STOR 556: Time Series Data Analysis

Course goals and key learning objectives: Time series analysis is understood in a broad sense as the analysis of data collected in time, and is related to Signal Processing, Machine Learning, and other areas. The main goal of this course is to introduce students to a range of both classical and modern topics in time series analysis that can be used as a foundation for applied work and a further exposure to technical literature.

Target audience: Upper-level undergraduate and MS students in STAN/STOR, Computer Science, Economics, Psychology/Neuroscience, Math and other programs and departments.

Place and Time: Hanes 120, Tuesday & Thursday, 8:00-9:15AM.

Instructor:
office:
e-mail:
Instructor office hours (starting 2nd week of classes): Monday 9:30-11:00AM, Wednesday 8:00-9:30AM, I also very much encourage you to ask questions on anything that may be unclear during classes.

Instructional assistant:
office:
e-mail:
Instructional assistant office hour:

Prerequisites: The official prerequisites are STOR 435/535: Introduction to Probability and STOR 455: Methods of Data Analysis. I will thus assume that you have seen basic probability (multivariate random variables, covariance, etc.) and statistics (multivariate regression, parameter estimation, hypotheses testing, etc.). I will also use some linear algebra (vector and matrix manipulations), which you may want to read about if unfamiliar. On the computing side, I expect that you are familiar with R/R-Studio or can pick up its basics quickly.

Course and lecture format: I will emphasize data and understanding basic principles and ideas, as opposed to technicalities of the theory. Here are several goals/highlights of the approach:

* I will use R-Markdown files to illustrate concepts and approaches. You will have access to the R-Markdown files, for experimentation with any ideas or questions you have.

* Motivating data sets will be used. They may not necessarily be the most exciting, but techniques will be illustrated, and something will be achieved for the data sets.

* My main goal is that at the end of each topic, you have a good idea of what the topic is about, maybe without necessarily understanding all the technical details around it.

* My other goal is for you to see how data and practice, on one hand, and theory and methods, on the other hand, come together.

Topics: I plan to cover some of the following topics: Classical decomposition; Differencing and unit roots; Structural modeling; Spectral perspective; Seasonal/periodic models; Vector autoregression; Variable selection and penalized estimation; Cointegration; Factor models; Change point detection; Anomaly detection; Clustering/classification; Neural network models for time series data; Other machine learning methods.

Course website: The course website can be found at http://sakai.unc.edu. In particular, the lecture "slides" will be posted on Sakai at least one hour before they are given in class, in case you want to make notes on your tablet, follow them on your own computer, etc. Homework assignments, reading and any other class material will also be posted on Sakai.

Textbook: No textbooks are required to buy for the course. The lectures will be based on several sources, whose references will be provided and some of which will be posted on Sakai. For example, a good source for some course material is the textbook *Introduction to Time Series and Forecasting* by P. J. Brockwell and R. A. Davis. Its PDF files will be posted on Sakai.

Course requirements: Your performance in the course will be assessed based on homework and exams.

Homework: Unless announced otherwise, homework will be assigned every week on Thursday and will be due the Thursday after. Homework submission and grading will be handled through https://www.gradescope.com. Instructions for submitting homework will follow separately. Questions regarding homework grading should be discussed first with the instructional assistant. Each homework assignment will carry an equal weight.

Exams: There will be one in-class Midterm Exam and Final Exam. The Final Exam is scheduled on April 30, Saturday, at 8:00AM. The Midterm Exam will take place on March 8, Tuesday. The exams will mostly serve as a way of checking if you follow the material of the course, whereas most of the actual course work will be left for homework.

Grades: Homework 60%; Midterm Exam 20%; Final Exam 20%.

Schedule: To be updated during the semester:

Jan 11 (Tu): Time series and their models
Jan 13 (Th): Classical decomposition, Hw 1
Jan 18 (Tu): Classical decomposition
Jan 20 (Th): Classical decomposition, Hw 2, Hw 1 due
Jan 25 (Tu): …
Jan 27 (Th):
Feb 1 (Tu):
Feb 3 (Th):
Feb 8 (Tu):
Feb 10 (Th):
Feb 15 (Tu):
Feb 17 (Th):
Feb 22 (Tu):
Feb 24 (Th):
Mar 1 (Tu):
Mar 3 (Th):
Mar 8 (Tu): **Midterm Exam**

Mar 10 (Th):
Mar 15 (Tu): *Spring Break*
Mar 17 (Th): *Spring Break*
Mar 22 (Tu):
Mar 24 (Th):
Mar 29 (Tu):
Mar 31 (Th):
Apr 5 (Tu):
Apr 7 (Th):
Apr 12 (Tu):
Apr 14 (Th):
Apr 19 (Tu):
Apr 21 (Th):
Apr 26 (Tu):

Apr 30 (Sa), 8AM: **Final Exam**

Honor Code: All students must be familiar with and abide by the Honor Code, which covers issues such as plagiarism, falsification, unauthorized assistance, cheating, and other grievous acts of academic dishonesty. Violations of the Honor Code will not be taken lightly.

Syllabus changes: I reserve the right to make changes to the syllabus, due dates and other information, when circumstances demand. These changes will be announced as early as possible so that students can adjust their schedules. (See also the "last modified" date at the bottom of the syllabus.)

Syllabus last modified: