

Supplementary Notes #06

Data Mining and Data Warehousing

Solution to Exercises on Neural Networks (Supplementary Notes #9)

Question 1

Normalized Data

	Income Level	Average Number	Credit Rating
1	0.157143	0.358663	-1
2	0.514286	1	-1
3	0	0.717325	1
4	1	0.18541	1
5	0.4	0	1
6	0.785714	0.49848	1
7	0.485714	0.25228	-1
8	0.271429	0.635258	1
9	0.1	0.890578	-1
10	0.657143	0.617021	1

(a)

With $\theta = 0.9$ and $\alpha = 0.75$,

Original Input #1: $\langle 1, 0.16, 0.36 \rangle$

Original Output for #1: $\langle -1 \rangle$

Original Weight: $\langle 0.1, 0.3, 0.2 \rangle$

Weighted Sum: 0.22

Predicted Output: $\langle -1 \rangle$

New Weight: $\langle 0.1, 0.3, 0.2 \rangle$

Original Input #2: $\langle 1, 0.51, 1 \rangle$

Original Output for #2: $\langle -1 \rangle$

Original Weight: $\langle 0.1, 0.3, 0.2 \rangle$

Weighted Sum: 0.45

Predicted Output: $\langle -1 \rangle$

New Weight: $\langle 0.1, 0.3, 0.2 \rangle$

Original Input #3: <1, 0, 0.72>

Original Output for #3: <1>

Original Weight: <0.1, 0.3, 0.2>

Weighted Sum: 0.24

Predicted Output: <-1>

New Weight: <0.85, 0.3, 0.74>

Original Input #4: <1, 1, 0.19>

Original Output for #4: <1>

Original Weight: <0.85, 0.3, 0.74>

Weighted Sum: 1.29

Predicted Output: <1>

New Weight: <0.85, 0.3, 0.74>

Original Input #5: <1, 0.4, 0>

Original Output for #5: <1>

Original Weight: <0.85, 0.3, 0.74>

Weighted Sum: 0.97

Predicted Output: <1>

New Weight: <0.85, 0.3, 0.74>

Original Input #6: <1, 0.79, 0.50>

Original Output for #6: <1>

Original Weight: <0.85, 0.3, 0.74>

Weighted Sum: 1.45

Predicted Output: <1>

New Weight: <0.85, 0.3, 0.74>

Original Input #7: <1, 0.49, 0.25>

Original Output for #7: <-1>

Original Weight: <0.85, 0.3, 0.74>

Weighted Sum: 1.18

Predicted Output: <1>

New Weight: <0.1, -0.064, 0.55>

Original Input #8: $\langle 1, 0.27, 0.64 \rangle$

Original Output for #8: $\langle 1 \rangle$

Original Weight: $\langle 0.1, -0.064, 0.55 \rangle$

Weighted Sum: 0.43

Predicted Output: $\langle -1 \rangle$

New Weight: $\langle 0.85, 0.14, 1.03 \rangle$

Original Input #9: $\langle 1, 0.1, 0.89 \rangle$

Original Output for #9: $\langle -1 \rangle$

Original Weight: $\langle 0.85, 0.14, 1.03 \rangle$

Weighted Sum: 1.78

Predicted Output: $\langle 1 \rangle$

New Weight: $\langle 0.1, 0.064, 0.36 \rangle$

Original Input #10: $\langle 1, 0.66, 0.62 \rangle$

Original Output for #10: $\langle 1 \rangle$

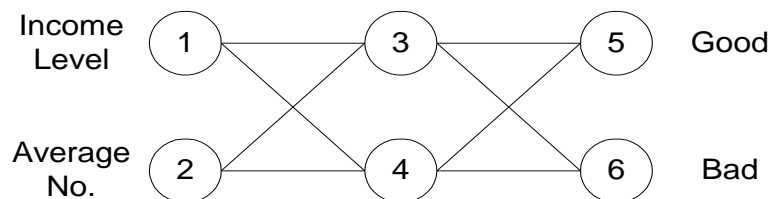
Original Weight: $\langle 0.1, 0.064, 0.36 \rangle$

Weighted Sum: 0.36

Predicted Output: $\langle -1 \rangle$

New Weight: $\langle 0.85, 0.56, 0.82 \rangle$

(b)



w_{ij} = weight between nodes i and j

b_i = bias value of node i

$w_{13} = 0.1, w_{23} = -0.1, b_3 = 0.1$

$w_{14} = 0.2, w_{24} = 0.1, b_4 = -0.1$

$w_{35} = 0.2, w_{45} = -0.1, b_5 = 0.2$

$w_{36} = 0.1, w_{46} = 0.2, b_6 = 0.1$

With learning rate = 0.9,

Original Input #1: <1, 0.16, 0.36>

Original Output for #1: <0, 1>

Node 3: Input = $0.16 (0.1) + 0.36 (-0.1) + 1 (0.1) = 0.08$, Output = $1 / (1 + e^{-0.08}) = 0.52$

