Parameters of ARIMA model

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Recap: Introduction to ARIMA

- Time Series forecasting model
- **ARIMA**: 'Auto Regressive Integrated Moving Average'

Recap: Introduction to ARIMA

- Time Series forecasting model
- **ARIMA**: 'Auto Regressive Integrated Moving Average'
- ARIMA has three parameters
  - Auto regressive - p
  - Integrated - d
  - Moving Average - q

Recap: Parameters of ARIMA model

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  - Auto regressive - p
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p, d, q

Recap: Parameters of ARIMA model

- ARIMA has three parameters
    - Auto regressive - p
    - Integrated - d
    - Moving Average - q

Differencing

Parameters of ARIMA model

- ARIMA has three parameters
  - Auto regressive - p
  - Integrated - d
  - Moving Average - q

Parameters of ARIMA model

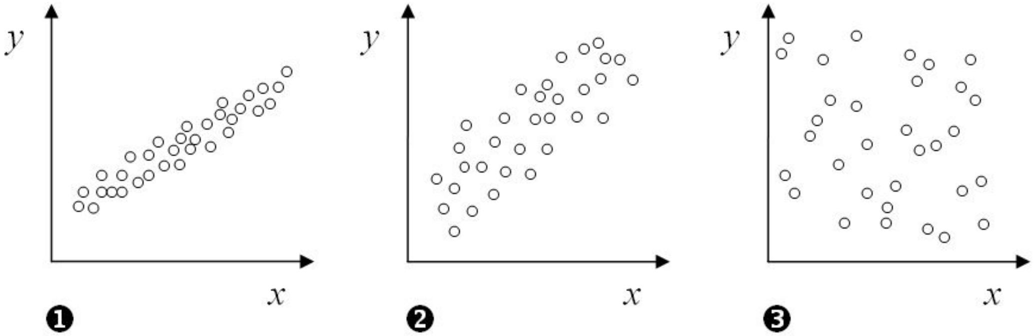
- ARIMA has three parameters
  - Auto regressive - p → ACF (autocorrelation function) plot
  - Integrated - d
  - Moving Average - q → PACF (partial autocorrelation function) plot

Parameters of ARIMA model

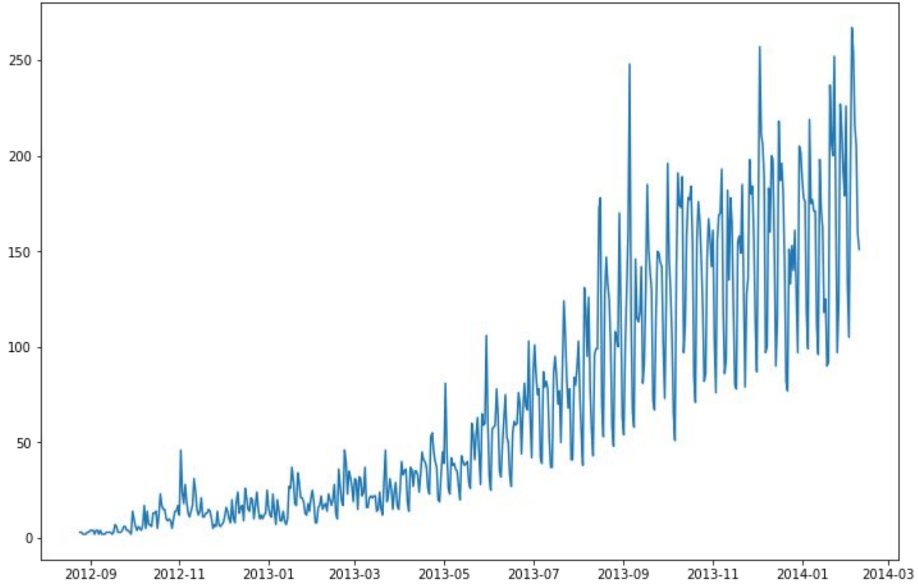
- Some important concepts before we move over to determining the values of p, and q-
    - Correlation
    - Autocorrelation
    - Partial Autocorrelation

