Time Series Analytics

109-1 Syllabus
IE5057 Monday 9h10-12h10

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Introduction

Time series and signals exist everywhere, and, in particular, the data collection and analysis are much easier than before with the advancement of modern information technology. This course starts by modeling the standard time series, such as the demands, economic indicators. Digital signals, such as the machine sensor readings, ECG, and soundwaves, are then analyzed with signal processing techniques. The goal is to develop a general sense of treating temporal signals.

Objective

Students from this course shall learn to:

1. comprehend the characteristics of different time series and signals;
2. understand the time series identification, estimation, and diagnostic;
3. understand the analytical techniques for digital signal processing;
4. apply proper treatments for analyzing time-series data.

Pre-requisite

probability & statistics, linear algebra, calculus, and programming skills

Reference Book

- Box, G. E. P., Jenkins, G. M., Reinsel, G. C., & Ljung, G. M. (2016). *Time Series Analysis: Forecasting and Control*.
- Davis, M. H. A., & Vinter, R. B. (1985). *Stochastic Modelling and Control*.
- Tsay, R. (2010). *Analysis of Financial Time Series*.
- Smith, S. W. (1999). *The Scientist and Engineer's Guide to Digital Signal Processing*.
- Lyons, R. G. (2010). *Understanding Digital Signal Processing*.
- Mallat, S. (2008). *A Wavelet Tour of Signal Processing*.

Evaluation

Homework (30%), Mid-term (30%), Final-term (30%), Report (10%)

Planning

Date	Topics
09/14	Review & Preview
09/21	Exponential Smoothing Models
09/28	Stationarity vs. Invertibility
10/05	Univariate Stationary Time Series Models
10/12	Univariate Stationary Time Series Models
10/19	Univariate Stationary Time Series Models
10/26	Univariate Nonstationary Time Series Models
11/02	Model Identification, Estimation, and Diagnostic
11/09	Mid-term Exam
11/16	Model Identification, Estimation, and Diagnostic
11/23	Seasonal Time Series Models
11/30	Time Series Forecasting and Multivariate Models
12/07	Time Series Modeling Practices in R*
12/14	Time-Frequency Analysis
12/21	Wavelet Transformation
12/28	Recurrent Neural Network
01/04	Fina-term Exam
01/11	Paper Reading Report Due (no physical class)