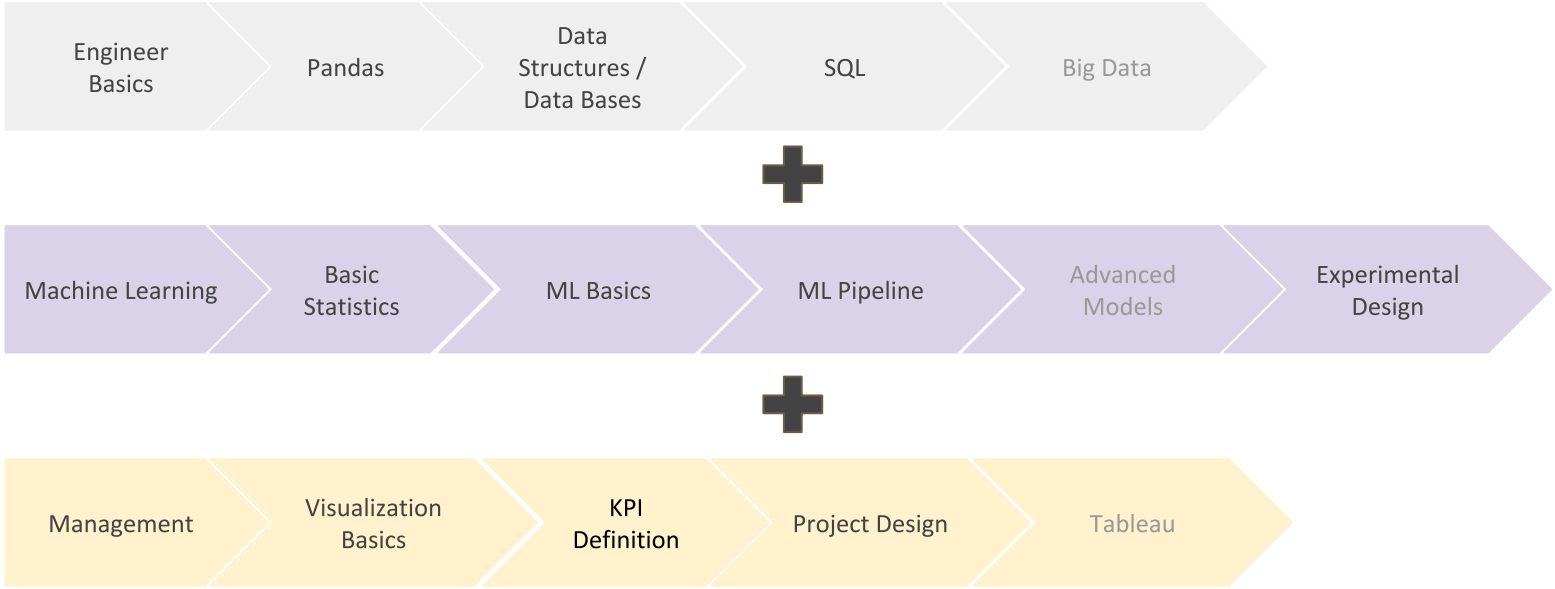
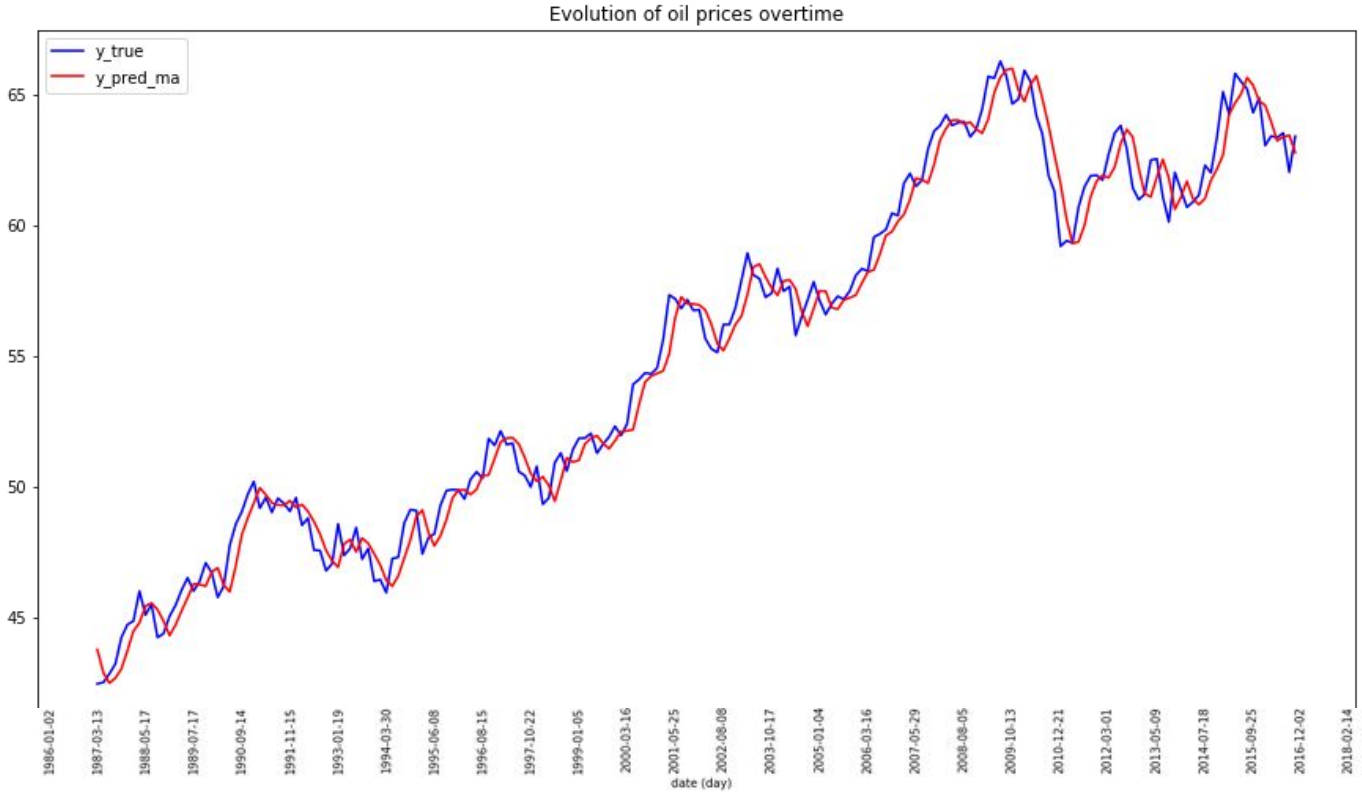
Time Series Forecast