Node 4: Input = -0.03 , Output = 0.49

Node 5: Input = 0.20 , Output = 0.55

Node 6: Input = 0.19 , Output = 0.55

Node 5: Error = $0.55 (1 - 0.55) (0 - 0.55) = -0.14$

Node 6: Error = $0.55 (1 - 0.55) (1 - 0.55) = 0.11$

Node 3: Error = $0.52 (1 - 0.52) (0.2 (-0.14) + 0.1 (0.11)) = -0.004$

Node 4: Error = $0.49 (1 - 0.49) (-0.1 (-0.14) + 0.2 (0.11)) = 0.009$

Node 5: $w_{35} = 0.2 + 0.9 (-0.14) (0.52) = 0.14$, $w_{45} = -0.1 + 0.9 (-0.14) (0.49) = -0.16$,

$b_5 = 0.2 + 0.9 (-0.14) = 0.08$

Node 6: $w_{36} = 0.1 + 0.9 (0.11) (0.52) = 0.15$, $w_{46} = 0.2 + 0.9 (0.11) (0.49) = 0.25$,

$b_6 = 0.1 + 0.9 (0.11) = 0.20$

Node 3: $w_{13} = 0.1 + 0.9 (-0.004) (0.16) = 0.10$, $w_{23} = -0.1 + 0.9 (-0.004) (0.36) = -0.10$,

$b_3 = 0.1 + 0.9 (-0.004) = 0.096$

Node 4: $w_{14} = 0.2 + 0.9 (0.009) (0.16) = 0.20$, $w_{24} = 0.1 + 0.9 (0.009) (0.36) = 0.10$,

