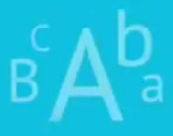
Introduction to Neural Networks -1

Source: https://www.youtube.com/playlist?list=PLAwxTw4SYaPkQXg8TkVdIvYv4HfLG7SiH

1

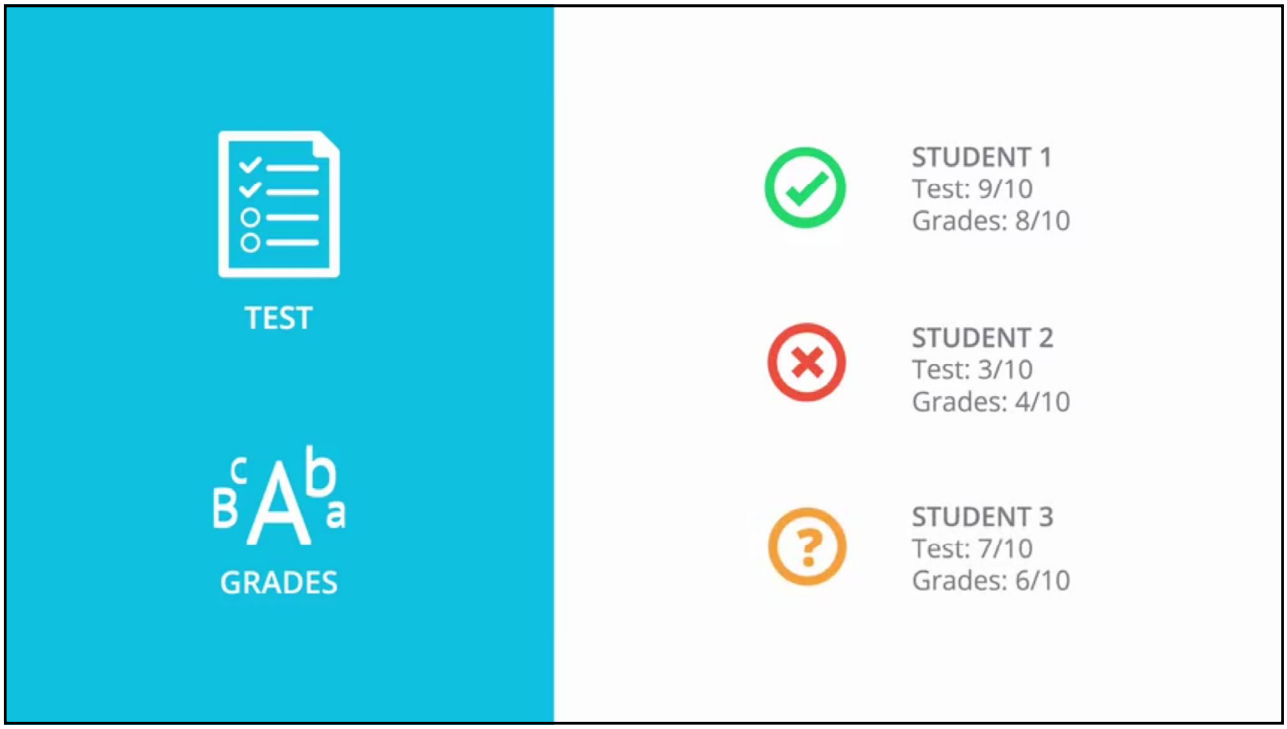
Acceptance at a University

TEST

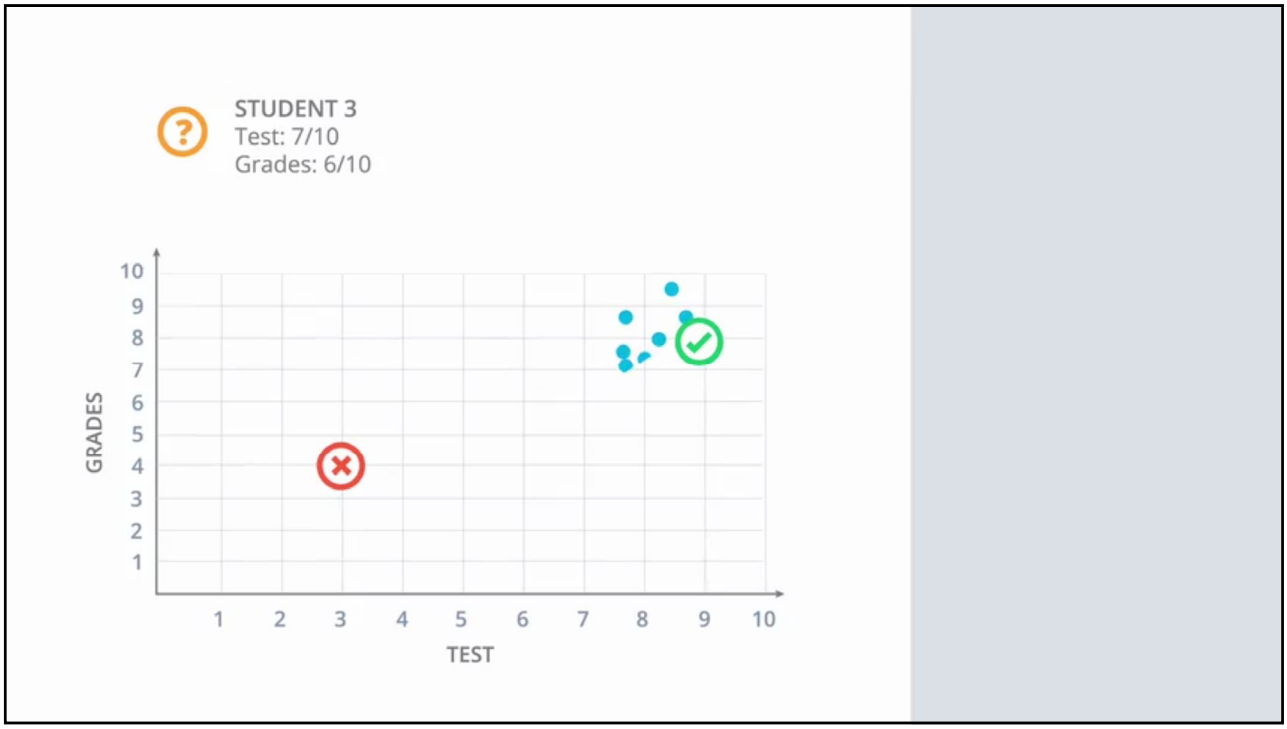


GRADES

2


TEST
GRADES
STUDENT 1
Test: 9/10
Grades: 8/10
STUDENT 2
Test: 3/10