Theory

Course Overview

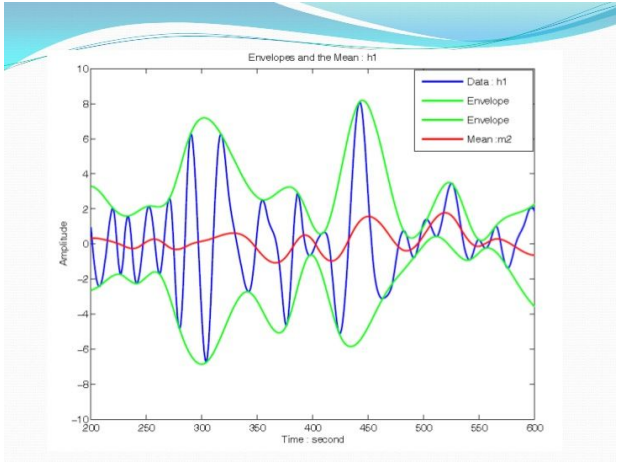


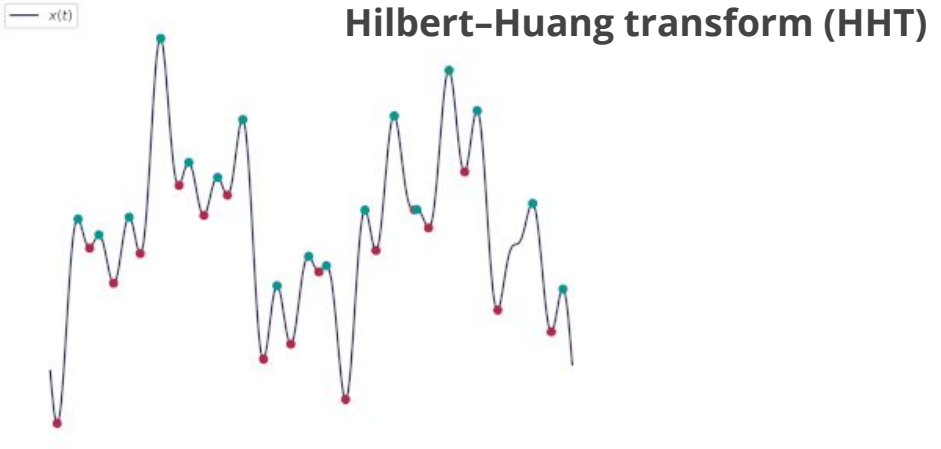
Time Series


Evolution of oil prices overtime
y_true
y_pred_ma
65
60
55
50
45
1986-01-02
1987-03-13
1988-05-17
1989-07-17
1990-09-14
1991-11-15
1993-01-19
1994-03-30
1995-06-08
1996-08-15
1997-10-22
1999-01-05
2000-03-16
2001-05-25
2002-08-08
2003-10-17
2005-01-04
2006-03-16
2007-05-29
2008-08-05
2009-10-13
2010-12-21
2012-03-01
2013-05-09
2014-07-18
2015-09-25
2016-12-02
2018-02-14
date (day)

