# MODERN STATISTICAL METHODS FOR BIG DATA ANALYTICS

Instructor:	Xuping Xie	Time:	TR 3:00 - 4:15 PM
Email:	xxie@odu.edu	Place:	VAB 2012

### Course Pages: https://canvas.odu.edu/courses/176052

Office Hours: TR 1:50 - 2:50 PM at ECSB 2113, or by appointment

#### Main References:

- Pattern Recognition and Machine Learning by Chris Bishop
- An Introduction to Statistical Learning, with Applications in R by James, Witten, Hastie and Tibshirani

**Objectives:** This course aims to provide students with a comprehensive understanding of modern statistical methods and their applications in analyzing large and complex datasets. By integrating both theoretical foundations and practical implementation

**Prerequisites:** Strong understanding of undergraduate-level probability, calculus, and linear algebra is required.

**Programming:** This course will use Python 3 for homework/projects. We will use jupyter notebook to do in-class codeing exercise. You could either use Google Colab or Anaconda.

### Main Topics:

- Bayesian Inference
- Generative Methods
- Randoom Process and Sampling
- Markov Chain Monte Carlo (MCMC) Methods
- Foundation of Reinforcement Learning (RL)

#### **Course Outcome:**

- Apply classical (Frequentist) and Bayesian inference methods to model and make predictions from large datasets.
- Implement statistical sampling strategies to ensure unbiased and efficient data collection and estimation.
- Use Monte Carlo simulations and probabilistic graphical models to handle uncertainty in data.
- Apply reinforcement learning (RL) to optimize sequential decision-making problems.

## Grading Policy: Homework/projects (40%), Midterm in-class exam(30%), Final project(30%).

Assignments: There will be homework/project assigned (roughly) every week. Each submission should be submitted as a single pdf file. To submit your homework and final project, create a folder BDA431-Your-first-name-and-last-name" or BDA531-Your-first-name-and-last-name" in your OneDrive and shared it with me (xxie@odu.edu). Please make sure I have the permission to edit them.

Discussion among students is encouraged. However, independent thinking and problem-solving skills are mandatory. The work turned in must be each student's own and copying of assignments is a violation of the Honor Code.

Class Policy: Regular attendance is essential and expected.

**Honor Code:** By enrolling in this course you agree to adhere to the honor code on all written work: "I pledge to support the Honor System of Old Dominion University. I will refrain from any form of academic dishonesty or deception, such as cheating or plagiarism. I am aware that as a member of the academic community, it is my responsibility to turn in all suspected violators of the Honor Code."

**Student Conduct:** Old Dominion University is committed to students' personal and academic success. In order to achieve this vision, students, faculty, and staff work together to create an environment that provides the best opportunity for academic inquiry and learning. All students must be honest and forthright in their academic studies. Your work in this course and classroom behavior must align with the expectations outlined in the Code of Student Conduct, which can be found at www.odu.edu/oscai. Academic dishonesty will be reported to the Office of Student Conduct & Academic Integrity and may result in sanctions up to and including expulsion from the University.

**Disability Accommodation:** Students are encouraged to self-disclose disabilities that have been verified by the Office of Educational Accessibility by providing Accommodation Letters to their instructors early in the semester in order to start receiving accommodations. Accommodations will not be made until the Accommodation Letters are provided to instructors each semester.