

lec 6 : Time Series - 5

- SARIMAX
- Linear Regression model on TS
- Facebook Prophet

Recap

SARIMA :

$$\hat{y}_t = \underbrace{\frac{AR}{P}}_{q} + \underbrace{\frac{MA}{q}}_{P} + \underbrace{AR\text{-Seasonal}}_{P} + \underbrace{MA\text{-Seasonal}}_{Q} \\ + \underbrace{\frac{diff}{d}}_{D} + \underbrace{Diff\text{-Seasonal}}_{S}$$

S: seasonality

dataset: XOTICA → restaurant → Daily footfall data
Time Series
Time series + "is-holiday"

Daily level data : Seasonality = $s = 7$

Linear Regression in time Series

Date	y
1	120
2	108
3	191
4	208
5	172



past values

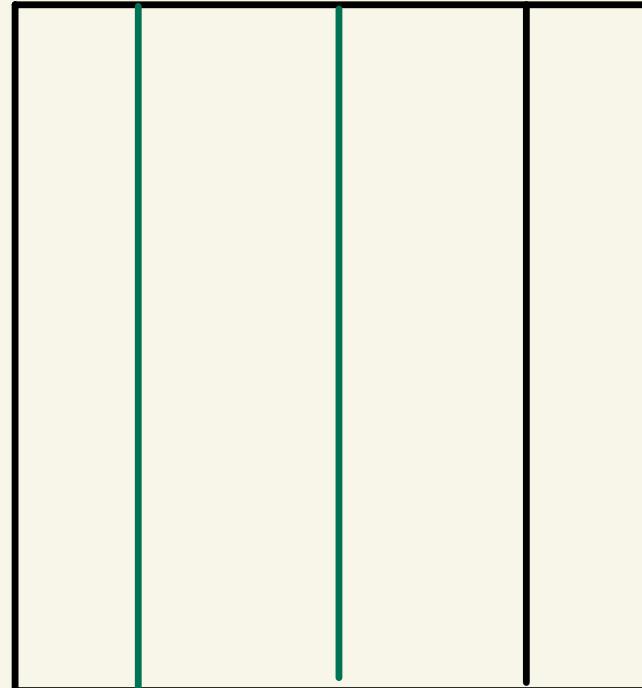
y_{t-3}	y_{t-2}	y_{t-1}	y_t
120	108	191	208

feature set = past values + "is_holiday"
+ "is_weekend" + "day-of-week"
+ "month-of-year" + "past seasonal values"
+ "max sales in last week"
+ "max sales in last month" +
+ "level of last week" + "level of last month"
+ "avg. Sale for day of week"
+ "avg sales for that day of month"

avg. sales

past seasonal values : Seasonality = 7

y_{t-21} y_{t-14} y_{t-7} y_t



Limitation :

Eq. # lag-1 , lag-2 , lag-3 → recent past values

2)

	Date	y
		102
		191
		202

31st Dec
2023

forecast : 1st Jan 2024

2nd Jan 2024

3rd Jan 2024

4th Jan 2024

future
dates

Q Can we generate prediction for all of these future dates using the model we just created?

Ans No. We can predict only for 1st Jan

Facebook Prophet → very similar to SARIMAX

$$\text{SARIMAX} = b(t) + s(t) + \varepsilon(t) + \text{exog}$$

↑ AR ↑ AR-seasonal ↑ MA + MA-seasonal

$$\text{PROPHET} = b(t) + s(t) + \varepsilon(t) + h(t) + \text{exog}$$

$h(t)$ = holidays

exact formulation are similar but more complex
than SARIMAX