Correlation

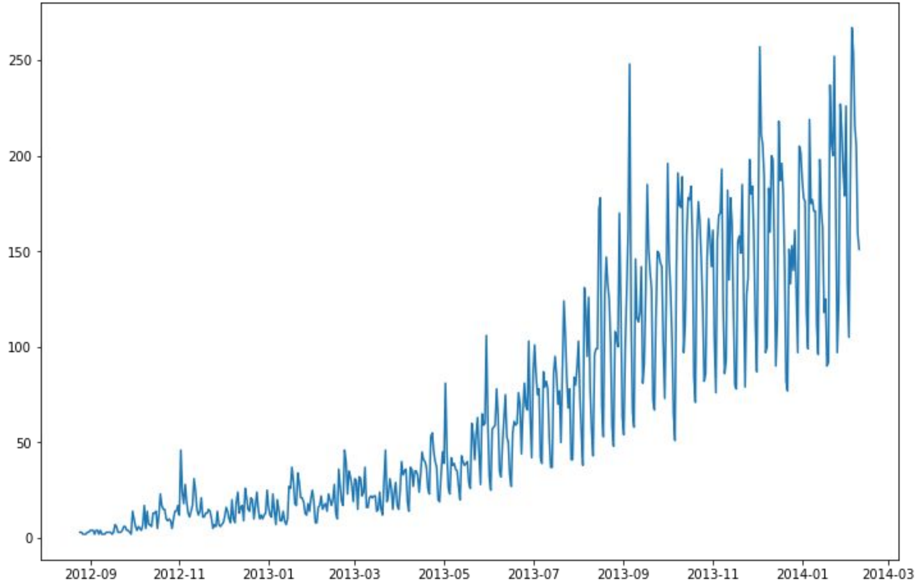
Correlation refers to the strength of mutual relationship between quantities.



Auto-Correlation



Auto-Correlation



32

36

44

25

30

37

27

11

10

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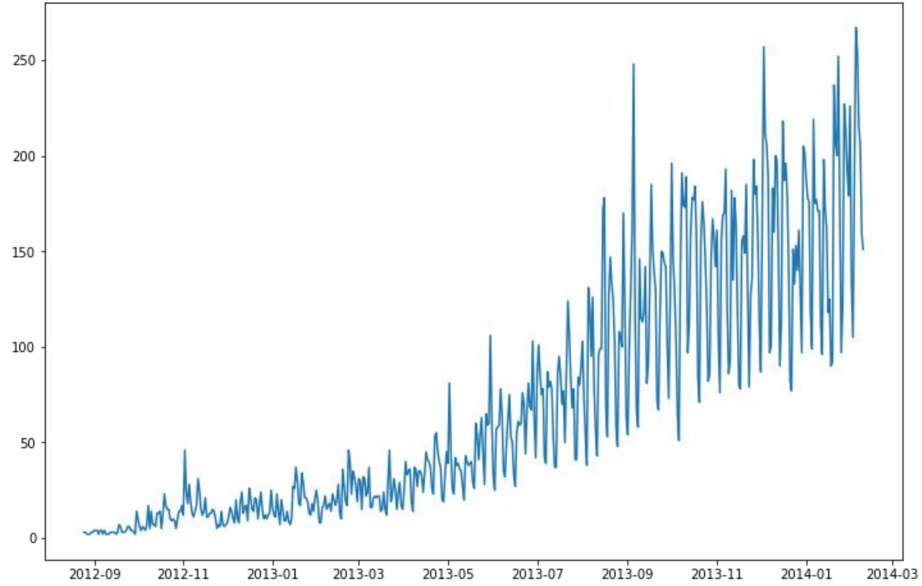
Auto-Correlation



