

Time Series Analysis and Models Homework 3 Report

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Problem 1: Average Method

1-step ahead prediction (training set)				
t	y_t	$\hat{y}_{t,t-1}$	e	e^2
1	112			
2	118	112		
3	132	115	17	289
4	129	120.667	8.33	69.44
5	121	122.75	-1.75	3.0625
6	135	122.4	12.6	158.76
7	148	124.5	23.5	555.25
8	136	128.858	8.14	66.306
9	119	128.875	-9.875	97.516
1-step ahead prediction (training set)				
h	y_{T+h}	\hat{y}_{T+h}	e	e^2
1	104	127.778	-23.78	565.383
2	118	127.778	-9.788	95.6049
3	115	127.778	-12.78	163.272
4	126	127.778	-1.778	3.16049
5	141	127.778	-13.22	174.827

- MSE of the 1-step = 176.62
- MSE of the h-step = 200.45

Problem 2

See Figure 1 below.

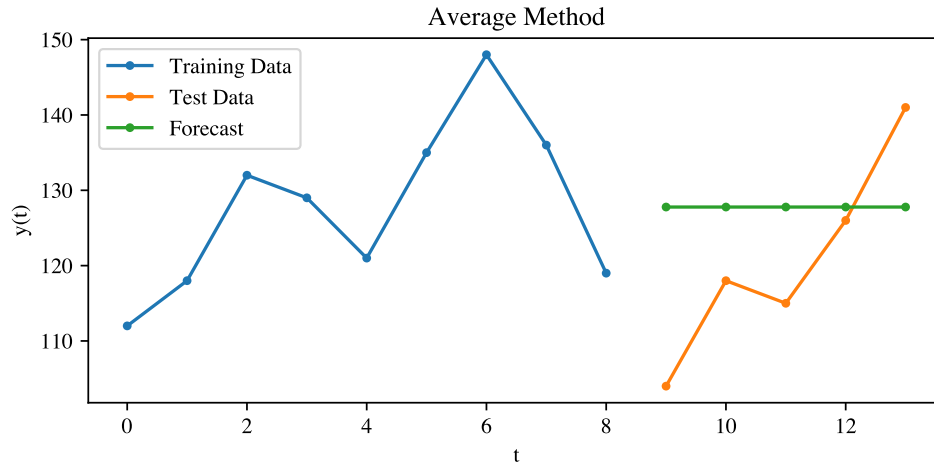


Figure 1: Average Method plot of the training set, test set and forecast.

Problem 3

We display the result from python:

- AVG METHOD 1-STEP MSE = 176.62
- AVG METHOD H-STEPS MSE = 200.45

Problem 4

- AVG METHOD VARIANCE OF PREDICTION ERROR = 108.08
- AVG METHOD VARIANCE OF FORECAST ERROR = 151.76

Problem 5

- AVG METHOD TRAINING RESIDUALS Q-VALUE = 5.78

Problem 6: Naive Method

Part 1: Table

1-step ahead prediction (training set)				
t	y_t	$\hat{y}_{t,t-1}$	e	e^2
1	112			
2	118	112		
3	132	118	14	196
4	129	132	-3	9
5	121	129	-8	64
6	135	121	14	196
7	148	135	13	169
8	136	148	-12	144
9	119	136	-17	289
1-step ahead prediction (training set)				
h	y_{T+h}	\hat{y}_{T+h}	e	e^2
1	104	119	-15	225
2	118	119	-1	1
3	115	119	-4	16
4	126	119	7	49
5	141	119	22	484

Part 2: Plot

See Figure 2 below.

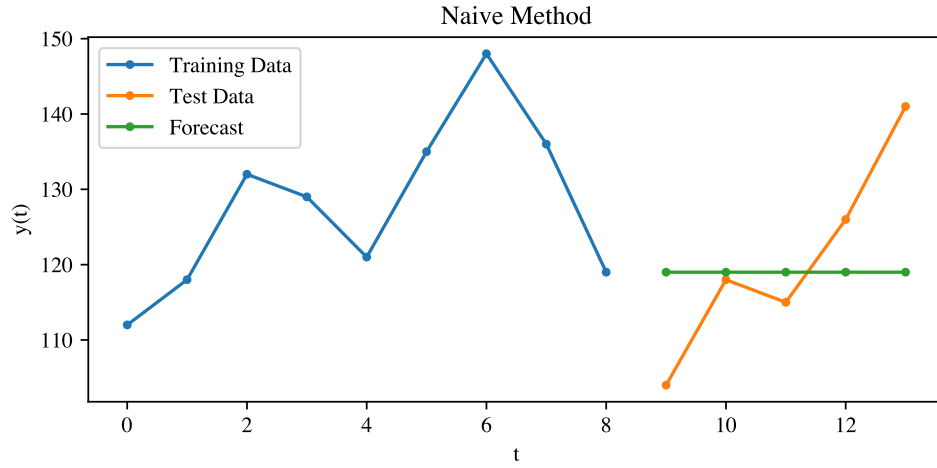


Figure 2: Naive Method plot of the training set, test set and forecast.

