Solutions to Assignment

Rongfei Jin

April 22, 2025

Question 1

We use the PACF to determine the order of the AR model. The PACF is defined as the correlation between Y_t and Y_{t-k} after removing the effect of all the intermediate variables $Y_{t-1}, Y_{t-2}, \ldots, Y_{t-(k-1)}$.

Consider the $AR(p+1)$ model:

$$Y_t = a_0 + \sum_{k=1}^{p+1} a_k Y_{t-k} + \epsilon_t, \quad \epsilon_t$$

Since the true model is $AR(p)$, we have $a_{p+1} = 0$ and the PACF should be zero for all lags greater than p.

Now to determine the PACF, we can use the Yule-Walker equations, which relate the autocorrelations of the time series to the coefficients of the AR model and we can compute the significant levels to check if PACF is significantly different from zero.

See q1.py for the implementation.

Question 2