	t-1
32	
36	32
44	36
25	44
30	25
37	30
27	37
11	27
10	11
	10

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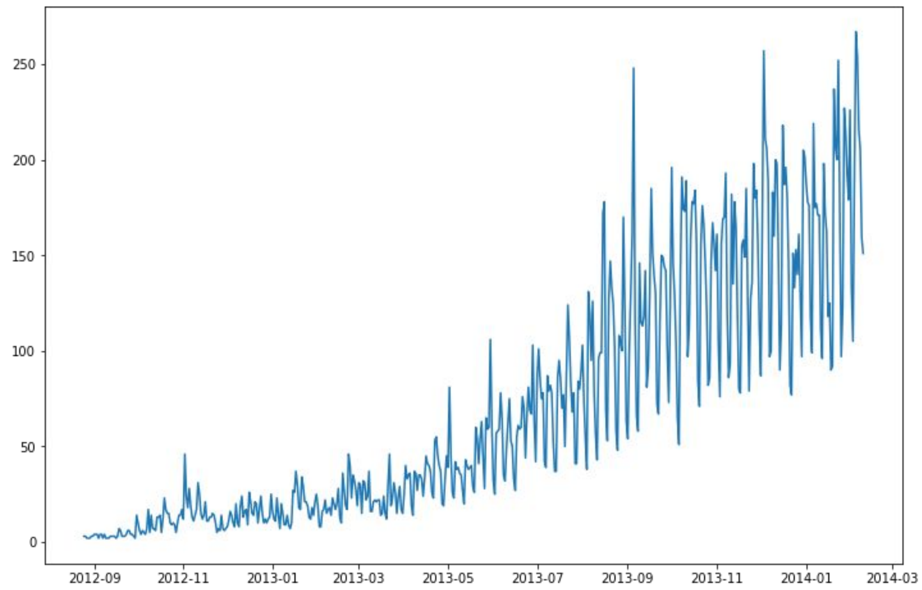
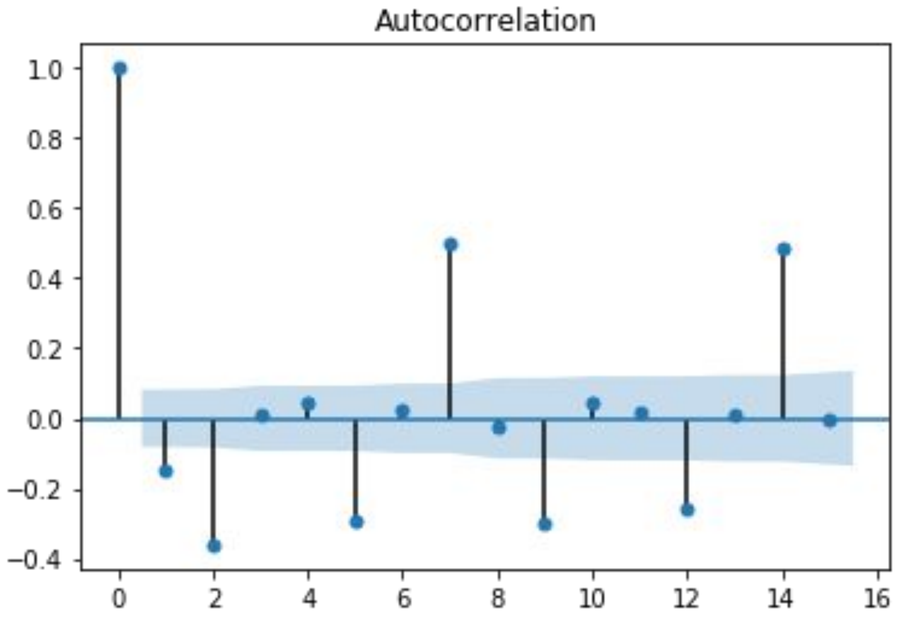
Auto-Correlation



	t-1	t-2
32		
36	32	
44	36	32
25	44	36
30	25	44
37	30	25
27	37	30
11	27	37
10	11	27
	10	11

Auto-Correlation Function (ACF)



