

University of Rhode Island

Department of Computer Science and Statistics STA541, Multivariate Statistical Methods, Fall 2014

Instructor:	Natallia V. Katenka
Email:	nkatenka@cs.uri.edu
Office Hours:	Tuesday/Thursday 2pm-4pm (Tyler Hall 247)
Class Days/Time:	Thursday 4:30-7:15pm
Classroom:	Tyler Hall 109
Prerequisites:	STA 409, 411, 412 or permission of instructor Matrix Analysis and Computing are desired
Required Text/Reading:	<i>An Introduction to Applied Multivariate Analysis with R</i> , by Brian Everitt and Torsten Hothorn (Springfield) ISBN- 10: 1441996494 ISBN-13: 978-1441996497. Additional Course Material will be posted on SAKAI!
Software	R will be used in this class (free to download online).

Assignments and Grading Policy

Assignments	30%
Project	30%
Final Exam	40% (take home)

Course Description

This course will help students to gain knowledge and experience on applied multivariate data analysis. Topics will include review of matrix algebra and multivariate normal distribution, visualization of high dimensional data, dimension reduction (e.g., principal component and factor analysis, multidimensional scaling), classification (linear and quadratic discriminant analysis, classification trees, support vector machines, neural networks, etc.), cluster analysis (hierarchical, partition, and model based), introduction to confirmatory factor analysis, analysis of categorical and repeated measures data (mixed-effect models). The main focus of the course will be on the fundamentals and the appropriate use of multivariate analysis techniques. Students will be able to work independently on homework assignments and to collaborate in small groups (2-3 students) on application-oriented studies. For all computations R will be used as the main computing environment.

Course Goals

- To develop statistical ability to think critically about numerical information
- To learn and be able to apply multivariate data analysis concepts
- To recognize their common usage and limitations
- To learn statistical computing techniques using R
- To recognize and appreciate the importance of collaborative group work
- To be able to produce quality report and present the results of conducted analysis

Classroom Protocol

- **Attendance is mandatory!** Each unexcused absence = **-1%** of your final grade. Please don't be late for a class.
- Lecture notes, data sets, and R code examples will be posted on SAKAI and will be used during all lectures. Please print/download them in advance. There will be times designed to be interactive. Take advantage and participate!
- **Group projects** will be assigned to give you experience in applying what you learn in the course. At the end of the course, you will be expected to present the results of the project and write a final report. **Don't wait till the last moment; find your group as soon as possible!**
- **Homework** will be assigned. **No late homework will be accepted!**
- Students are encouraged to work with their fellow students on homework and in studying. **Copying from someone is STRICTLY prohibited.**
- **Cell Phones:** no cell phone talking/texting/browsing during class.
- **Laptops:** laptops can be used only for computing and data analysis.

Disability Accommodations and Opportunities

Please contact me if you require special accommodations due to learning disabilities. **Confirmation is required.** As part of this process, please be in touch with Disability Services for Students Office at 330 Memorial Union, 401-874-2098.

Tentative Course Outline and Reading Assignment

Week	Topics, Readings, Assignments, Due Dates, Deadlines
1	<u>Introduction and Course Preliminaries:</u> Review of matrix algebra and multivariate normal distribution. Introduction to R. (SAKAI+CHAPTER 1)
2	<u>Multivariate Data Visualization:</u> Scatter plots and density plots, 2D and 3D plots in R. (CHAPTER 2)
3	<u>Dimension Reduction:</u> principal components analysis and canonical correlation analysis. (SAKAI+CHAPTER 3)
4	<u>Dimension Reduction:</u> multidimensional scaling analysis. (SAKAI+CHAPTER 4)
5	<u>Dimension Reduction:</u> exploratory factor analysis. (SAKAI+CHAPTER 5)
6	<u>Classification (Tools Overview):</u> linear and quadratic discriminant analysis, classification trees and random forests, nearest neighbor classifiers. (SAKAI)
7	Group Project Proposals
8	<u>Cluster analysis:</u> hierarchical and partition algorithms, model based clustering (SAKAI+CHAPTER 6)
9	<u>Confirmatory factor analysis and structural equation models</u> (SAKAI+CHAPTER 7)
10	Some elements of categorical data analysis (contingency tables, loglinear models) and analysis of repeated measures data (mixed-effect models for repeated measures). (SAKAI+CHAPTER 8)
11	Classical Multivariate Analysis: MANOVA, Regression for Multivariate Response (SAKAI)
12	GROUP PROJECT PRESENTATIONS
13	FINAL EXAM

The University of Rhode Island uses an emergency notification system, URI Emergency ALERT that allows news and instructions to be sent quickly to all members of the University community in the event of an emergency (for more details go to <http://www.uri.edu/emergency/alert.html>).