Part 3

- NAIVE METHOD 1-STEP MSE = 152.43
- NAIVE METHOD FORECAST H-STEPS MSE = 155.00

Part 4

- NAIVE METHOD VARIANCE OF PREDICTION ERROR = 152.41
- NAIVE METHOD VARIANCE OF FORECAST ERROR = 151.76

Part 5

- NAIVE METHOD TRAINING RESIDUALS Q-VALUE = 3.38

Problem 7: Drift Method

Part 1: Table

1-step ahead prediction (training set)				
t	y_t	$\hat{y}_{t,t-1}$	e	e^2
1	112			
2	118			
3	132	142	-10	100
4	129	134.667	-5.67	32.11
5	121	123.25	-2.25	5.0625
6	135	139.6	-4.6	21.16
7	148	154	-6	36
8	136	139.429	-3.429	11.76
9	119	119.875	-0.875	0.766
1-step ahead prediction (training set)				
h	y_{T+h}	\hat{y}_{T+h}	e	e^2
1	104	119.875	-15.875	252.016
2	118	120.75	-2.75	7.5625
3	115	121.625	-6.625	43.8906
4	126	122.5	3.5	12.25
5	141	123.375	17.625	310.641

Part 2: Plot

See Figure below 3.

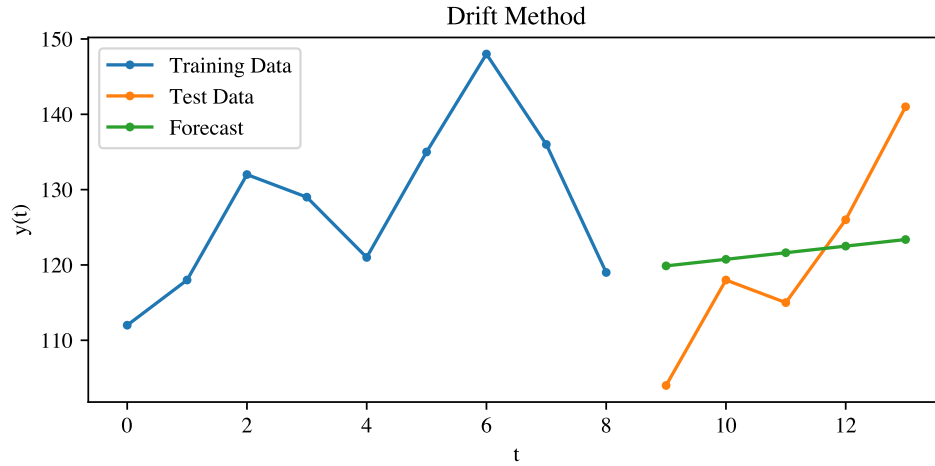


Figure 3: Drift Method plot of the training set, test set and forecast.

Part 3

- DRIFT METHOD 1-STEP MSE = 29.55
- DRIFT METHOD FORECAST H-STEPS MSE = 125.27

Part 4

- DRIFT METHOD VARIANCE OF PREDICTION ERROR = 7.57
- DRIFT METHOD VARIANCE OF FORECAST ERROR = 124.59

Part 5

- DRIFT METHOD TRAINING RESIDUALS Q-VALUE = 1.72

Problem 8: Simple Exponential Method

Set $\alpha = 0.5$ and $l_0 = y_1$.

Part 1: Table

1-step ahead prediction (training set)				
t	y_t	$\hat{y}_{t,t-1}$	e	e^2
1	112			
2	118	112		
3	132	115	17.00	289.00
4	129	123.5	5.50	30.25
5	121	126.25	-5.25	27.56
6	135	123.62	11.38	129.39
7	148	129.31	18.69	349.22
8	136	138.66	-2.66	7.06
9	119	137.33	-18.33	335.92
1-step ahead prediction (training set)				
h	y_{T+h}	\hat{y}_{T+h}	e	e^2
1	104	128.16	-24.16	583.90
2	118	128.16	-10.16	103.31
3	115	128.16	-13.16	173.29
4	126	128.16	-2.16	4.68
5	141	128.16	12.84	164.76