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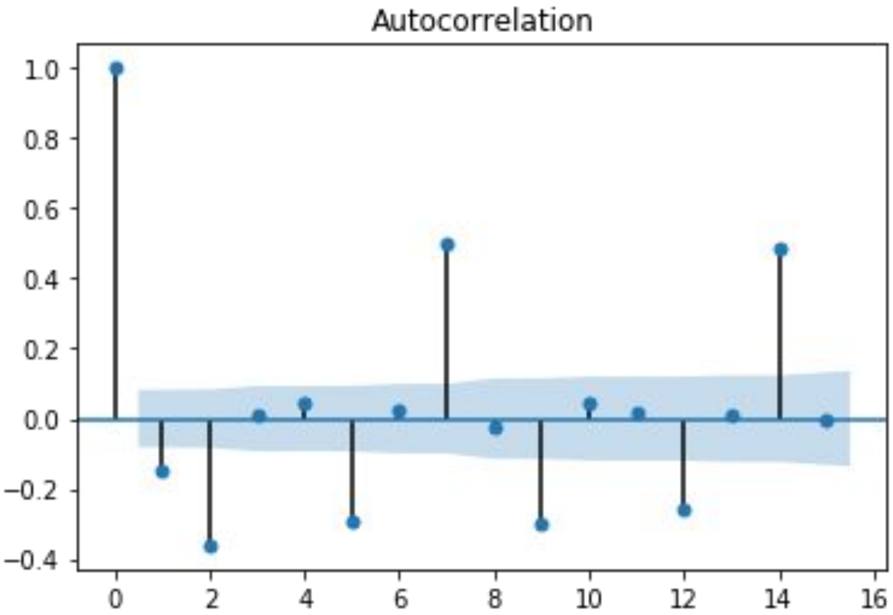
Auto-Correlation Function (ACF)



$$\frac{1.96}{\sqrt{n}}$$

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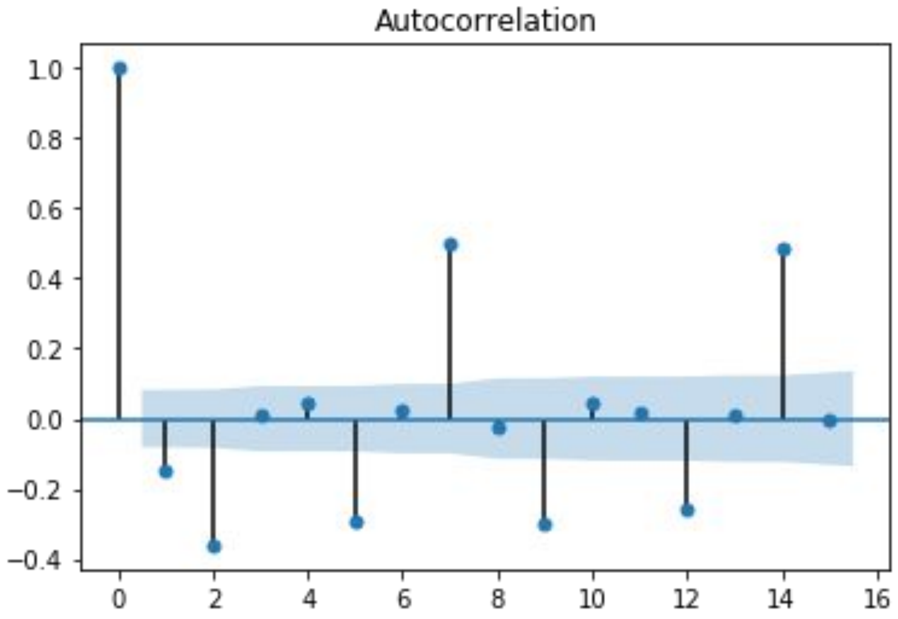
Auto-Correlation Function (ACF)



AR(2)

y(t) = a1*y(t-1) + a2*y(t-2) + u

Lag = 2 have significant correlation

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Summarizing - Auto-Correlation Function (ACF)