Grades: 4/10
STUDENT 3
Test: 7/10
Grades: 6/10

3


STUDENT 3
Test: 7/10
Grades: 6/10
GRADES
TEST
1
2
3
4
5
6
7
8
9
10

4

STUDENT 3
Test: 7/10
Grades: 6/10

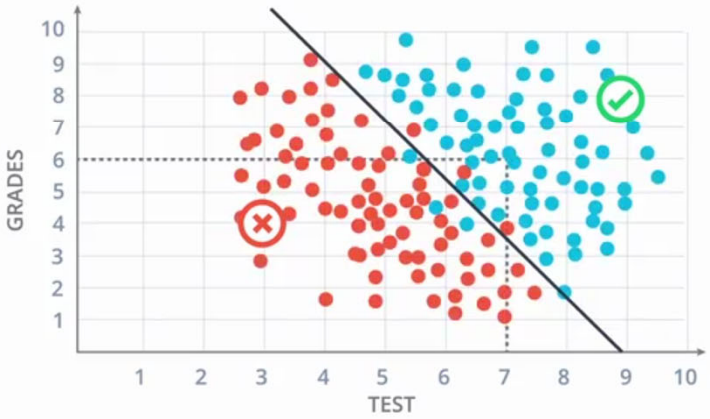
QUIZ

Does the student get Accepted?

- Yes
- No

5

Acceptance at a University



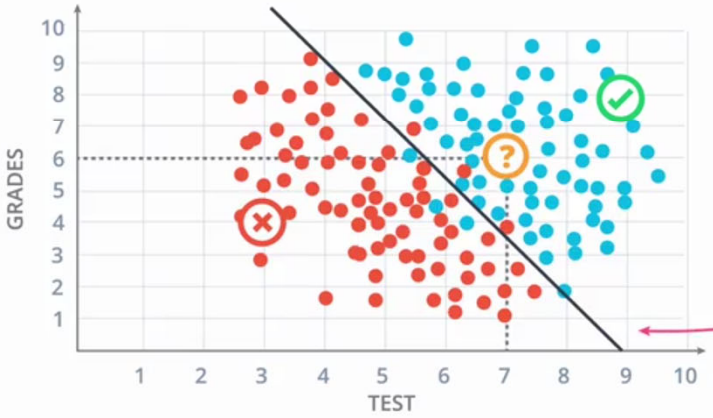
QUIZ

Does the student get Accepted?