$b_4 = 0.1 + 0.9 (0.009) = -0.092$

Original Input #2: <1, 0.51, 1>

Original Output for #2: <0, 1>

Node 3: Input = 0.05 , Output = 0.51

Node 4: Input = 0.11 , Output = 0.53

Node 5: Input = -0.01 , Output = 0.50

Node 6: Input = 0.53 , Output = 0.63

Node 5: Error = -0.12

Node 6: Error = 0.09

Node 3: Error = -0.0009

Node 4: Error = 0.01

Node 5: $w_{35} = 0.08$, $w_{45} = -0.22$, $b_5 = -0.03$

Node 6: $w_{36} = 0.19$, $w_{46} = 0.29$, $b_6 = 0.28$

Node 3: $w_{13} = 0.10$, $w_{23} = -0.10$, $b_3 = 0.096$

Node 4: $w_{14} = 0.21$, $w_{24} = 0.11$, $b_4 = -0.08$

Original Input #3: $\langle 1, 0, 0.72 \rangle$

Original Output for #3: $\langle 1, 0 \rangle$

Node 3: Input = 0.02, Output = 0.51

Node 4: Input = -0.002, Output = 0.50

Node 5: Input = -0.19, Output = 0.45

Node 6: Input = 0.49, Output = 0.62

Node 5: Error = 0.14

Node 6: Error = -0.15

Node 3: Error = -0.004

Node 4: Error = -0.02

Node 5: $w_{35} = 0.15$, $w_{45} = -0.16$, $b_5 = 0.09$

Node 6: $w_{36} = 0.13$, $w_{46} = 0.23$, $b_6 = 0.15$

Node 3: $w_{13} = 0.10$, $w_{23} = -0.10$, $b_3 = 0.092$

Node 4: $w_{14} = 0.21$, $w_{24} = 0.10$, $b_4 = -0.099$

Original Input #4: $\langle 1, 1, 0.19 \rangle$

Original Output for #4: $\langle 1, 0 \rangle$

Node 3: Input = 0.17, Output = 0.54

Node 4: Input = 0.13, Output = 0.53

Node 5: Input = 0.20, Output = 0.55

Node 6: Input = 0.32, Output = 0.58

Node 5: Error = 0.11

Node 6: Error = -0.14

Node 3: Error = -0.0005

Node 4: Error = -0.01

Node 5: $w_{35} = 0.20$, $w_{45} = -0.10$, $b_5 = 0.19$

Node 6: $w_{36} = 0.06$, $w_{46} = 0.16$, $b_6 = 0.02$

Node 3: $w_{13} = 0.10$, $w_{23} = -0.11$, $b_3 = 0.091$

Node 4: $w_{14} = 0.19$, $w_{24} = 0.10$, $b_4 = -0.11$

Original Input #5: $\langle 1, 0.4, 0 \rangle$

Original Output for #5: $\langle 1, 0 \rangle$

Node 3: Input = 0.13, Output = 0.53

Node 4: Input = -0.03, Output = 0.49

Node 5: Input = 0.27, Output = 0.57

Node 6: Input = 0.04, Output = 0.51

Node 5: Error = 0.11

Node 6: Error = -0.13

Node 3: Error = 0.003

Node 4: Error = -0.007

Node 5: $w_{35} = 0.24$, $w_{45} = -0.06$, $b_5 = 0.28$

Node 6: $w_{36} = -0.004$, $w_{46} = 0.10$, $b_6 = -0.09$

Node 3: $w_{13} = 0.10$, $w_{23} = -0.11$, $b_3 = 0.094$

Node 4: $w_{14} = 0.19$, $w_{24} = 0.10$, $b_4 = -0.12$

Original Input #6: $\langle 1, 0.79, 0.50 \rangle$

Original Output for #6: $\langle 1, 0 \rangle$

Node 3: Input = 0.12, Output = 0.53

Node 4: Input = 0.08, Output = 0.52

Node 5: Input = 0.45, Output = 0.61

Node 6: Input = -0.05, Output = 0.49

Node 5: Error = 0.09

Node 6: Error = -0.12

Node 3: Error = 0.006

Node 4: Error = -0.004

Node 5: $w_{35} = 0.29$, $w_{45} = -0.01$, $b_5 = 0.37$

Node 6: $w_{36} = -0.06$, $w_{46} = 0.04$, $b_6 = -0.20$

Node 3: $w_{13} = 0.10$, $w_{23} = -0.10$, $b_3 = 0.099$

Node 4: $w_{14} = 0.19$, $w_{24} = 0.10$, $b_4 = -0.12$

Original Input #7: $\langle 1, 0.49, 0.25 \rangle$

Original Output for #7: $\langle 0, 1 \rangle$

Node 3: Input = 0.12, Output = 0.53

Node 4: Input = -0.005, Output = 0.50

Node 5: Input = 0.50, Output = 0.62

Node 6: Input = -0.22, Output = 0.44

Node 5: Error = -0.15