Time Series Decomposition

- T_t, the trend component at time t, which reflects the long-term progression of the series
- C_t, the cyclical component at time t, which reflects repeated but non-periodic fluctuations
- S_t, the seasonal component at time t, reflecting seasonality
- I_t, the irregular component (or "noise") at time t, which describes random, irregular influences





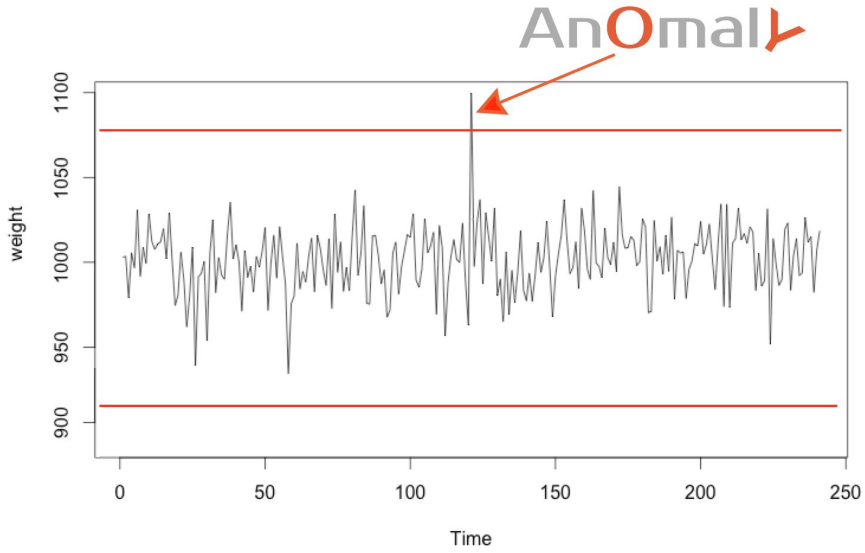
Moving Average

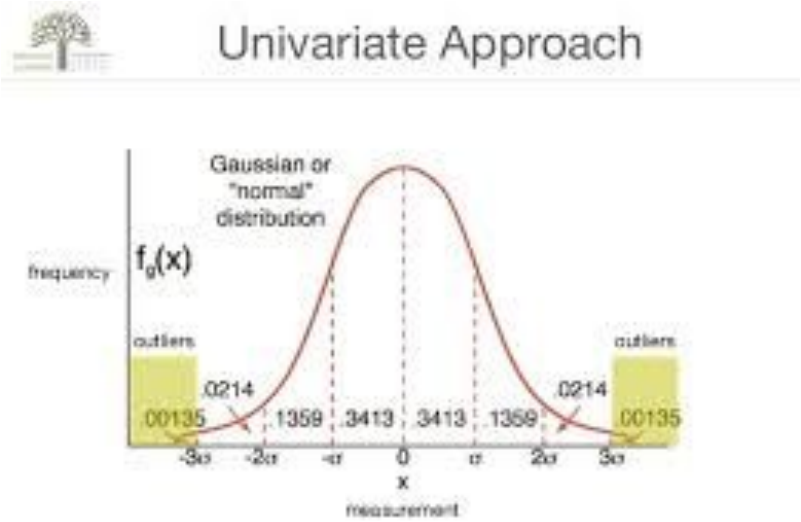
- Simple Moving Average (SMA): is the unweighted mean of the previous *n* data

$$\begin{aligned}\bar{p}_{\mathrm{SM}} &= \frac{p_M + p_{M-1} + \cdots + p_{M-(n-1)}}{n} \\ &= \frac{1}{n}\sum_{i=0}^{n-1} p_{M-i}\end{aligned}$$

- Weighted Moving Average (WMA): is an average that has multiplying factors to give different weights to data at different positions in the sample window
- Exponentially Weighted Moving Average (EWMA): is a type of infinite impulse response filter that applies weighting factors which decrease exponentially

Anomaly Detection





Applications

- Any temporal behavior when we have labeled historical data
- Mainly in those cases where we only have one dimension as training set