- Yes
- No

6

Question

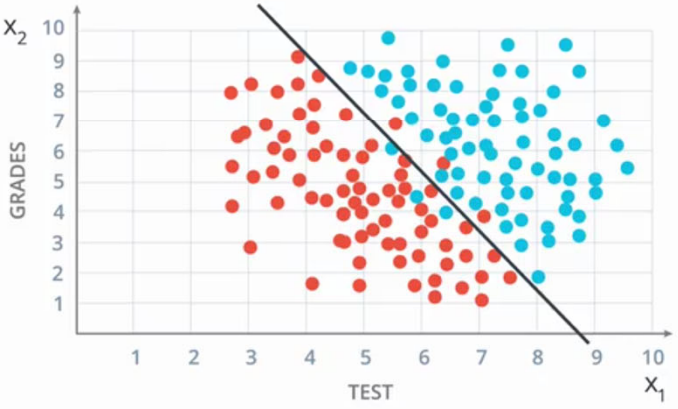


QUESTION

How do we find this line?

7

Acceptance at a University



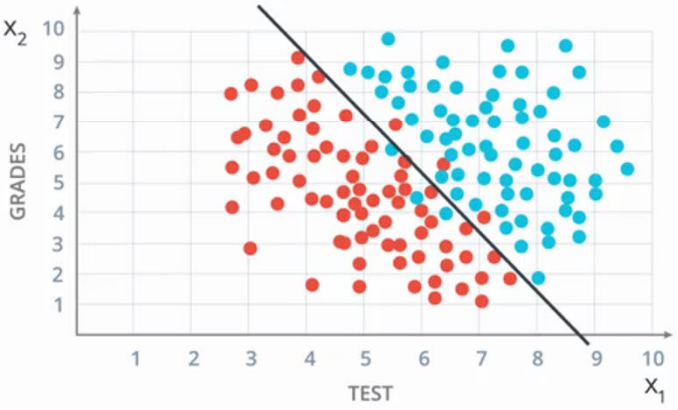
BOUNDARY:
A LINE
$2x_1 + x_2 - 18 = 0$

Score =
2*Test + Grades - 18

PREDICTION:
Score > 0: Accept
Score < 0: Reject

8

Acceptance at a University



BOUNDARY:
A LINE

$w_1x_1 + w_2x_2 + b = 0$
$Wx + b = 0$
$W = (w_1, w_2)$
$x = (x_1, x_2)$
y = label: 0 or 1

PREDICTION:

$$\hat{y} = \begin{cases} 1 \text{ if } Wx + b \geq 0 \\ 0 \text{ if } Wx + b < 0 \end{cases}$$

9

Acceptance at a University

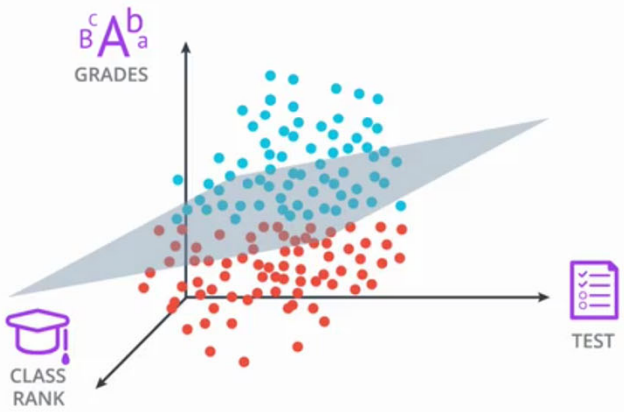
GRADES

TEST

CLASS RANK

10

Acceptance at a University



BOUNDARY:
A PLANE

$w_1x_1 + w_2x_2 + w_3x_3 + b = 0$

$Wx + b = 0$

PREDICTION:

$$\hat{y} = \begin{cases} 1 \text{ if } Wx + b \geq 0 \\ 0 \text{ if } Wx + b < 0 \end{cases}$$

11

Acceptance at a University

	x_1	x_2	x_3		x_n	y
	EXAM 1	EXAM 2	GRADES	...	ESSAY	PASS?
STUDENT 1	9	6	5	...	6	1(yes)
STUDENT 2	8	4	8	...	3	0(no)
...	...	...	...	...	...	
STUDENT n	6	7	2	...	8	1(yes)

← n columns →

n-dimensional space

$x_1, x_2, \ldots, x_n$

BOUNDARY:

n-1 dimensional hyperplane

$w_1x_1 + w_2x_2 + w_nx_n + b = 0$

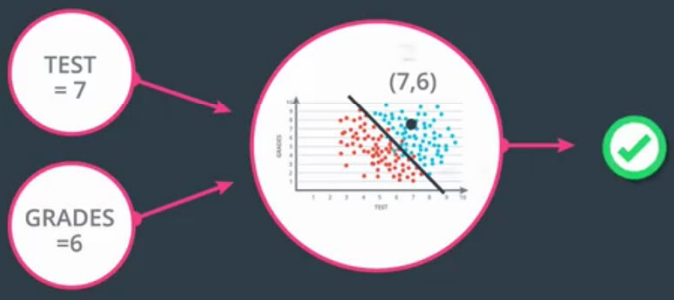
$Wx + b = 0$

PREDICTION:

$$\hat{y} = \begin{cases} 1 \text{ if } Wx + b \geq 0 \\ 0 \text{ if } Wx + b < 0 \end{cases}$$

