FALL 2014 - STAT 890 G100

STATISTICS: SELECTED TOPICS (4)

Delivery Method: In Person

COURSE TIMES + LOCATION:

Tu, Th 9:30 AM – 11:20 AM
Burnaby

INSTRUCTOR:

Derek Bingham
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Office: SC-K 10569

Description

COURSE DETAILS:

DYNAMIC COMPUTER EXPERIMENTS

Course will be held in the IRMACS Theatre

Prerequisites:

Familiarity, at a senior undergraduate level, with variance and covariance properties of linear combinations of random variables, statistical concepts such as estimation bias and variance, statistical regression modelling. Experience with Matlab or R will be useful. Students not doing a graduate degree in Actuarial Science, Statistics or Mathematics should obtain permission from the instructor.

Course Contents:

The rapid growth in computing power has made the computational simulation of complex systems feasible. Scientists are able to adjust inputs to computer simulators in order to help understand their impact on a system. That is, they perform a designed computer experiment (or simply a computer experiment). These are commonly used in science and engineering, and are making inroads in health sciences, etc.

The course will introduce students to the statistical design and analysis of computer experiments in general. Of particular interest are dynamic computer models, with output overtime and/or space.

Specic topics to be covered are likely to include:

- What is a computer experiment?
  > Motivating examples selected from glaciology, atmospheric pollution, ocean science and other domains; the data and

scientic objectives

- Analysis
  > Emulation of a computer code: Gaussian process (GP) statistical models to predict the output of a computer code, along with a measure of uncertainty
  > Estimation of parameters of the GP model using likelihood and Bayesian methods
  > Assessment of prediction error; statistical model diagnostics
  > Building a GP model (choosing the components)
  > Other methods, e.g., MARS, polynomial chaos
  > Computation: avoiding ill-conditioning; faster computations for large sample sizes

- Design of computer experiments
  > Space-lling designs: Latin hypercubes and variants
  > Sequential design for optimization and quantile estimation

- Scientic and engineering objectives
  > Screening and sensitivity analysis, visualization
  > Propagation of variation

- Combining computer model runs and physical data
  > Calibration of unknown parameters in a computer model
  > Estimating the discrepancy between computer code output and physical reality

- Dynamic computer codes
  > Statistical approaches to handle computer-model output over time and/or space
  > Motivating applications revisited

Logistics:

Classes at SFU and UBC will be held jointly by video link, with Professor Derek Bingham the instructor at SFU and Professor Will Welch at UBC. A video link with researchers at Acadia University is also planned, and Professors Chipman and Ranjan at Acadia may give guest presentations (as may others).

Mode of instruction:

An introduction to the above topics and their computer implementation will take about half the class time. Students will present reviews of key papers and projects in an informal discussion setting for the remaining classes.

Course web page http://www.stat.ubc.ca/~will/cx/
(currently points to a previous oering of the course; will be updated)

Grading

Assignments	30%
Presentation(s) of papers in the literature	30%

Analysis / Computing mini Project(s) 40%

Materials

REQUIRED READING:

Course Text:

A list of seminal papers will be provided

DEPARTMENT GRADUATE NOTES:

Students with Disabilites:
Students requiring accommodations as a result of disability must contact the Centre for Students with Disabilities 778-782-3112 or csdo@sfu.ca

GRADUATE STUDIES NOTES:

Important dates and deadlines for graduate students are found here: https://www.sfu.ca/dean-gradstudies/current/important_dates/fall_2014.html. The deadline to drop a course with a 100% refund is the end of week 2. The deadline to drop with no notation on your transcript is the end of week 3.

REGISTRAR NOTES:

SFU's Academic Integrity web site http://students.sfu.ca/academicintegrity.html is filled with information on what is meant by academic dishonesty, where you can find resources to help with your studies and the consequences of cheating. Check out the site for more information and videos that help explain the issues in plain English.

Each student is responsible for his or her conduct as it affects the University community. Academic dishonesty, in whatever form, is ultimately destructive of the values of the University. Furthermore, it is unfair and discouraging to the majority of students who pursue their studies honestly. Scholarly integrity is required of all members of the University. http://www.sfu.ca/policies/gazette/student/s10-01.html

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