Node 6: Error = 0.14

Node 3: Error = -0.01

Node 4: Error = 0.002

Node 5: $w_{35} = 0.22$, $w_{45} = -0.08$, $b_5 = 0.24$

Node 6: $w_{36} = 0.003$, $w_{46} = 0.11$, $b_6 = -0.08$

Node 3: $w_{13} = 0.10$, $w_{23} = -0.11$, $b_3 = 0.088$

Node 4: $w_{14} = 0.19$, $w_{24} = 0.10$, $b_4 = -0.12$

Original Input #8: $\langle 1, 0.27, 0.64 \rangle$

Original Output for #8: $\langle 1, 0 \rangle$

Node 3: Input = 0.05, Output = 0.51

Node 4: Input = -0.006, Output = 0.50

Node 5: Input = 0.24, Output = 0.56

Node 6: Input = -0.01, Output = 0.50

Node 5: Error = 0.11

Node 6: Error = -0.12

Node 3: Error = 0.006

Node 4: Error = -0.006

Node 5: $w_{35} = 0.27$, $w_{45} = -0.03$, $b_5 = 0.33$

Node 6: $w_{36} = -0.05$, $w_{46} = 0.05$, $b_6 = -0.19$

Node 3: $w_{13} = 0.10$, $w_{23} = -0.10$, $b_3 = 0.093$

Node 4: $w_{14} = 0.19$, $w_{24} = 0.09$, $b_4 = -0.12$

Original Input #9: $\langle 1, 0.1, 0.89 \rangle$

Original Output for #9: $\langle 0, 1 \rangle$

Node 3: Input = 0.01, Output = 0.50

Node 4: Input = -0.02, Output = 0.49

Node 5: Input = 0.33, Output = 0.58

Node 6: Input = -0.15, Output = 0.46

Node 5: Error = -0.14

Node 6: Error = 0.13

Node 3: Error = -0.01

Node 4: Error = 0.003

Node 5: $w_{35} = 0.21$, $w_{45} = -0.09$, $b_5 = 0.21$

Node 6: $w_{36} = 0.007$, $w_{46} = 0.11$, $b_6 = -0.07$

Node 3: $w_{13} = 0.10$, $w_{23} = -0.11$, $b_3 = 0.083$

Node 4: $w_{14} = 0.19$, $w_{24} = 0.10$, $b_4 = -0.12$

Original Input #10: $\langle 1, 0.66, 0.62 \rangle$

Original Output for #10: $\langle 1, 0 \rangle$

Node 3: Input = 0.08, Output = 0.52

Node 4: Input = 0.06, Output = 0.52

Node 5: Input = 0.28, Output = 0.57

Node 6: Input = -0.0001, Output = 0.50

Node 5: Error = 0.11

Node 6: Error = -0.12

Node 3: Error = 0.005

Node 4: Error = -0.006

Node 5: $w_{35} = 0.26$, $w_{45} = -0.05$, $b_5 = 0.30$

Node 6: $w_{36} = -0.05$, $w_{46} = 0.05$, $b_6 = -0.18$

Node 3: $w_{13} = 0.10$, $w_{23} = -0.11$, $b_3 = 0.088$

Node 4: $w_{14} = 0.19$, $w_{24} = 0.09$, $b_4 = -0.13$

Question 2

Normalized Data

	Low	Medium	High	Visa	Cheque	AMEX	Frequent	Not Frequent	Yes	No	Credit
1	1	0	0	1	0	0	1	0	1	0	-1
2	1	0	0	0	1	0	1	0	0	1	-1
3	0	0	1	0	1	0	0	1	0	1	1
4	1	0	0	0	0	1	1	0	1	0	1
5	0	1	0	1	0	0	0	1	0	1	1
6	0	1	0	0	1	0	0	1	0	1	1
7	1	0	0	1	0	0	1	0	1	0	-1
8	0	0	1	1	0	0	0	1	0	1	1
9	0	0	1	0	1	0	0	1	1	0	-1
10	0	1	0	0	0	1	1	0	1	0	1

(a)

With $\theta = 0.9$ and $\alpha = 0.75$,

Original Input #1: $\langle 1, 1, 0, 0, 1, 0, 0, 1, 0, 1, 0 \rangle$

Original Output for #1: $\langle -1 \rangle$

Original Weight: $\langle 0.1, 0.2, 0.3, 0.2, 0.25, 0.15, 0.1, 0.1, 0.05, 0.2, 0.3 \rangle$

Weighted Sum: 0.85

Predicted Output: $\langle -1 \rangle$

New Weight: $\langle 0.1, 0.2, 0.3, 0.2, 0.25, 0.15, 0.1, 0.1, 0.05, 0.2, 0.3 \rangle$

Original Input #2: $\langle 1, 1, 0, 0, 0, 1, 0, 1, 0, 0, 1 \rangle$

Original Output for #2: $\langle -1 \rangle$

Original Weight: $\langle 0.1, 0.2, 0.3, 0.2, 0.25, 0.15, 0.1, 0.1, 0.05, 0.2, 0.3 \rangle$

Weighted Sum: 0.85

Predicted Output: $\langle -1 \rangle$

New Weight: $\langle 0.1, 0.2, 0.3, 0.2, 0.25, 0.15, 0.1, 0.1, 0.05, 0.2, 0.3 \rangle$