Part 2: Plot

See figure below [4](#)

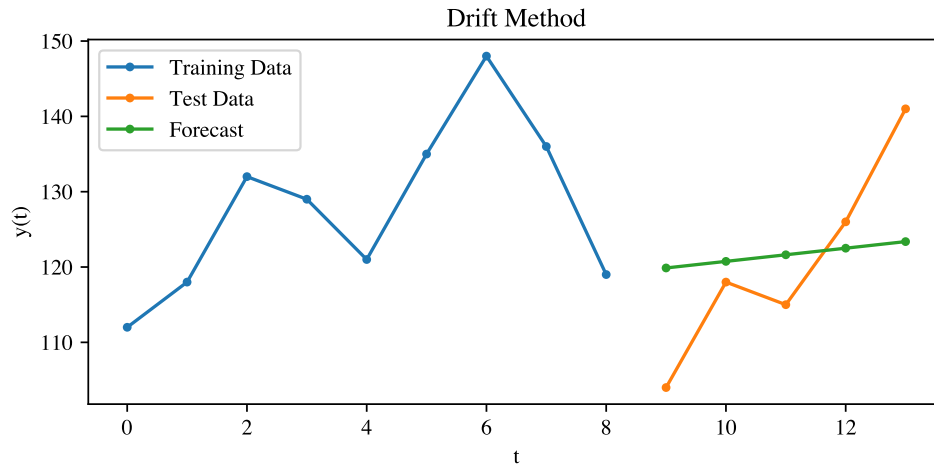


Figure 4: SES Method plot of the training set, test set and forecast.

Part 3

- SES METHOD 1-STEP MSE = 166.91
- SES METHOD FORECAST H-STEPS MSE = 205.99

Part 4

- SES METHOD VARIANCE OF PREDICTION ERROR = 152.77
- SES METHOD VARIANCE OF FORECAST ERROR = 151.76

Part 5

- SES METHOD TRAINING RESIDUALS Q-VALUE = 3.26

Problem 9

See Figure 5

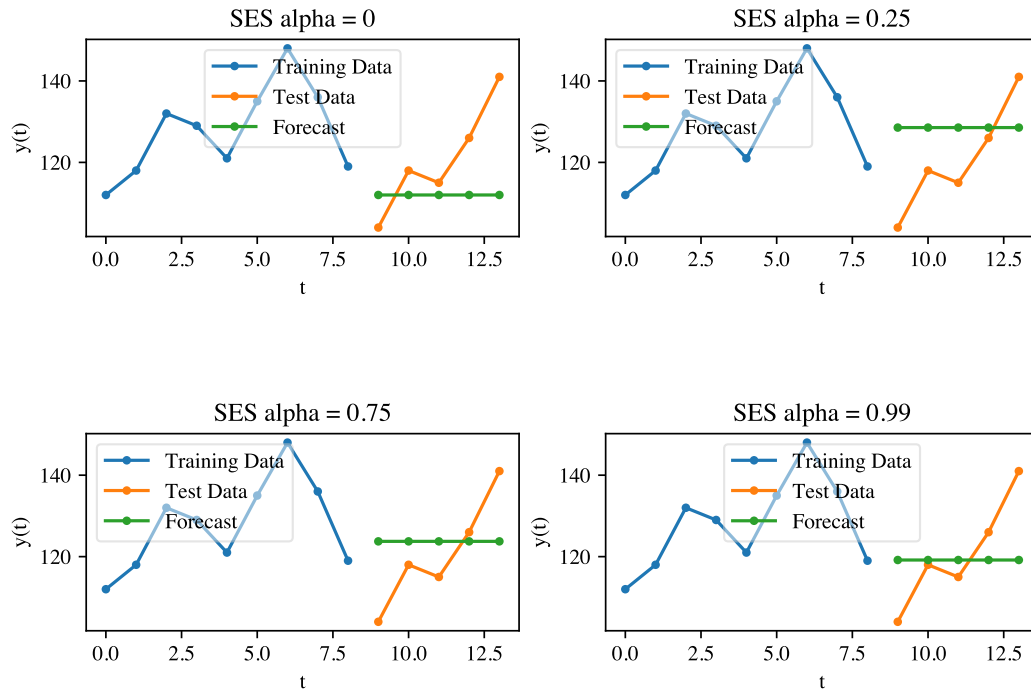


Figure 5: SES METHODS with different values of α

Problem 10

Model	Q	MSE	Mean Residual Errors	Variance Residual Error