- Auto Correlation refers to how correlated is the series with its past self
- ACF plot shows the auto correlation values
- ACF plot can be used to select the value of p for ARIMA

Partial Auto-Correlation

Partial Auto-Correlation

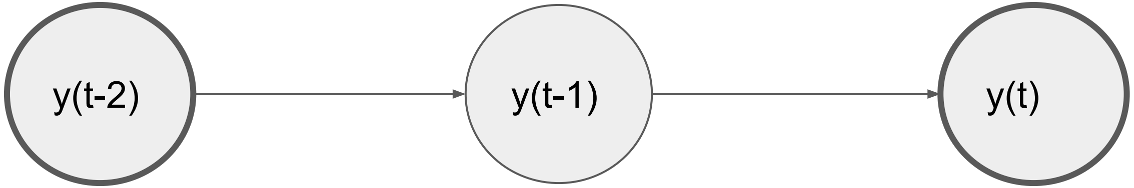
AR(1)

y(t) = a1*y(t-1) + const.

Partial Auto-Correlation

AR(1)

y(t) = a1*y(t-1) + const.



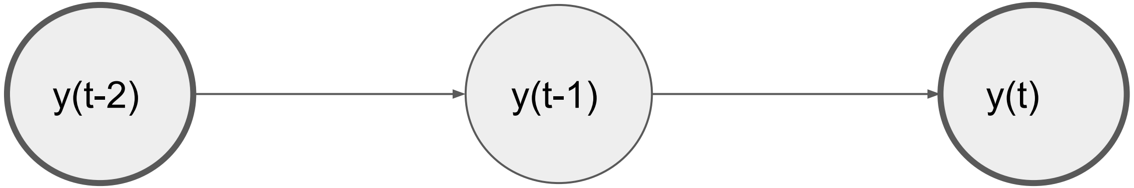
Partial Auto-Correlation

AR(1)

y(t) = a1*y(t-1) + const.

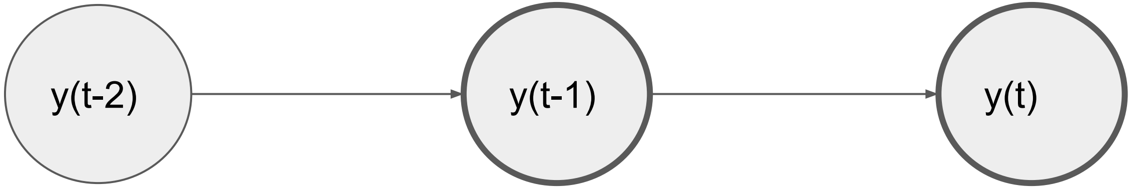
AR(2)

y(t) = a1*y(t-1) + a2*y(t-2) + const.



Partial Auto-Correlation

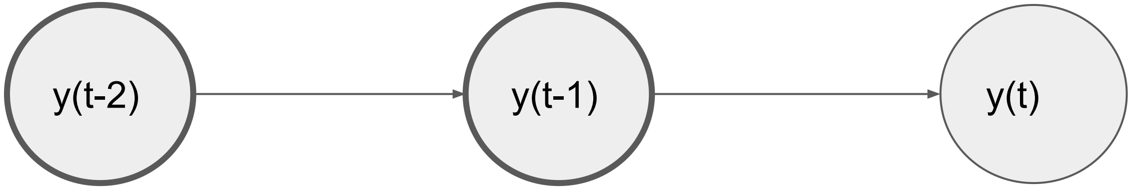
1. Amount of variance in y(t) which is not explained by y(t-1)



