

Time Series ARMA

Moving Average (MA) models

For AR models we considered models of the form:

$$y_t = w_0 + w_1 y_{t-1} + \dots + w_p y_{t-p} + \text{noise}_t$$

So the past p observations were used as inputs. In MA(q) models we take a different approach:

$$y_t = \text{noise}_t + \theta_1 \text{noise}_{t-1} + \dots + \theta_q \text{noise}_{t-q}$$

MA(q) models are more difficult to fit because the noise terms are not observed.

Autoregression Moving Average (ARMA) models

These try to combine AR and MA models together!

Idea: AR model accounts for autoregressive component. Then MA fits any trends in the noise which we cannot explain with the AR model!

Idea: sometimes we can use the error at time $t-1$ as a valuable predictor for time t !

Example: assume we have an AR(p) model that does a reasonable job, but always over-predicts according to the latest error! We can use an MA model to account for this!

Autoregression with more features

These try to combine AR and MA models together!

Idea: AR model accounts for autoregressive component. Then MA fits any trends in the noise which we cannot explain with the AR model!

$$y_t = c + \underbrace{\phi_1 y_{t-1} + \cdots + \phi_p y_{t-p}}_{AR(p)} + \underbrace{\theta_1 e_{t-1} + \cdots + \theta_q e_{t-q}}_{MA(q)} + e_t,$$

This cannot be mapped directly to a Linear Regression therefore finding the coefficients is more complicated.



Hands-on session

`time_series_autoregression.ipynb`