SMU | Bobby B. Lyle School of Engineering

CSE 8091 - Fall 2011
Advanced Scientific Computing with R

M 3:00-3:50pm, Caruth 383
http://michael.hahsler.net/SMU/ScientificCompR/

Introduction

Scientific computing applies computational methods to scientific and engineering problems. This course will help you exploit the power of R, a freely available language and environment for statistical computing and graphics, to boost your research with state of the art data analysis and visualization. R is currently the 2nd most widely used environment for data analysis/mining beating the well-known commercial tools IBM/SPSS, SAS and Matlab (2011 KDDnuggets Survey).

We will cover R basics and programming; simulating, analyzing and visualizing data; vectorization; interfacing algorithms in C/C++/Java; easy creation of scientific documents with Sweave; packaging R software for reuse; and advanced topics as needed.

Part of the course is a project focusing on each participant's research interest/need.

Instructor Contact Information

Dr. Michael Hahsler
Caruth 451
(214) 768-8878
mhahsler@lyle.smu.edu
Office hours: MW 12:00-12:30pm and 2:00-3:00pm

Reading

- An Introduction to R (http://cran.r-project.org/manuals.html)
- Writing R Extensions (http://cran.r-project.org/manuals.html)
- CRAN TaskViews (http://cran.r-project.org/)
- How S4 Methods Work (http://developer.r-project.org/howMethodsWork.pdf)
- Sweave User Manual (www.stat.uni-muenchen.de/~leisch/Sweave/Sweave-manual.pdf)

Course Prerequisites

Basic C/C++/Java programming knowledge. Permission of instructor.

Course Work and Grading

This course consists of participation in class, in-class assignments and a project covering each individual student's research interests.

Grading is satisfactory/unsatisfactory. You have to participate actively in class and complete at least 60% of the assignments/project.

Tools and Software

You can install R for Linux/OS X or Windows from the Comprehensive R Archive Network:

http://cran.r-project.org/ (under "R Binaries")

If possible install R on Linux (e.g. with an Ubuntu installation using Virtual Box in Windows). Developing code that interfaces R with C/C++/Java code is very hard with Windows.

Covered Topics

Session	Date	Topic	Reading
Week 1	8/22	Overview, installation, using R, numbers and vectors	An Introduction to R Ch. 1-2
Week 2	8/29	Objects, arrays, lists, reading from file	An Introduction to R Ch. 3-7
Week 3	9/5	**M - Labor Day**	
Week 4	9/12	Loops, lapply, functions	An Introduction to R Ch. 9-10
Week 5	9/19	Plots	An Introduction to R Ch. 12
Week 6	9/29	Simulating data	An Introduction to R Ch. 8
Week 7	10/3	Analyzing/Prediction data (clustering, linear models, etc.)	lm, kmeans, hclust
Week 8	10/10	**M - Fall break.**	
Week 9	10/17	Graphs	igraph
Week 10	10/24	Using R-packages, OO design and Classes in R	CRAN taskviews, How S4 Methods Work
Week 11	10/31	Sweave	Sweave User Manual
Week 12	11/7	Creating R-packages	Writing R Extensions
Week 13	11/14	Working on project	
Week 14	11/21	Working on project	
Week 15	11/28	Project Presentations	
Week 16	**12/5**	Project Presentations	

Attendance Policy

Attendance is strongly encouraged.

Additional Information

Disability Accommodations: Students needing academic accommodations for a disability must first contact Ms. Rebecca Marin, Coordinator, Services for Students with Disabilities (214-768-4557) to verify the disability and establish eligibility for accommodations. Then schedule an appointment with me to make appropriate arrangements. (See University Policy No. 2.4.)

Religious Observance: Religiously observant students wishing to be absent on holidays that require missing class should notify me in writing at the beginning of the semester, and should discuss with her, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No. 1.9.)

Excused Absences for University Extracurricular Activities: Students participating in an officially sanctioned, scheduled University extracurricular activity will be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with me prior to any missed scheduled examination or other missed assignment for making up the work. (University Undergraduate Catalog)