

STA243

Computational Statistics (Graduate)

This course covers modern and classical methods of statistical computing and computational statistics. The course material includes algorithms and numerical computing. The goal is to give students a foundation in common computational techniques and algorithms that are used in the implementation of statistical methods. Students will learn to design robust and accurate software to support their research. They will also be able to critically understand the techniques used in existing software.

We will use examples drawn from diverse fields including bioinformatics, ecology, medicine, computer vision, and stochastic finance.

We will focus on the *R* language. We will discuss the use of *Matlab* for large matrix calculations. We will also talk about interfacing different languages, such as calling *C* from *R* for more efficient (faster, lower memory usage) computations.

- Week 1. Numerical Analysis & Representation of Numbers
Information Theory
- Week 2. Algorithmic Complexity
Efficiency & Data Reduction
- Week 3. Introduction to *C* and Pointers
- Week 4. Calling *C* from *R*
Linking & Loading
- Week 5. Optimization
- Week 6. Linear Algebra Calculations
Matrix Decompositions
- Week 7. Random Number Generation
- Week 8. Simulations
Computer Experiments
- Week 9. Resampling Methods
- Week 10. Fast Fourier Transform
Dynamic Programming