OBJECTIVE：

This course aims at developing basic knowledge and introducing methods used in time series analysis. An important focus of the course is to understand the mathematical root and statistics techniques so that one may be able to apply and generalize them to different real-world data analysis tasks. Programming exercises and real-world projects will also help students to develop written and oral scientific communication.

Grading Policy

Assignments and Projects.

CONTENT

The course mainly focuses on identification of appropriate stationary ARMA models, model diagnostic and model selection for real data sets. The course will also present case studies to students on real-world applications.

Textbook

B. L. Bowerman and R. T. O'Connell. (1993) Forecasting and Time Series: An applied approach. (3rd Edition). Duxbury Press
G.E. P. Box, G. M. Jenkins and G. C. Reinsel (1994) Time Series Analysis, Forecasting and Control. Prentics Hall.

Course syllabus:

1) Introduction to time series
    a) Components of time series
    b) Autocorrelation functions and error in forecasting
2) Linear Regression Model and Forecasting
    a) Estimation of multiple regression model
    b) Inference about multiple regression model
3) Models for stationary time series
    a) Moving Average and Auto regressive (ARMA)
    b) Stationarity and invertibility
4) Parameter estimation
    a) The method of moments
    b) Least Squares Estimation
5) Model diagnostic and selection
    a) Residual Analysis
    b) AIC and BIC
6) Forecasting
    a) Exponential smoothing

b) Forecasting from seasonal ARIMA models

7) Non-stationary time series

   a) Time series with non-stationary variance and non-stationary mean
   b) Unit root

8) Spectral analysis

   a) Periodogram
   b) Spectral density

9) Time series models of heteroscedasticity
   a) Some Common Features of Financial Time Series
   b) GARCH Models

10) Rare event detection (Change point detection)

   a) Statistical Quality Control
   b) CUSUM