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Time series

Homework

Spring 2017

All Problems are compulsory. Do not give raw computer output as your main answer to any question; do include R code in an appendix. Remember that providing a clear and reasonable justification of your answers is at least as important as getting the answer right.

Due to June 19, 2016.

You may discuss with other students but you **have to** make your own answer.

a) Problems 1.2, 2.2, 2.3, 3.6, 3.9, 3.19, 3.21 in the textbook (3rd edition). All data sets are available on "*http://www.stat.pitt.edu/stoffer/tsa2/tsa2.html*". In R, use *read.table* to import the data in txt files.

b) Generate 1000 observations from AR(2) model.

   i) Draw time series plot, sample ACF and PACF plots.

   ii) Fit the model under AR(2) and under AR(4) and explain the result. What do you think is the problem when you fit bigger model then necessary?

   iii) Fit the model under MA(p) varying p from 1 to 10. What do you observe? Explain your observation.

c) Consider the time series data in the file sunspot2.txt. It consists of $n = 288$ observations of the number of sunspots, from 1700 to 1987. This is a quantity that is believed to affect our weather patterns. We will study the square root of the data (this transformation ensures that the variance is roughly constant). That is, for the series $Z_1, \ldots, Z_n$ from the file sunspot.dat, first compute the series $X_t = \sqrt{Z_t}$, and work with the series $\{X_t\}$ in what follows.

   i) Draw time series plot, sample ACF and PACF plots.

   ii) By considering the sample ACF and sample PACF, decide which of the following would be appropriate for this data: AR(1), AR(2), MA(1) or MA(2). Use the data to estimate the parameters of the model that you choose.

   iii) Using your fitted model, calculate forecasts X^n_{n+h}, for $h = 1, 2, 3, 4$. Calculate the 95% prediction intervals (assuming Gaussian noise).

   iv) Use the observation from 1700 to 1983 for fitting the model. Plot all of the data, and your forecasts and prediction intervals for the last four years. (Dont forget to undo the square root transformation by taking the square of your predictions.)

d) Visit Korean statistical information service web (http://kosis.kr/). Find the data set of monthly average of greenhouse gas in Anmyeondo. Analyze the time series of Carbon Dioxide from 1999, Jan to 2013. Dec by using seasonal ARIMA models. Forecast monthly averages for year 2014. Compare your forecast with the observed values. Do any thing you can and make a readable answer.