Original Input #3: <1, 0, 0, 1, 0, 1, 0, 0, 1, 0, 1>

Original Output for #3: <1>

Original Weight: <0.1, 0.2, 0.3, 0.2, 0.25, 0.15, 0.1, 0.1, 0.05, 0.2, 0.3>

Weighted Sum: 0.8

Predicted Output: <-1>

New Weight: <0.85, 0.2, 0.3, 0.95, 0.25, 0.9, 0.1, 0.1, 0.8, 0.2, 1.05>

Original Input #4: <1, 1, 0, 0, 0, 0, 1, 1, 0, 1, 0>

Original Output for #4: <1>

Original Weight: <0.85, 0.2, 0.3, 0.95, 0.25, 0.9, 0.1, 0.1, 0.8, 0.2, 1.05>

Weighted Sum: 1.45

Predicted Output: <1>

New Weight: <0.85, 0.2, 0.3, 0.95, 0.25, 0.9, 0.1, 0.1, 0.8, 0.2, 1.05>

Original Input #5: <1, 0, 1, 0, 1, 0, 0, 0, 1, 0, 1>

Original Output for #5: <1>

Original Weight: <0.85, 0.2, 0.3, 0.95, 0.25, 0.9, 0.1, 0.1, 0.8, 0.2, 1.05>

Weighted Sum: 3.25

Predicted Output: <1>

New Weight: <0.85, 0.2, 0.3, 0.95, 0.25, 0.9, 0.1, 0.1, 0.8, 0.2, 1.05>

Original Input #6: <1, 0, 1, 0, 0, 1, 0, 0, 1, 0, 1>

Original Output for #6: <1>

Original Weight: <0.85, 0.2, 0.3, 0.95, 0.25, 0.9, 0.1, 0.1, 0.8, 0.2, 1.05>

Weighted Sum: 3.9

Predicted Output: <1>

New Weight: <0.85, 0.2, 0.3, 0.95, 0.25, 0.9, 0.1, 0.1, 0.8, 0.2, 1.05>

Original Input #7: <1, 1, 0, 0, 1, 0, 0, 1, 0, 1, 0>

Original Output for #7: <-1>

Original Weight: <0.85, 0.2, 0.3, 0.95, 0.25, 0.9, 0.1, 0.1, 0.8, 0.2, 1.05>

Weighted Sum: 1.6

Predicted Output: <1>

New Weight: <0.1, -0.55, 0.3, 0.95, -0.5, 0.9, 0.1, -0.65, 0.8, -0.55, 1.05>

Original Input #8: <1, 0, 0, 1, 1, 0, 0, 0, 1, 0, 1>

Original Output for #8: <1>

Original Weight: <0.1, -0.55, 0.3, 0.95, -0.5, 0.9, 0.1, -0.65, 0.8, -0.55, 1.05>

Weighted Sum: 2.4

Predicted Output: <1>

New Weight: <0.1, -0.55, 0.3, 0.95, -0.5, 0.9, 0.1, -0.65, 0.8, -0.55, 1.05>

Original Input #9: <1, 0, 0, 1, 0, 1, 0, 0, 1, 1, 0>

Original Output for #9: <-1>

Original Weight: <0.1, -0.55, 0.3, 0.95, -0.5, 0.9, 0.1, -0.65, 0.8, -0.55, 1.05>

Weighted Sum: 2.2

Predicted Output: <1>

New Weight: <-0.65, -0.55, 0.3, 0.2, -0.5, 0.15, 0.1, -0.65, 0.05, -1.3, 1.05>

Original Input #10: <1, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0>

Original Output for #10: <1>

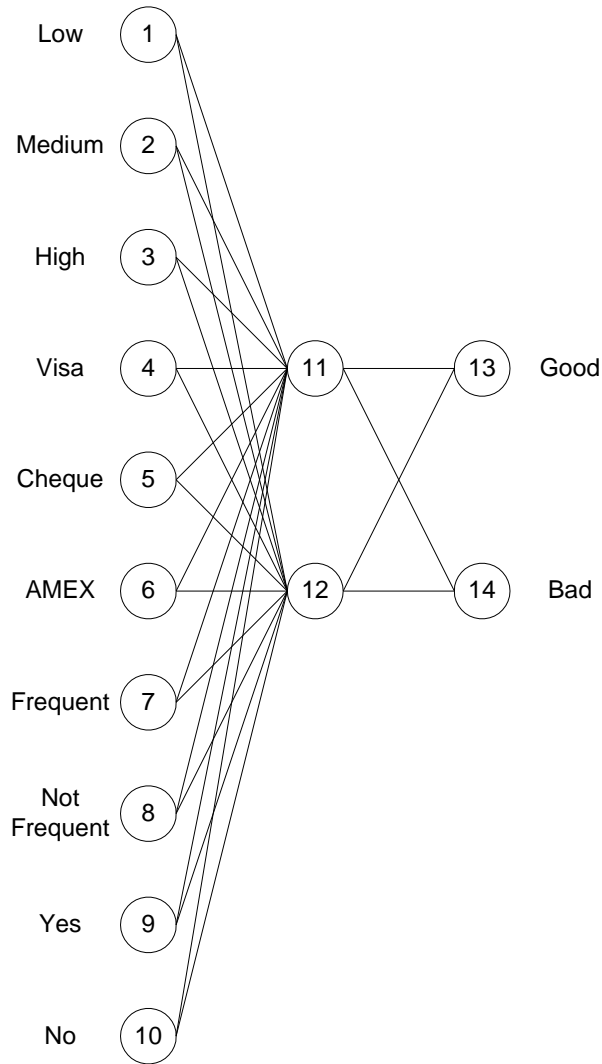
Original Weight: <-0.65, -0.55, 0.3, 0.2, -0.5, 0.15, 0.1, -0.65, 0.05, -1.3, 1.05>

