

AMS 225 (Winter 2014)

Multivariate Statistical Methods

Lecturer

Juhee Lee

juheele@soe.ucsc.edu

Office hours: Monday and Friday 9:00-10:00am or by appointment

Office: BE 359C

Lectures

Tu and Th 12:00PM–01:45PM in Porter Acad 241.

Overview

Multivariate analysis is a graduate level course in statistical methods for analyzing multivariate data. It is concerned with the simultaneous statistical analysis of multiple variables. The course will introduce students to methodology, theoretical foundations, and computational aspects of multivariate data analysis from a modern perspective. Theoretical derivations will be presented together with practical aspects and intuition.

The course will include topics from the following:

- Random Vectors and Matrices
- Multivariate Normal Distribution Theory
- Multivariate Regression
- Linear Dimension Reduction: Principal Components Analysis, Canonical Correlation Analysis
- Linear Discriminant Analysis
- Latent Variable Models: Factor Analysis, Independent Component Analysis

Prerequisites: AMS 206, or permission of instructor. Preparation in multivariate calculus and linear algebra is absolutely necessary for this course. The instructor assumes that students are familiar with:

- Maximum likelihood, Fisher information
- Loss function, risk of an estimator
- Bias and variance
- Trace, determinants, eigenvalues, and eigenvectors
- Gradients and Hessians

Students are expected to be able to write R computer programs. The first homework will have a few review problems that indicate the level of preparation this course requires. If you find them too difficult, then you will probably have difficulty with the rest of the course.

Website

The class schedule, important announcements, lecture notes, homework problems and solutions, and other information about the course will be posted on the course website (<https://ams225-fall15-01.courses.soe.ucsc.edu/>).

Textbooks

- Press SJ (2005). *Applied Multivariate Analysis, second edition*. Mineola NY: Dover (a decent reference for some of the Bayesian ideas in this course).
- Izenman, A. J. (2008): *Modern Multivariate Statistical Techniques*. [Free access through Library]
- Rowe, D. B. (2003): *Multivariate Bayesian Statistics*. [Free access through Library]
- Mardia KV, Kent JT, Bibby JM (2003). *Multivariate Analysis*. New York: Academic Press (a good reference text for the likelihood part of this material).

Evaluation

Your final grade will be based on the following components:

Homework	30%
Midterm (Thursday, Nov 5th)	30%
Final Project	40%

Project: Students will work alone or in teams of two. The project will consist of:

- A one page proposal due Thursday, Oct 29 (tentative).
- A three page progress report due Thursday, Nov 19 (tentative).
- A short presentation on Thursday Dec 3 (the last day of class, tentative!).
- A final report (maximum 8 pages) due Tuesday, Dec 8 (10am).

Policy on Collaboration: Collaboration on homework assignments with fellow students is encouraged. However, such collaboration should be clearly acknowledged, by listing the names of the students with whom you had discussions. You may not, however, share written work or code with others. Your homework submission should be written by you alone.

Academic misconduct

Cheating, plagiarism and other forms of academic dishonesty will not be tolerated. Any violation will be prosecuted to the fullest extent as set out in University Rule.

Disclaimer

This syllabus should be taken as a fairly reliable guide for the course content. However, you cannot claim any rights from it and in particular I reserve the right to change due dates or the methods of assessment. Official announcements will ALWAYS be those made in class.