

A Practical Approach to Timeseries Forecasting using Python

- Overview of the Section
- Revision for Data Preparation
- Applied Machine Learning in Time Series

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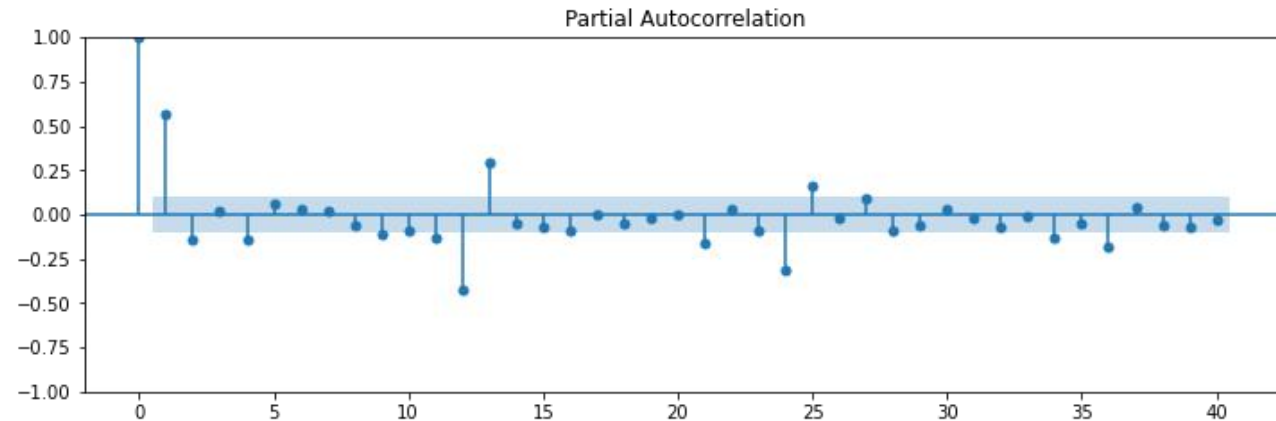
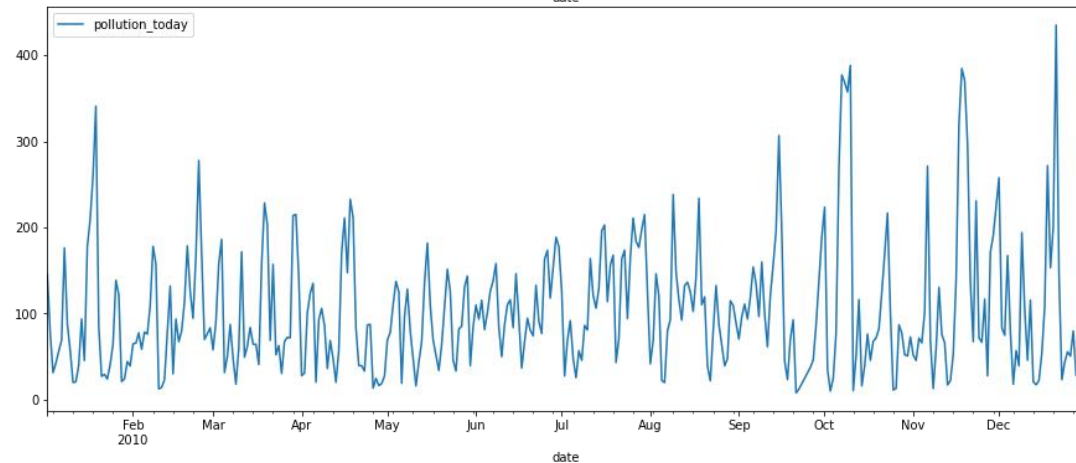
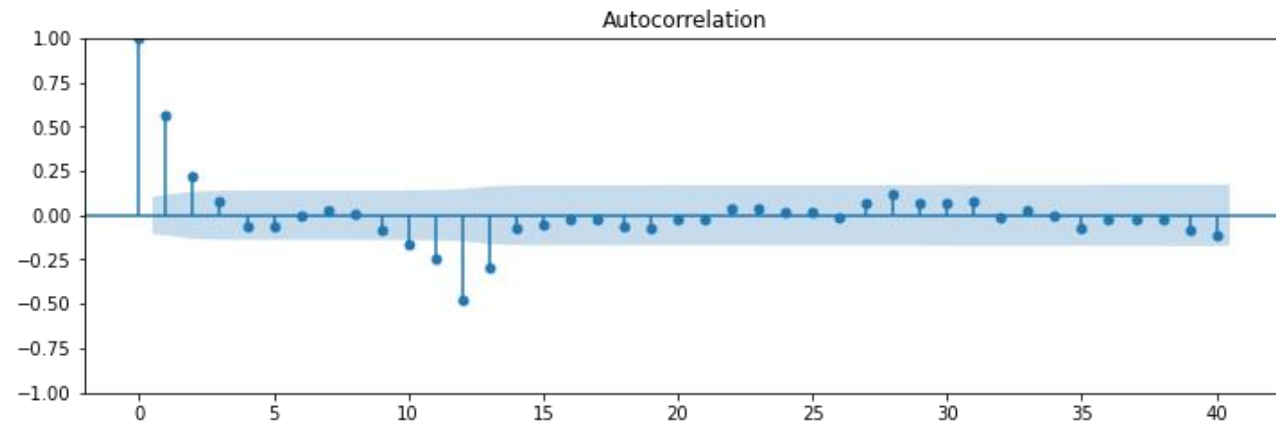
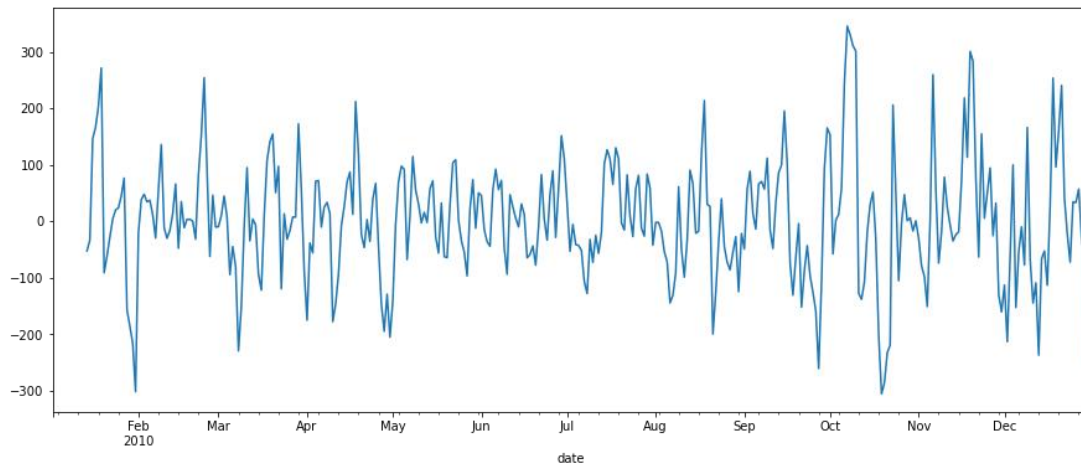
Overview of the Section