Weighted Sum: -2.2

Predicted Output: <-1>

New Weight: <0.1, -0.55, 1.05, 0.2, -0.5, 0.15, 0.85, 0.1, 0.05, -0.55, 1.05>

(b)



w_{ij} = weight between nodes i and j

b_i = bias value of node i

$$w_{1(11)} = 0.1, w_{2(11)} = -0.1, w_{3(11)} = 0.1, w_{4(11)} = -0.2, w_{5(11)} = -0.1, w_{6(11)} = 0.1, w_{7(11)} = 0.2, w_{8(11)} = 0.1, w_{9(11)} = 0.2, w_{10(11)} = 0.1, b_{11} = 0.1$$

$$w_{1(12)} = 0.1, w_{2(12)} = 0.2, w_{3(12)} = 0.1, w_{4(12)} = -0.2, w_{5(12)} = -0.1, w_{6(12)} = 0.1, w_{7(12)} = 0.2, w_{8(12)} = 0.1, w_{9(12)} = 0.2, w_{10(12)} = 0.1, b_{12} = 0.1$$

$$w_{(11)(13)} = 0.2, w_{(12)(13)} = -0.1, b_{13} = 0.2$$

$$w_{(11)(14)} = 0.1, w_{(12)(14)} = 0.2, b_{14} = 0.1$$

With learning rate = 0.9,

#1	bias	1	2	3	4	5	6	7	8	9	10					
Original Input	1	1	0	0	1	0	0	1	0	1	0					
Original Output	0	1														
	Node	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
	Input	1	0	0	1	0	0	1	0	1	0	0.400	0.400	0.260	0.280	
(1/1+exp(-input))	Output	0.731	0.500	0.500	0.731	0.500	0.500	0.731	0.500	0.731	0.500	0.599	0.599	0.565	0.569	
	Error															
Node 13	-0.139	(original output - node output)(node output)(1-node output)														
Node 14	0.106	(original output - node output)(node output)(1-node output)														
Node 11	-0.004	[Σ(Error*weight)] (node output)(1-node output)														
Node 12	0.008	[Σ(Error*weight)] (node output)(1-node output)														
New weights	w(x)(y)=	(old weight) + (learning rate) * (error of node y) * (output of node x)														
	bias	1	2	3	4	5	6	7	8	9	10	11	12			
Node 13	0.075											0.125	-0.175			
Node 14	0.195											0.157	0.257			
Node 11	0.096	0.097	-0.103	0.097	-0.203	-0.103	0.097	0.197	0.097	0.197	0.097					
Node 12	0.108	0.106	0.206	0.106	-0.194	-0.094	0.106	0.206	0.106	0.206	0.106					

#2	bias	1	2	3	4	5	6	7	8	9	10				
Original Input	1	1	0	0	0	1	0	1	0	0	1				
Original Output	0	1													
	Node	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Input	1	0	0	0	1	0	1	0	0	1	0.385	0.430	0.044	0.444
(1/1+exp(-input))	Output	0.731	0.500	0.500	0.500	0.731	0.500	0.731	0.500	0.500	0.731	0.595	0.606	0.511	0.609
	Error														
Node 13	-0.128	(original output - node output)(node output)(1-node output)													
Node 14	0.093	(original output - node output)(node output)(1-node output)													
Node 11	-0.0003	[Σ(Error*weight)] (node output)(1-node output)													
Node 12	0.011	[Σ(Error*weight)] (node output)(1-node output)													
New weights	w(x)(y)=	(old weight) + (learning rate) * (error of node y) * (output of node x)													
	bias	1	2	3	4	5	6	7	8	9	10	11	12		
Node 13	-0.040											0.057	-0.244		
Node 14	0.279											0.207	0.308		
Node 11	0.096	0.097	-0.103	0.097	-0.203	-0.103	0.097	0.197	0.097	0.197	0.097				
Node 12	0.117	0.113	0.213	0.113	-0.187	-0.087	0.113	0.213	0.113	0.213	0.113				