Partial Auto-Correlation

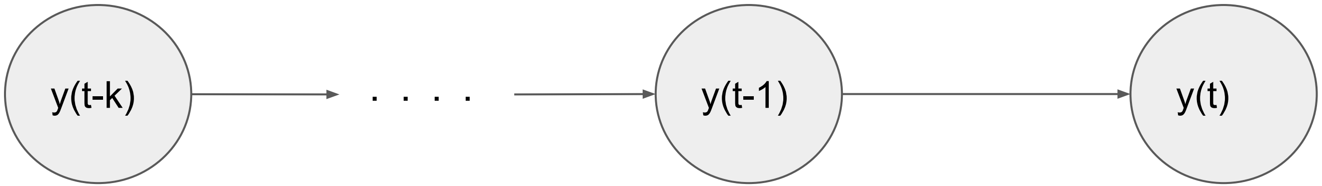
1. Amount of variance in y(t) which is not explained by y(t-1)

2. Amount of variance in y(t-2), which is not explained by y(t-1)

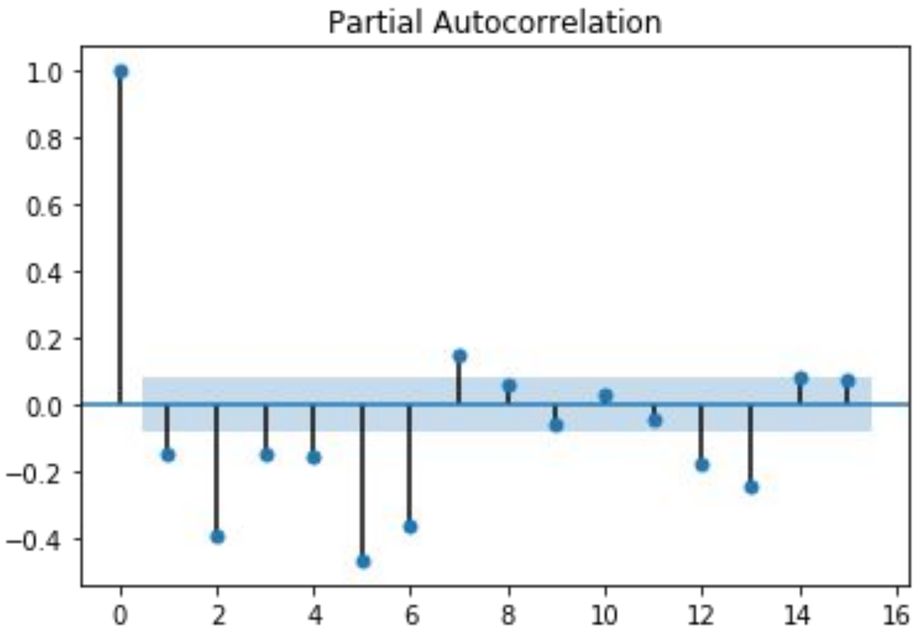


Partial Auto-Correlation

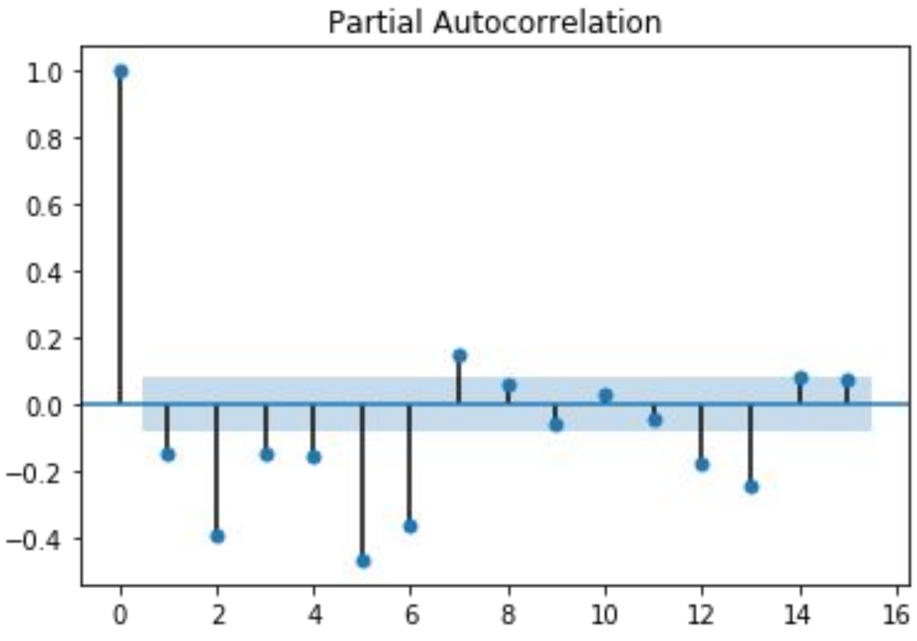
Partial Auto-Correlation: Correlation between y(t) and y(t-k) after removing correlation of time steps in between