- In this section
- Impact and Overview of Machine Learning on Time Series Forecasting
- Univariate Time Series Forecasting
 - Autoregression (AR)
 - Moving Average (MA)
 - Autoregressive Moving Average (ARMA)
 - Autoregressive integrated moving average (ARIMA)
 - Auto ARIMA
 - Seasonal Autoregressive Integrated Moving-Average (SARIMA)
 - Auto - SARIMA in Time Series Forecasting

Revision for Data Preparation

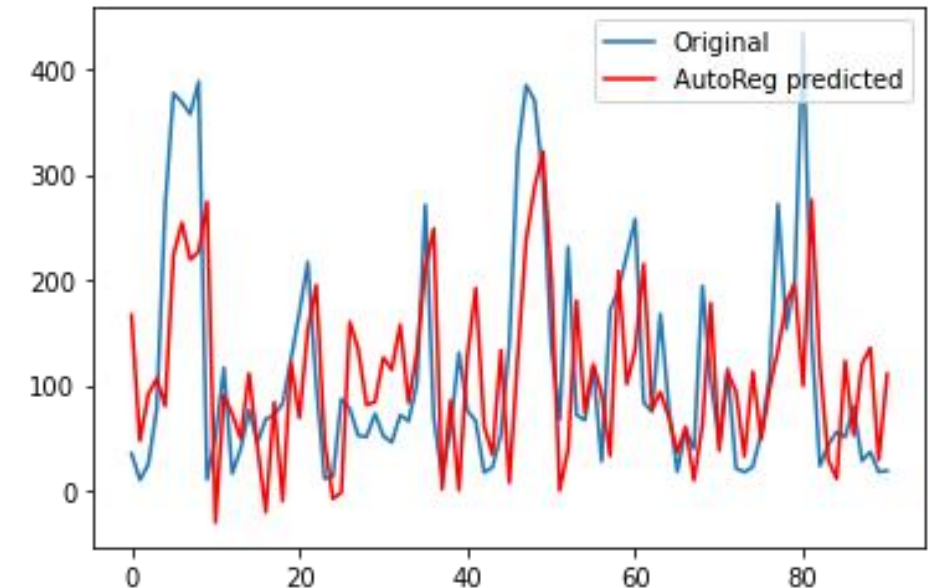
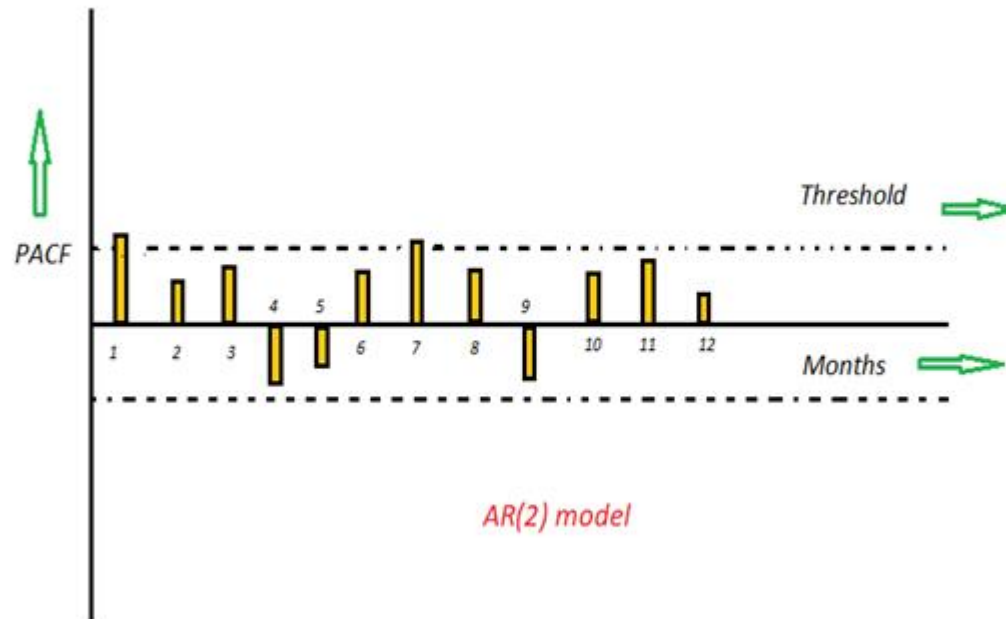
- Basic Data Analysis and Visualization for Time Series
- Data Manipulation and Preprocessing
- Feature Engineering and RVT in Time Series
- Stationary Check
- Making a Non-Stationary Data Stationary

Auto Correlation and Partial Correlation



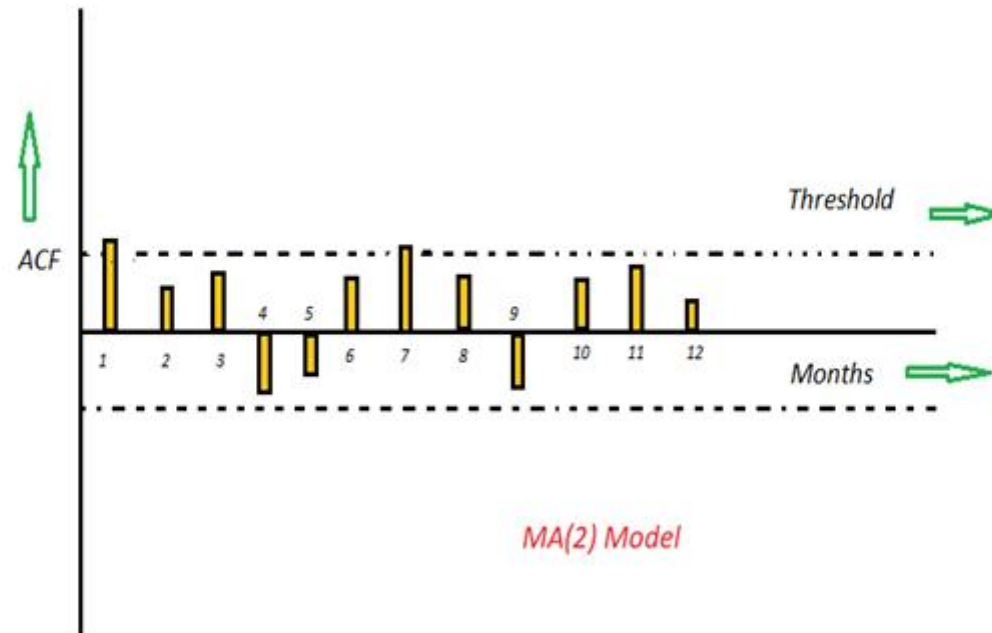
Autoregression (AR)