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#3	bias	1	2	3	4	5	6	7	8	9	10										
Original Input	1	0	0	1	0	1	0	0	1	0	1										
Original Output	1	0																			
	Node	1	2	3	4	5	6	7	8	9	10	11	12	13	14						
	Input	0	0	1	0	1	0	0	1	0	1	0.284	0.369	-0.152	0.579						
(1/1+exp(-input))	Output	0.500	0.500	0.731	0.500	0.731	0.500	0.500	0.731	0.500	0.731	0.571	0.591	0.462	0.641						
	Error																				
Node 13	0.134	(original output - node output)(node output)(1-node output)																			
Node 14	-0.147	(original output - node output)(node output)(1-node output)																			
Node 11	-0.0056	[Σ(Error*weight)] (node output)(1-node output)																			
Node 12	-0.019	[Σ(Error*weight)] (node output)(1-node output)																			
New weights	w(x)(y)=	(old weight) + (learning rate) * (error of node y) * (output of node x)																			
	bias	1	2	3	4	5	6	7	8	9	10	11	12								
Node 13	0.081											0.125	-0.173								
Node 14	0.146											0.131	0.229								
Node 11	0.091	0.095	-0.105	0.095	-0.205	-0.105	0.095	0.195	0.095	0.195	0.095										
Node 12	0.101	0.104	0.204	0.104	-0.196	-0.096	0.104	0.204	0.104	0.204	0.104										
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#4	bias	1	2	3	4	5	6	7	8	9	10										
Original Input	1	1	0	0	0	0	1	1	0	1	0										
Original Output	1	0																			
	Node	1	2	3	4	5	6	7	8	9	10	11	12	13	14						
	Input	1	0	0	0	0	1	1	0	1	0	0.669	0.718	0.047	0.387						
(1/1+exp(-input))	Output	0.731	0.500	0.500	0.500	0.500	0.731	0.731	0.500	0.731	0.500	0.661	0.672	0.512	0.595						
	Error																				
Node 13	0.122	(original output - node output)(node output)(1-node output)																			
Node 14	-0.143	(original output - node output)(node output)(1-node output)																			
Node 11	-0.0008	[Σ(Error*weight)] (node output)(1-node output)																			
Node 12	-0.012	[Σ(Error*weight)] (node output)(1-node output)																			
New weights	w(x)(y)=	(old weight) + (learning rate) * (error of node y) * (output of node x)																			
	bias	1	2	3	4	5	6	7	8	9	10	11	12								
Node 13	0.190											0.198	-0.099								
Node 14	0.017											0.046	0.142								
Node 11	0.090	0.094	-0.106	0.094	-0.206	-0.106	0.094	0.194	0.094	0.194	0.094										
Node 12	0.090	0.096	0.196	0.096	-0.204	-0.104	0.096	0.196	0.096	0.196	0.096										

#5	bias	1	2	3	4	5	6	7	8	9	10				
Original Input	1	0	1	0	1	0	0	0	1	0	1				
Original Output	1	0													
	Node	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Input	0	1	0	1	0	0	0	1	0	1	-0.034	0.276	0.231	0.120
(1/1+exp(-input))	Output	0.500	0.731	0.500	0.731	0.500	0.500	0.500	0.731	0.500	0.731	0.492	0.568	0.558	0.530
	Error														
Node 13	0.109	(original output - node output)(node output)(1-node output)													
Node 14	-0.132	(original output - node output)(node output)(1-node output)													
Node 11	0.004	[Σ(Error*weight)] (node output)(1-node output)													
Node 12	-0.007	[Σ(Error*weight)] (node output)(1-node output)													
New weights	w(x)(y)=	(old weight) + (learning rate) * (error of node y) * (output of node x)													
	bias	1	2	3	4	5	6	7	8	9	10	11	12		
Node 13	0.289											0.246	-0.044		
Node 14	-0.102											-0.013	0.075		
Node 11	0.094	0.096	-0.104	0.096	-0.204	-0.104	0.096	0.196	0.096	0.196	0.096				
Node 12	0.083	0.093	0.193	0.093	-0.207	-0.107	0.093	0.193	0.093	0.193	0.093				
#6	bias	1	2	3	4	5	6	7	8	9	10				
Original Input	1	0	1	0	0	1	0	0	1	0	1				
Original Output	1	0													
	Node	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Input	0	1	0	0	1	0	0	1	0	1	0.077	0.356	0.391	-0.065
(1/1+exp(-input))	Output	0.500	0.731	0.500	0.500	0.731	0.500	0.500	0.731	0.500	0.731	0.519	0.588	0.596	0.484
	Error														
Node 13	0.097	(original output - node output)(node output)(1-node output)													
Node 14	-0.121	(original output - node output)(node output)(1-node output)													
Node 11	0.006	[Σ(Error*weight)] (node output)(1-node output)													
Node 12	-0.003	[Σ(Error*weight)] (node output)(1-node output)													
New weights	w(x)(y)=	(old weight) + (learning rate) * (error of node y) * (output of node x)													
	bias	1	2	3	4	5	6	7	8	9	10	11	12		
Node 13	0.376											0.292	0.008		
Node 14	-0.211											-0.069	0.011		
Node 11	0.099	0.099	-0.101	0.099	-0.201	-0.101	0.099	0.199	0.099	0.199	0.099				
Node 12	0.080	0.092	0.192	0.092	-0.208	-0.108	0.092	0.192	0.092	0.192	0.092				