Partial Auto-Correlation Function (PACF)



Partial Auto-Correlation Function (PACF)



MA(2)

y(t) = E(t) + a1*E(t-1) + a2*E(t-2) + u

Lag = 2

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Summarizing - Partial Auto-Correlation Function (PACF)

- Partial Auto Correlation refers to the correlation with the residuals of the lags.
- PACF plot shows the partial auto correlation values
- PACF plot can be used to select the value of q for ARIMA

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Thank You

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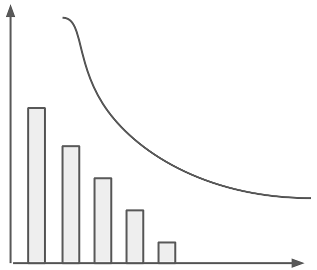
Autoregressive Models - ACF

y(t) = a1 * y(t-1) + a2 * y(t-2) + … + ap * y(t-p) + E(t)

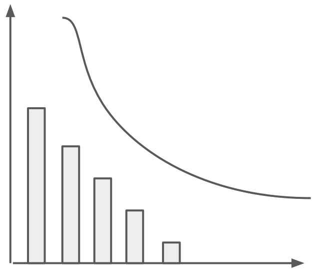
AR(1)

y(t) = a1*y(t-1) + E(t)



AR(2)

y(t) = a1*y(t-1) + a2*y(t-2) + E(t)

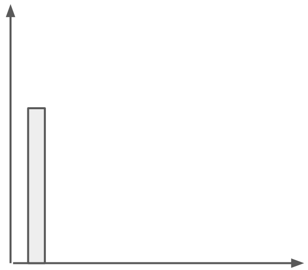


Autoregressive Models - PACF

y(t) = a1 * y(t-1) + a2 * y(t-2) + … + ap * y(t-p) + E(t)

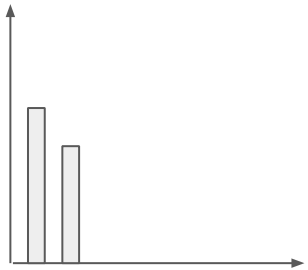
AR(1)

y(t) = a1*y(t-1) + E(t)



AR(2)

y(t) = a1*y(t-1) + a2*y(t-2) + E(t)

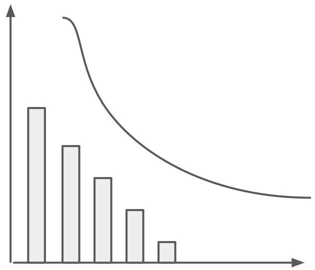


Moving Average Models - PACF

y(t) = u + E(t) + a1 * E(t-1) + a2 * E(t-2) + … + aq * E(t-q)

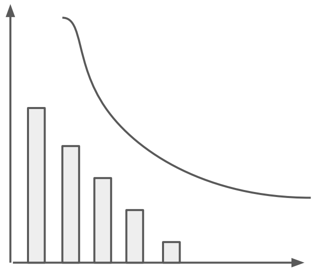
MA(1)

y(t) = u + E(t) + a1*E(t-1)



MA(2)

y(t) = u + E(t) + a1*E(t-1) + a2*E(t-2)



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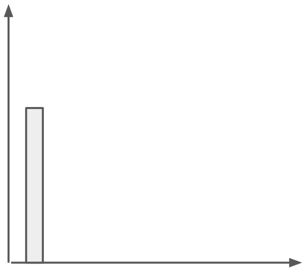
Moving Average Models - ACF

y(t) = a1 * y(t-1) + a2 * y(t-2) + … + ap * y(t-p) + E(t)

