Time series Analysis & Modeling

DATS 6450

LAB#4- Simple Forecasting Methods

In this lab, you will compare the performance of 4 simple forecasting method:

- **Average Method**
- **Naïve Method**
- **Drift Method**
- **Simple Exponential Smoothing**

1- Let suppose a time series dataset is given as below. Without a help of Python and using the average forecast method perform one-step ahead prediction and fill out the table. To perform the correct cross-validation, start with two observations {y1, y2} and predict y3 (you can now generate the first error). Add observations by one {y1, y2, y3} and predict y4 (you can now generate the second error). Continue this through the dataset. Then calculate the MSE of the 1-step prediction and MSE of h-step forecast.

1-step ahead prediction (training set)				
t	y_t	$\widehat{y_{t+1\|t}}$	e	e^2
1	112			
2	118			
3	132			
4	129			
5	121			
6	135			
7	148			
8	136			
9	119			
h-step ahead forecast (testing set)				
h	y_{t+h}	$\widehat{y_{t+h\|t}}$	e	e^2
1	104			
2	118			
3	115			
4	126			
5	141			

2- Write a python code that perform the task in step 1. Plot the test set, training set and the h-step forecast in one graph with different marker/color. Add an appropriate title, legend, x-label, y-label to each graph. No need to include the 1-step prediction in this graph.

3- Using python, calculate the MSE of prediction errors and the forecast errors. Display the result on the console.

4- Using python, calculate the variance of prediction error and the variance of forecast error. Display the result.

5- Calculate the Q value for this estimate and display the Q-value on the console. (# of lags = 8)
6- Repeat step 1 through 5 with the Naïve method.
7- Repeat step 1 through 5 with the drift method.
8- Repeat step 1 through 5 with the simple exponential method. Consider alfa = 0.5 and the initial condition to be the first sample in the training set.
9- Using SES method, plot the test set, training set and the h-step forecast in one graph for alfa = 0, 0.25, 0.75 and 0.99. You can use a subplot 2x2. Add an appropriate title, legend, x-label, y-label to each graph. No need to include the 1-step prediction in this graph
10- Create a table and compare the four forecast method above by displaying, Q values, MSE, mean of prediction errors, variance of prediction errors.
11- Using the python program developed in the previous LAB, plot the ACF of prediction errors.
12- Compare the above 4 methods by looking at the variance of prediction error versus the variance of forecast error and pick the best estimator. Justify your answer.

Upload the **formal report (as a single pdf**) plus **the three .py files** through BB.