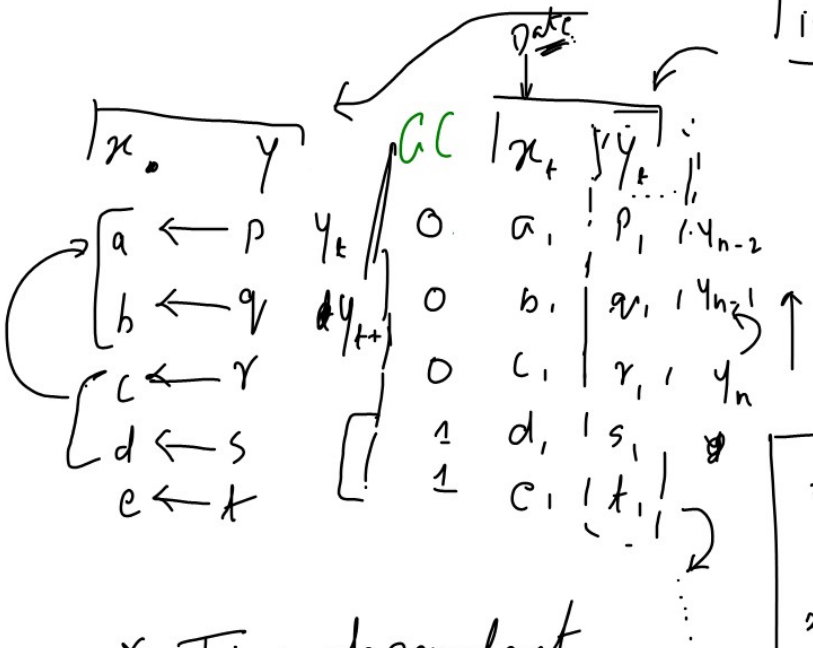
Time Series forecasting



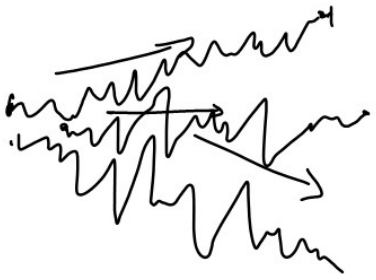
$p_1 = ma_1 + c$

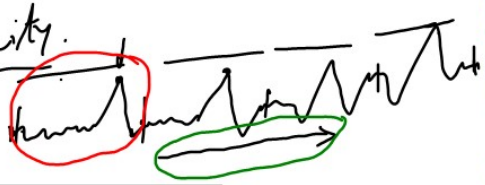
28/09/2024

$r_1 = mq_1 + np_1$

* Time dependent.
* Sequence
* Trend, Seasonality
  Level.

* Level :
* Trend :
* Seasonality.





Exponential Smoothing

1) Single Exp. Smoothing.
2) Double Exp Smoothing.
   * Level & Trend.
   Holt's Model
3) Triple Exp Smoothing.
   * Level, Trend, Seasonality
   Holt's Winter Model
4) ARIMA
5) SARIMA
6) SARIMAX ←

* Simple Exponential :

$$f_{t+1} = \alpha y_t + (1-\alpha) f_t$$

$$= \alpha y_t + f_t - \alpha f_t$$

$$= f_t + \alpha (y_t - f_t)$$

→ Only Level in data

* Trend
* Seasonality

$$f_t = f_{t-1} + \alpha (y_{t-1} - f_{t-1})$$

$$f_{t+1} = f_t + \alpha (y_t - (f_{t-1} + \alpha (y_{t-1} - f_{t-1})))$$

$$f_{t+1} = \alpha f_t + \alpha^{(1-\alpha)} f_{t-1} + \alpha (1-\alpha)^2 f_{t-2} \ldots$$

f_{t+1}

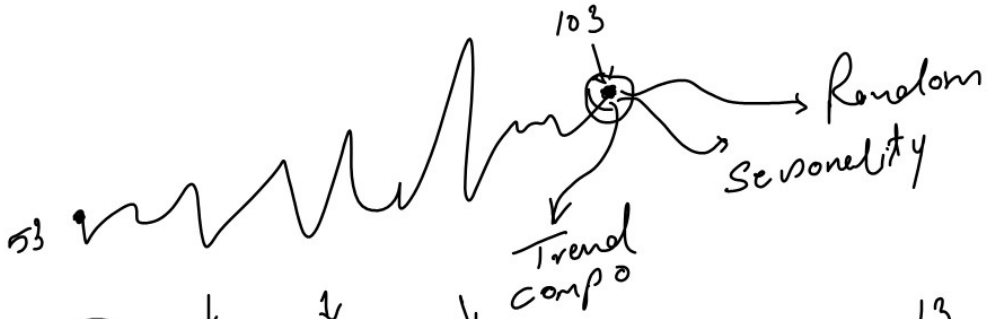
f_t α y_2

$\alpha(1-\alpha)$ y_4

$\alpha(1-\alpha)^2$ y_8

$0 < \alpha < 1$:

Decomposition:



$$103 = \underset{\text{Trend}}{47} + \underset{\text{Seaso}}{29} + \underset{\text{Rand.}}{27}$$

Additive:

$$130 = \underset{\text{Trend}}{13} \times \underset{\text{Seaso}}{5} \times \underset{\text{Rand.}}{2}$$

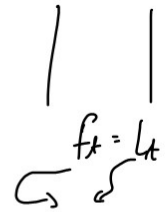
Multiplicative

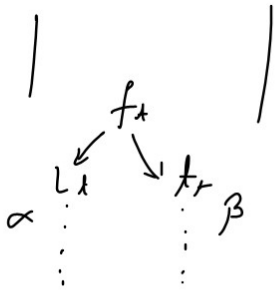
* Double Exp Smoothing

$$f_{t+1} = L_t + T_t$$

$$L_t = \alpha y_{t-1} + (1-\alpha) f_{t-1}$$

$$T_t = \beta (L_t - L_{t-1}) + (1-\beta) T_{t-1}$$





* Triple Ex Smoothing