- The term AR stands for autoregression.
- The number of preceding inputs used to predict the next value is called order and is usually referred to as p
- The time period at t is impacted by the observation at various slots $t-1$, $t-2$, $t-3$,, $t-k$.



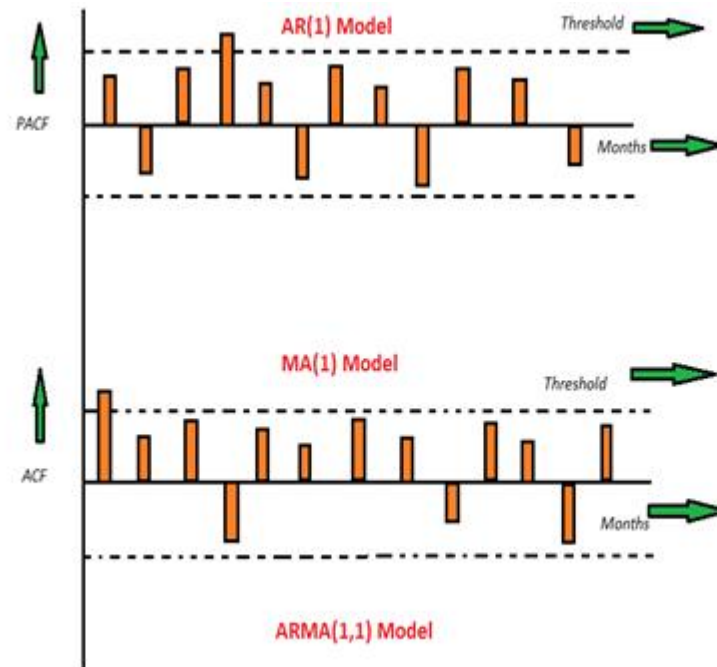
Moving average (MA)

- Number of MA (Moving Average) terms (q)
- Example: Cake Distribution



Autoregressive Moving Average (ARMA)

- This is a model that is combined from the AR and MA models.
- The impact of previous lags along with the residuals is considered for forecasting the future values of the time series.

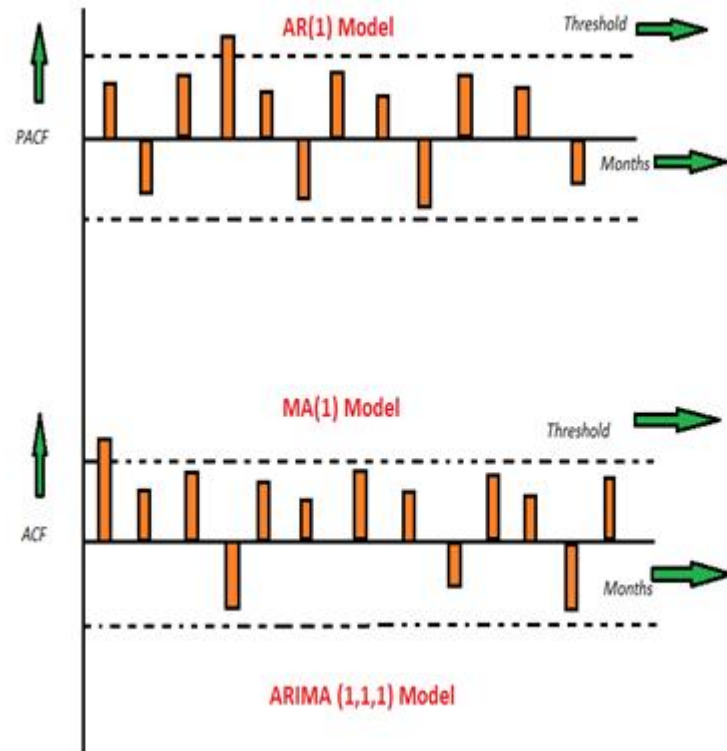


We consider only 1 significant values in each AR model and MA model. So the combined ARMA model will have the inputs as ARMA(1,1)

