Modelling a time series using a feedforward neural network

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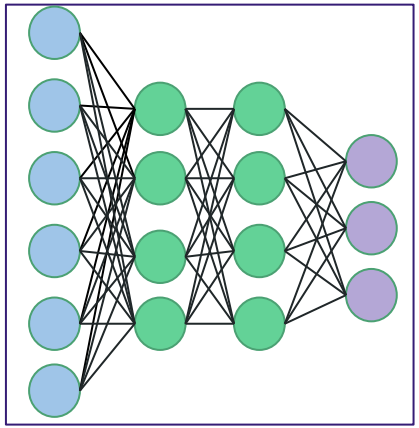
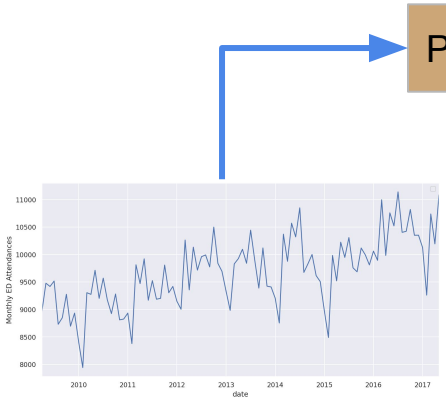
Overview

By the end of the lecture you will have gained knowledge in:

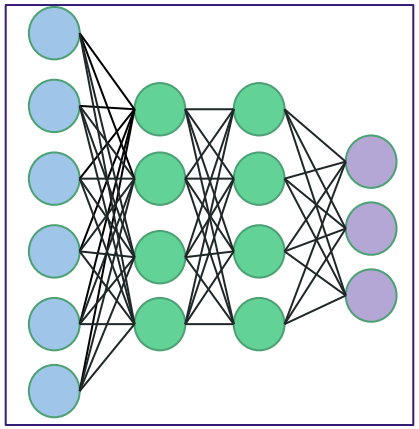
- Preprocessing time series ready for neural networks
- Methods for forecasting with feedforward neural networks
  - Iterative method
  - Director method
  - Vector output method
- How to reduce overfitting using ensemble learning



Feedforward neural networks for time series



	lag_2	lag_1	y_t
0	1.000000	0.980067	0.921061
1	0.980067	0.921061	0.825336
2	0.921061	0.825336	0.696707
3	0.825336	0.696707	0.540302
4	0.696707	0.540302	0.362358

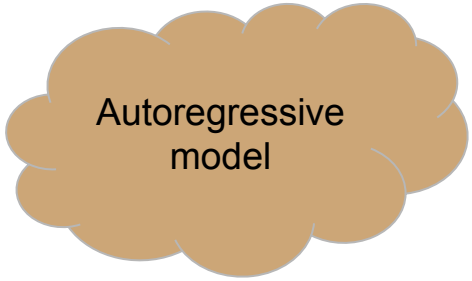


Raw time series

Normalised tabular training data “regression format”.

Trained regression model

Preprocessing - building tabular data



Raw time series

10
15
12
18
21
11
16

Processed time series

lag_2	lag_1	Y

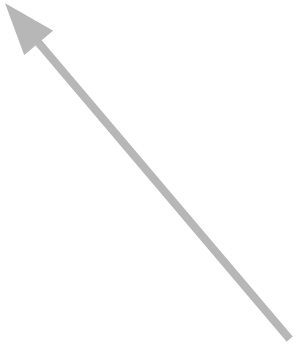
Let’s build a training dataset for a lag 2 AR model.

Preprocessing - building tabular data

Autoregressive model

Raw time series

10
15
12
18
21
11
16



Sliding window.

lag_2	lag_1	Y
10	15	12

Preprocessing - building tabular data

Autoregressive model

Raw time series

10
15
12
18
21
11
16

lag_2	lag_1	Y
10	15	12
15	12	18

Preprocessing - building tabular data

Autoregressive model

Raw time series

10
15
12
18
21
11
16

lag_2	lag_1	Y
10	15	12
15	12	18
12	18	21

Preprocessing - building tabular data

Autoregressive model

Raw time series

10
15
12
18
21
11
16

lag_2	lag_1	Y
10	15	12
15	12	18
12	18	21
18	21	11

Preprocessing - building tabular data

Autoregressive model

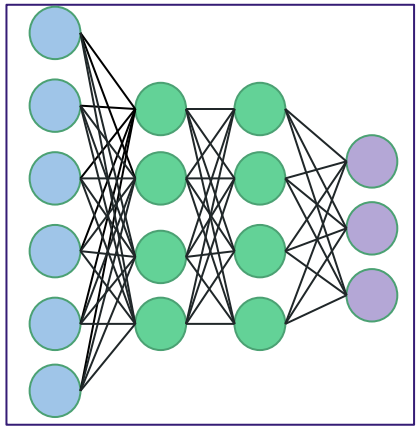
Raw time series

10
15
12
18
21
11
16

lag_2	lag_1	Y
10	15	12
15	12	18
12	18	21
18	21	11
21	11	16

Iterative Forecasting

l_6	l_5	l_4	l_3	l_2	l_1
10	17	18	12	10	15



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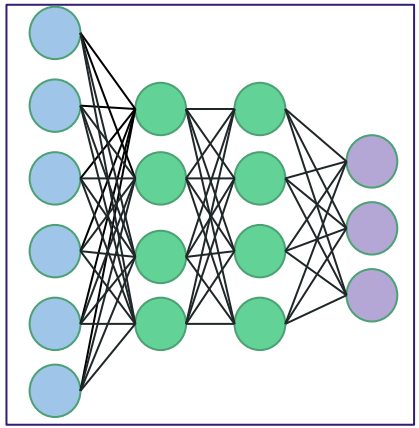
Multi-step forecasting: iterative approach