#7	bias	1	2	3	4	5	6	7	8	9	10				
Original Input	1	1	0	0	1	0	0	1	0	1	0				
Original Output	0	1													
	Node	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Input	1	0	0	1	0	0	1	0	1	0	0.394	0.347	0.555	-0.246
(1/1+exp(-input))	Output	0.731	0.500	0.500	0.731	0.500	0.500	0.731	0.500	0.731	0.500	0.597	0.586	0.635	0.439
	Error														
Node 13	-0.147	(original output - node output)(node output)(1-node output)													
Node 14	0.138	(original output - node output)(node output)(1-node output)													
Node 11	-0.013	[Σ(Error*weight)] (node output)(1-node output)													
Node 12	0.000	[Σ(Error*weight)] (node output)(1-node output)													
New weights	w(x)(y)=	(old weight) + (learning rate) * (error of node y) * (output of node x)													
	bias	1	2	3	4	5	6	7	8	9	10	11	12		
Node 13	0.243											0.213	-0.070		
Node 14	-0.086											0.005	0.084		
Node 11	0.088	0.090	-0.110	0.090	-0.210	-0.110	0.090	0.190	0.090	0.190	0.090				
Node 12	0.080	0.092	0.192	0.092	-0.208	-0.108	0.092	0.192	0.092	0.192	0.092				
#8	bias	1	2	3	4	5	6	7	8	9	10				
Original Input	1	0	0	1	1	0	0	0	1	0	1				
Original Output	1	0													
	Node	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Input	0	0	1	1	0	0	0	1	0	1	0.149	0.148	0.320	-0.039
(1/1+exp(-input))	Output	0.500	0.500	0.731	0.731	0.500	0.500	0.500	0.731	0.500	0.731	0.537	0.537	0.579	0.490
	Error														
Node 13	0.103	(original output - node output)(node output)(1-node output)													
Node 14	-0.123	(original output - node output)(node output)(1-node output)													
Node 11	0.005	[Σ(Error*weight)] (node output)(1-node output)													
Node 12	-0.004	[Σ(Error*weight)] (node output)(1-node output)													
New weights	w(x)(y)=	(old weight) + (learning rate) * (error of node y) * (output of node x)													
	bias	1	2	3	4	5	6	7	8	9	10	11	12		
Node 13	0.336											0.262	-0.020		
Node 14	-0.197											-0.054	0.025		
Node 11	0.093	0.093	-0.107	0.093	-0.207	-0.107	0.093	0.193	0.093	0.193	0.093				
Node 12	0.077	0.090	0.190	0.090	-0.210	-0.110	0.090	0.190	0.090	0.190	0.090				

#9	bias	1	2	3	4	5	6	7	8	9	10				
Original Input	1	0	0	1	0	1	0	0	1	1	0				
Original Output	0	1													
	Node	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Input	0	0	1	0	1	0	0	1	1	0	0.364	0.336	0.479	-0.214
(1/1+exp(-input))	Output	0.500	0.500	0.731	0.500	0.731	0.500	0.500	0.731	0.731	0.500	0.590	0.583	0.617	0.447
	Error														
Node 13	-0.146	(original output - node output)(node output)(1-node output)													
Node 14	0.137	(original output - node output)(node output)(1-node output)													
Node 11	-0.011	[Σ(Error*weight)] (node output)(1-node output)													
Node 12	0.002	[Σ(Error*weight)] (node output)(1-node output)													
New weights	w(x)(y)=	(old weight) + (learning rate) * (error of node y) * (output of node x)													
	bias	1	2	3	4	5	6	7	8	9	10	11	12		
Node 13	0.204											0.185	-0.097		
Node 14	-0.074											0.018	0.096		
Node 11	0.083	0.088	-0.112	0.088	-0.212	-0.112	0.088	0.188	0.088	0.188	0.088				
Node 12	0.078	0.091	0.191	0.091	-0.209	-0.109	0.091	0.191	0.091	0.191	0.091				
#10	bias	1	2	3	4	5	6	7	8	9	10				
Original Input	1	0	1	0	0	0	1	1	0	1	0				
Original Output	1	0													
	Node	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Input	0	1	0	0	0	1	1	0	1	0	0.434	0.740	0.251	0.003
(1/1+exp(-input))	Output	0.500	0.731	0.500	0.500	0.500	0.731	0.731	0.500	0.731	0.500	0.607	0.677	0.562	0.501
	Error														
Node 13	0.108	(original output - node output)(node output)(1-node output)													
Node 14	-0.125	(original output - node output)(node output)(1-node output)													
Node 11	0.004	[Σ(Error*weight)] (node output)(1-node output)													
Node 12	-0.005	[Σ(Error*weight)] (node output)(1-node output)													
New weights	w(x)(y)=	(old weight) + (learning rate) * (error of node y) * (output of node x)													
	bias	1	2	3	4	5	6	7	8	9	10	11	12		
Node 13	0.301											0.244	-0.031		
Node 14	-0.186											-0.050	0.020		
Node 11	0.087	0.090	-0.110	0.090	-0.210	-0.110	0.090	0.190	0.090	0.190	0.090				
Node 12	0.074	0.088	0.188	0.088	-0.212	-0.112	0.088	0.188	0.088	0.188	0.088				