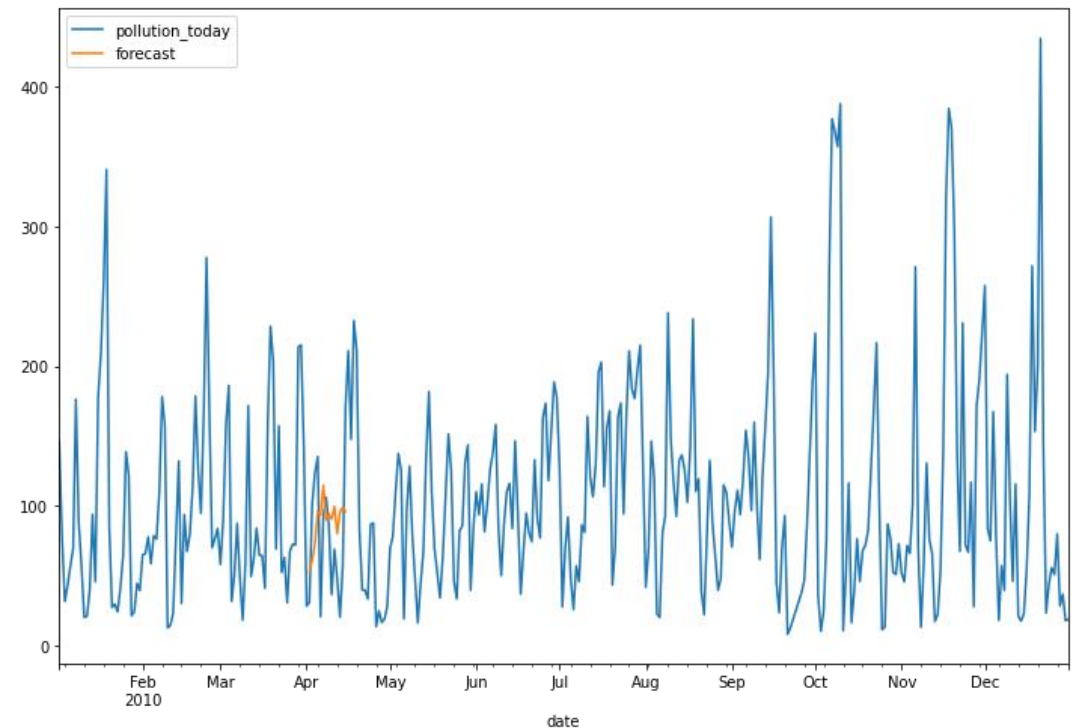
```
# ARMA example
from statsmodels.tsa.arima_model import ARMA
from random import random
```

Auto-Regressive Integrated Moving Average (ARIMA) Model

- The ARIMA model is quite similar to the ARMA model other than the fact that it includes one more factor known as Integrated(I)
- In an ARIMA model there are 3 parameters that are used to help model the major aspects of a times series: seasonality, trend, and noise. These parameters are labeled p,d,and q.



Assume that the time series was applied differencing once to attain stationarity . Also the MA and AR models consider 1 significant values each . So the combined model will have ARIMA(1,1,1) pattern.



Seasonal Autoregressive Integrated Moving-Average (SARIMA)

- There are three trend elements that require configuration. They are the same as the ARIMA model, specifically:
 - p : Trend autoregression order.
 - d : Trend difference order.
 - q : Trend moving average order
- There are four seasonal elements that are not part of ARIMA that must be configured; they are:
 - P : Seasonal autoregressive order.
 - D : Seasonal difference order.
 - Q : Seasonal moving average order.
 - m : The number of time steps for a single seasonal period. For example, an S of 12 for monthly data suggests a yearly seasonal cycle.

