszadeh
Assistant Professor, Department of Civil & Environmental Engineering

Course Overview

Master the power of modern statistical methods and transform your engineering expertise. This comprehensive course equips you with cutting-edge techniques in probability theory, Bayesian and frequentist approaches, and advanced machine learning algorithms. Through hands-on Python programming, you will explore density estimation, clustering, classification, and kernel methods while mastering Gaussian processes, optimization techniques, and Markov chain Monte Carlo inference. Whether you are analyzing complex datasets or building predictive models, this course provides the essential toolkit for solving real-world engineering challenges with statistical rigor and computational excellence.



Key Learning Outcomes

- Understand mathematical foundations of probability and statistical inference
- Apply probabilistic models and density estimation techniques
- Implement Bayesian and frequentist methods for parameter estimation
- Use Monte Carlo and MCMC methods for uncertainty quantification
- Employ clustering, classification, kernel methods, and Gaussian processes
- Build complete statistical workflows in Python for real datasets

Topics Covered

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| <ul style="list-style-type: none"> • Probability & Random Variables • Probabilistic Models • Bayesian vs. Frequentist Statistics • Density Estimation • Clustering & Classification | <ul style="list-style-type: none"> • Kernel Methods • Markov Processes • Monte Carlo & MCMC Inference • Gaussian Processes • Optimization & Error Estimation |
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Course Format

Lectures: Comprehensive and example-driven

Programming: Python (Google Colab/Jupyter Notebook)

Assessment: Homework-based + Final Project (No Exams)

Mode: In-person

Prerequisites

It is strongly recommended that students complete **Stat 243/244** or **Stat 460** prior to enrolling in this course for optimal preparation.