l_6	l_5	l_4	l_3	l_2	l_1
10	17	18	12	10	15

l_6	l_5	l_4	l_3	l_2	l_1
17	18	12	10	15	16



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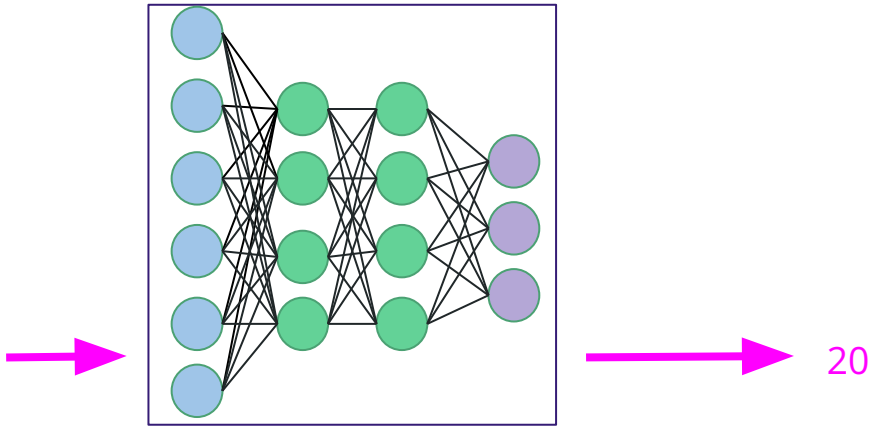
Multi-step forecasting: iterative approach

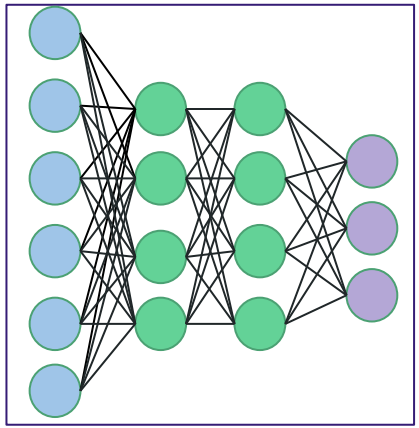
1_6	1_5	1_4	l_3	l_2	l_1
17	18	12	10	15	16



Multi-step forecasting: iterative approach

1_6	1_5	1_4	l_3	l_2	l_1
18	12	10	15	16	20

1_6	1_5	1_4	l_3	l_2	l_1
17	18	12	10	15	16



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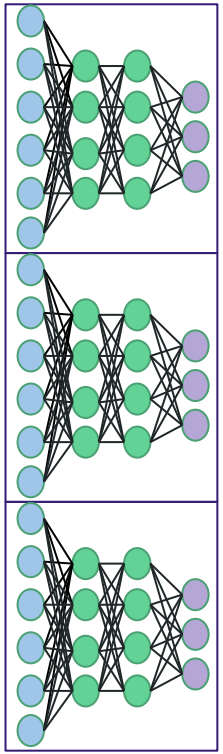
Multi-step forecasting: direct method

1_6	1_5	1_4	l_3	l_2	l_1
10	17	18	12	10	15

1_6	1_5	1_4	l_3	l_2	l_1
10	17	18	12	10	15

1_6	1_5	1_4	l_3	l_2	l_1
10	17	18	12	10	15



t+1	t+2	t+3
16		

t+1	t+2	t+3
	20	

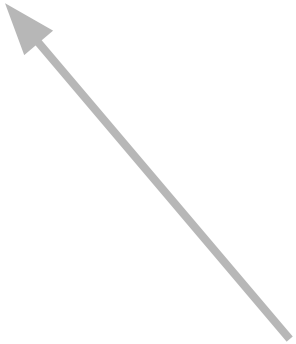
t+1	t+2	t+3
		18

Preprocessing for direct method

Autoregressive model

Raw time series

10
15
12
18
21
11
16



lag_2	lag_1	Y
10	15	18

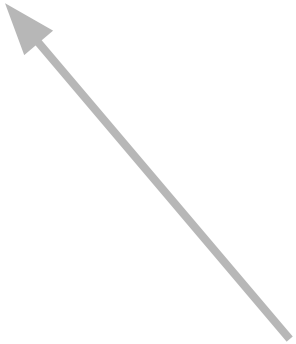
For a model where h = 2

Preprocessing for direct method

Autoregressive model

Raw time series

10
15
12
18
21
11
16

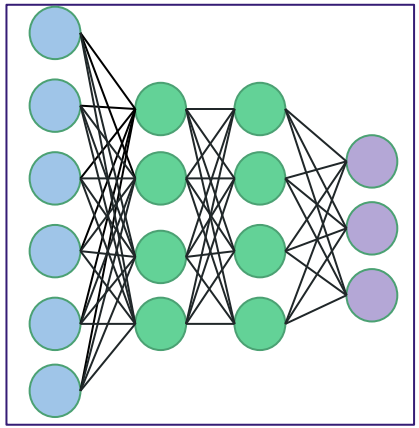


For a model where h = 3

lag_2	lag_1	Y
10	15	21

Forecasting a vector

1_6	1_5	1_4	l_3	l_2	l_1
10	17	18	12	10	15



t+1	t+2	t+3
16	20	18

Preprocessing for vector method

Autoregressive model

Raw time series

10
15
12
18
21
11
16

lag_2	lag_1	Y{t+1}	Y{t+2}	Y{t+3}
10	15	12	18	21

For a model where h = 3