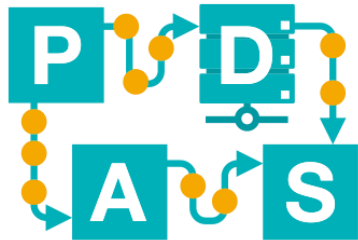# Neural Network (2/2)

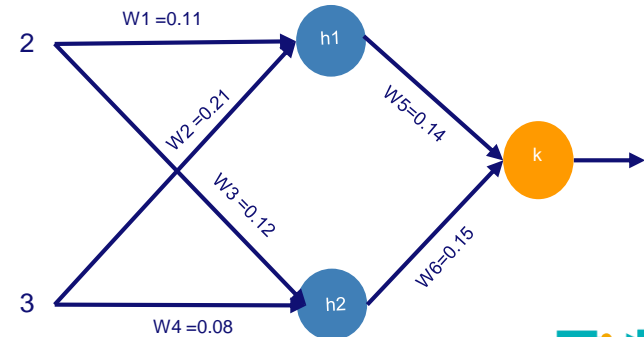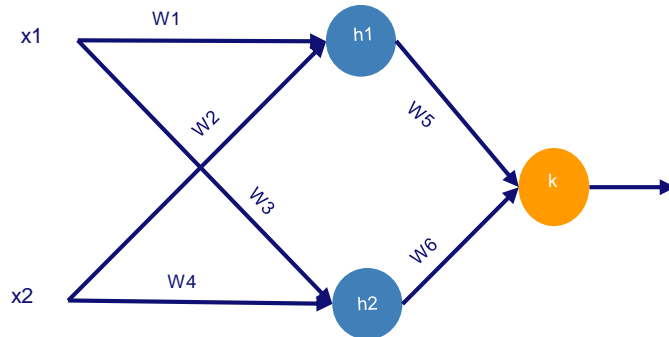**Lecture 7 instruction**

IDS-I-L7

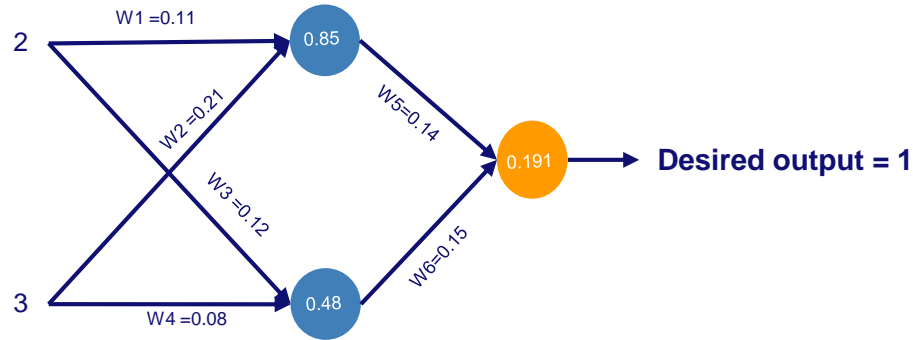**Chair of Process and Data Science**

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Exercise.1

- **Imagine a neural network with two inputs and one hidden layer same as below. Calculate the new weights based on back propagation.**
  - **Learning rate = 0.05**
  - **The real output is 1**
    - **Note! Consider the derivative of the activation function to be 1.**

Solution.1

$$2 \times 0.11 + 3 \times 0.21 = \boxed{0.85}$$

$$2 \times 0.12 + 3 \times 0.08 = \boxed{0.48}$$

$$0.85 \times 0.14 + 0.48 \times 0.15 = \boxed{0.191}$$

Solution.1
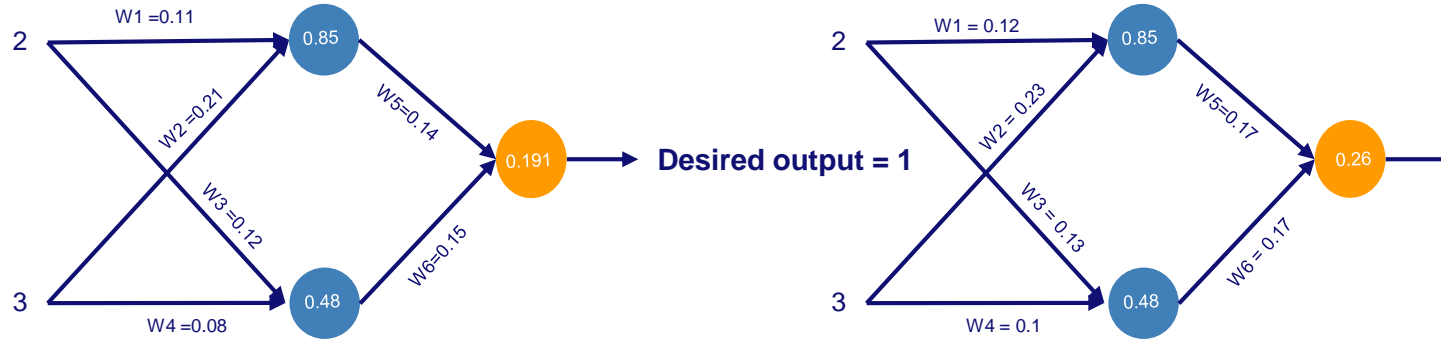
$$\text{Error} = 1 - 0.191 = 0.809$$

$$\text{learning\_rate} = 0.05$$

Now repeat feed forward with new weighs

$$E_6 = 0.809$$
$$w_6 = 0.15 + 0.05(0.809)0.48 \quad = 0.17$$

$$E_5 = 0.15 * 0.809$$
$$w_4 = 0.08 + 0.05(0.809 * 0.15)3 \quad = 0.17$$

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Exercise.2 (Homework)

- **The following table consists of training data from an employee database. For a given row entry, Count represents the number of data tuples having the values for department, status, age , and salary given in that row.**

department	status	age	salary	count
sales	senior	31 ... 35	46K ... 50K	30
sales	junior	26 ... 30	26K ... 30K	40
sales	junior	31 ... 35	31K ... 35K	40
systems	junior	21 ... 25	46K ... 50K	20
systems	senior	31 ... 35	66K ... 70K	5
systems	junior	26 ... 30	46K ... 50K	3
systems	senior	41 ... 45	66K ... 70K	3
marketing	senior	36 ... 40	46K ... 50K	10
marketing	junior	31 ... 35	41K ... 45K	4
secretary	senior	46 ... 50	36K ... 40K	4
secretary	junior	26 ... 30	26K ... 30K	6

Exercise.2 (Homework)

- **Let status be the label attribute:**
  - **(a) Design a multilayer feed-forward neural network or the given data. Label the nodes in the input and output layers.**
  - **Using the multilayer feed-forward neural network obtained in (a), show the weight values after one iteration of the backpropagation algorithm, given the training instance:**
    - **"(sales, senior, 31 . . . 35, 46K . . 50K)".**
    - **Indicate your initial weight values and learning rate.**

Solution.2 (Homework)

- **Every feasible solution is correct. Discrete-valued attributes can be encoded such that there is one input unit per domain value.**

- **For hidden layer units, the number should be smaller than that of input units, but larger than that of output units.**

Exercise.3

- **Explain the network architecture knowing that we are trying to distinguish between head and tail!**
  - **And an example of training tuple's is as follows:**
    - **T1{0.6, 0.1, head},**
    - **T2{0.2, 0.3, tail}.**

Solution.3

- **This network should have two inputs and two outputs based on the training samples and also the number of hidden layers can be for example one layer with three neurons.**