جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Time Series Analysis - STAT 350

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	STAT 350
Course Title	Time Series Analysis
Academic Semester	Spring
Academic Year	2017/2018
Semester Start Date	01/28/2018
Semester End Date	05/24/2018
Class Schedule (Days & Time)	10:30 AM - 12:00 PM | Mon Thu

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Hernando Catequista Ombao	hernando.ombao@kaust.edu.sa			TBA

Teaching Assistant(s)

Name	Email
TBA	TBA

Course Information

Comprehensive Course Description	This course will cover models for analyzing time series data from both time and frequency domain perspectives. The emphases will be a balance of theory and applications. The course is intended to prepare the student for methodological research in this area and to train the students on cutting-edge data analytic methods for time series. The primary topics include ARMA/ARIMA models; spectral and coherence estimation; transfer function modeling; and classification and discrimination of time series. The course will conclude with advanced topics on non-stationary time series, time-frequency analysis and state- space models.
Course Description from Program Guide	This course will cover models for analyzing time series data from both time and frequency domain perspectives. The emphases will be a balance of theory and applications. The course is intended to prepare the student for methodological research in this area and to train the students on cutting-edge data analytic methods for time series. The primary topics include ARMA/ARIMA models; spectral and coherence estimation; transfer function modeling; and classification and discrimination of time series. The course will conclude with advanced topics on non-stationary time series, time-frequency analysis and state- space models.
Goals and Objectives	The students are espected to master the basic concepts of time domain and spectral domain aspects of time series analysis. The students are expected to produce high quality data analysis that demonstrate state-of-the-art methods and techniques. The students are expected to master the basic theoretical results on estimation and inference on the spectrum, coherence and parametric models.
Required Knowledge	Mathematical statistics (estimation, hypothesis testing and confidence interval estimation). Linear models.
Reference Texts	**Textbook** Shumway R and Stoffer D. (2017). Time Series Analysis and Its Applications with R Examples, 4th ed. Springer. [e-Version vailable at the KAUST library.]
Method of evaluation	**30.00**% - Course Project(s) **30.00**% - Homework /Assignments **40.00**% - Exam 1

Nature of the assignments	**Grading Policy** 2-3 Problem Sets (30%) Midterm exam (40%) Individual Paper Project (30%) broken into Proposal (3%) Draft (7%) Final Paper (10%)
Course Policies	No late homework will be accepted. No late proposal, draft and final paper will be accepted. Students are expected to adhere to the KAUST standards of academic excellence and integrity.
Additional Information	Group discussions are encouraged but writing up the solutions to the homework, proposal, paper draft and final paper are all indivudual work.

Tentative Course Schedule *(Time, topic/emphasis & resources)*		
Week	**Lectures**	**Topic**
1	Mon 01/29/2018 Thu 02/01/2018	Characteristics of time series Auto and cross-correlation Regression Analysis with correlated errors Intro to R Estimation (maximum likelihood and method of moments) Asymptotic distribution of the MLE
2	Mon 02/05/2018 Thu 02/08/2018	Stationarity ARIMA Models
3	Mon 02/12/2018 Thu 02/15/2018	Auto-correlation and partial auto-correlation functions Estimation Estimation and Forecasting
4	Mon 02/19/2018 Thu 02/22/2018	Lagged Regression Cyclical Behavior and Periodicity Power Spectrum AR(2) processes
5	Mon 02/26/2018 Thu 03/01/2018	Linear Filters Cramer representation Discrete Fourier transform
6	Mon 03/05/2018 Thu 03/08/2018	Spectral estimation: periodogram Spectral estimation: parametric
7	Mon 03/12/2018 Thu 03/15/2018	Multivariate spectral analysis Cramer representation Spectral Matrix Coherence Partial Coherence Estimation
8	Mon 03/19/2018 Thu 03/22/2018	VARMA/VARMAX models MIDTERM outside of class hours 6 pm – 9 pm
9	Mon 03/26/2018 Thu 03/29/2018	Special lecture on Statistical models for biological signals Special lecture on Statistical models for biological signals
10	Mon 04/02/2018 Thu 04/05/2018	Presentation of preliminary analysis of projects At the class time and special time 6 pm – 8 pm Regression for Jointly Stationary Time Series Regression with Deterministic Inputs Project first draft due

11	Mon 04/09/2018 Thu 04/12/2018	Discrimination and Cluster Analysis of Time Series Principal Components Factor Analysis
12	Mon 04/16/2018 Thu 04/19/2018	State-space models State-space models and Switching VAR model
13	Mon 04/23/2018 Thu 04/26/2018	Special lectures on wavelets Part I OPTIONAL attendance Special lectures on wavelets Special lectures on wavelets Part II
14	Mon 04/30/2018 Thu 05/03/2018	Class discussion on Projects Class discussion on Projects
15	Mon 05/07/2018 Thu 05/10/2018	ARCH and GARCH models Longitudinal data analysis
16	Mon 05/14/2018 Thu 05/17/2018	Linear mixed effects models Functional data analysis
17	Mon 05/21/2018 Thu 05/24/2018	Functional mixed effects models Class discussion on Projects Final Paper due!
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Note

The instructor reserves the right to make changes to this syllabus as necessary.