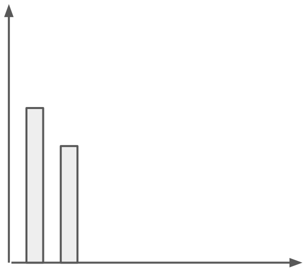
AR(1)

y(t) = a1*y(t-1) + E(t)



AR(2)

y(t) = a1*y(t-1) + a2*y(t-2) + E(t)



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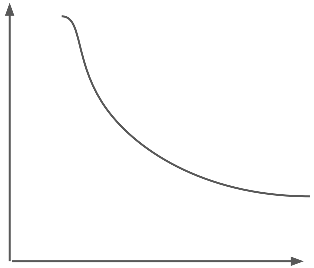
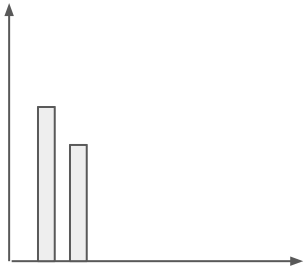
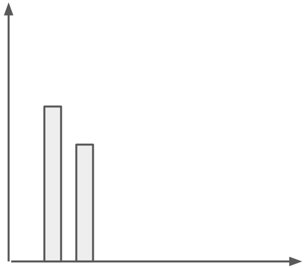
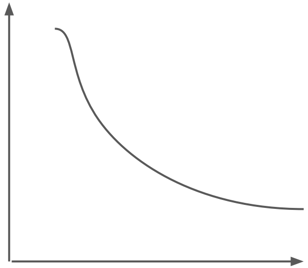
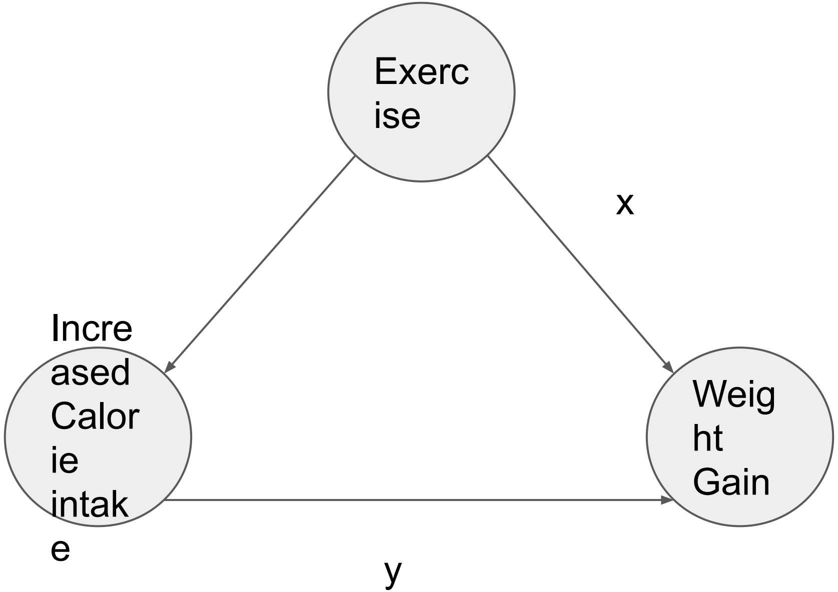
	ACF	PACF
AR		
MA		

Summarizing - Auto-Correlation Function (ACF)

- Lag 1 has positive autocorrelation? AR model
- -ve correlation at lag 1? MA model
- ACF drops of at lag k = AR(k) model
- PACF Gradual decrease? MA model

Partial Autocorrelation



Differencing - d

- Differencing
  - This is done to stabilize the mean by removing changes in the level
  - Differencing is performed by subtracting the previous observation from the present observation

$$[\ y(t) = x(t) - x(t-1)\ ]$$