12

Perceptron

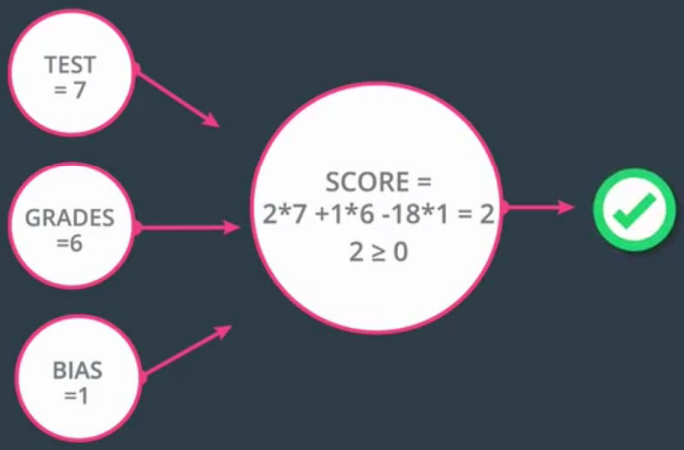


Score=
2*Test + 1*Grades -18

PREDICTION:
Score ≥ 0 Accept
Score < 0 Reject

13

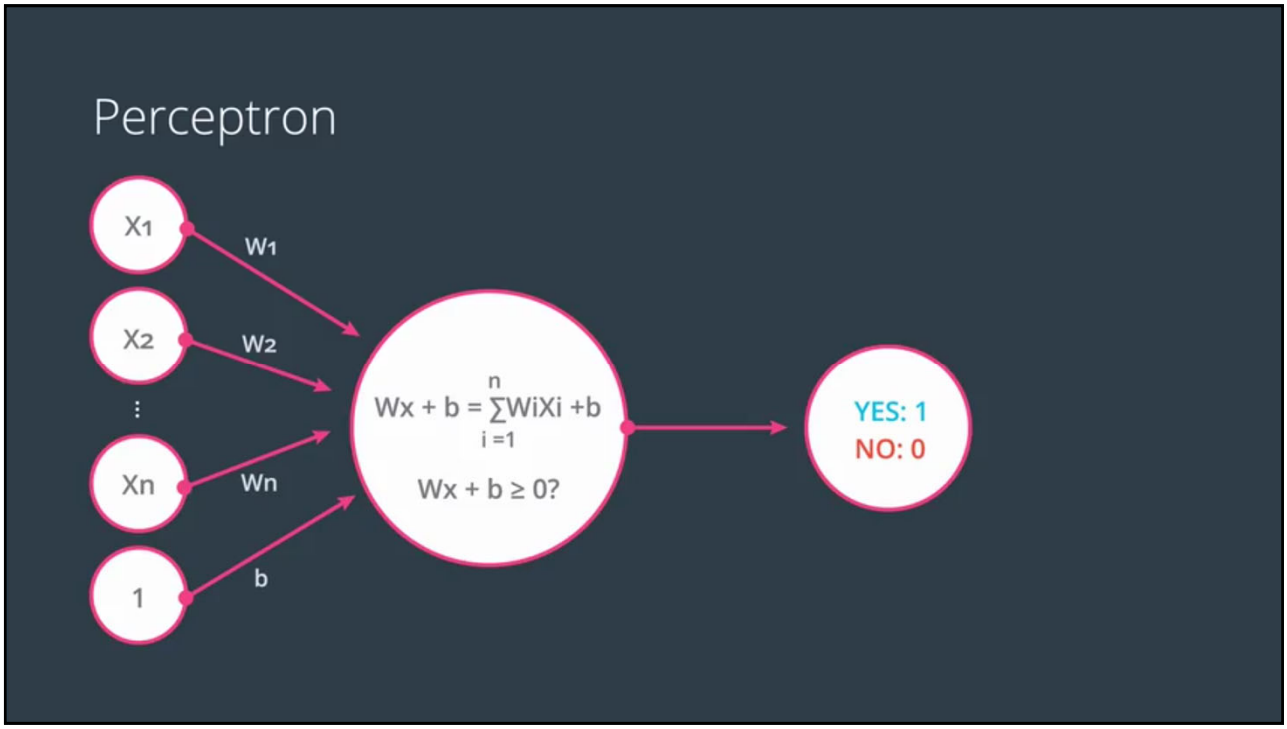
Perceptron



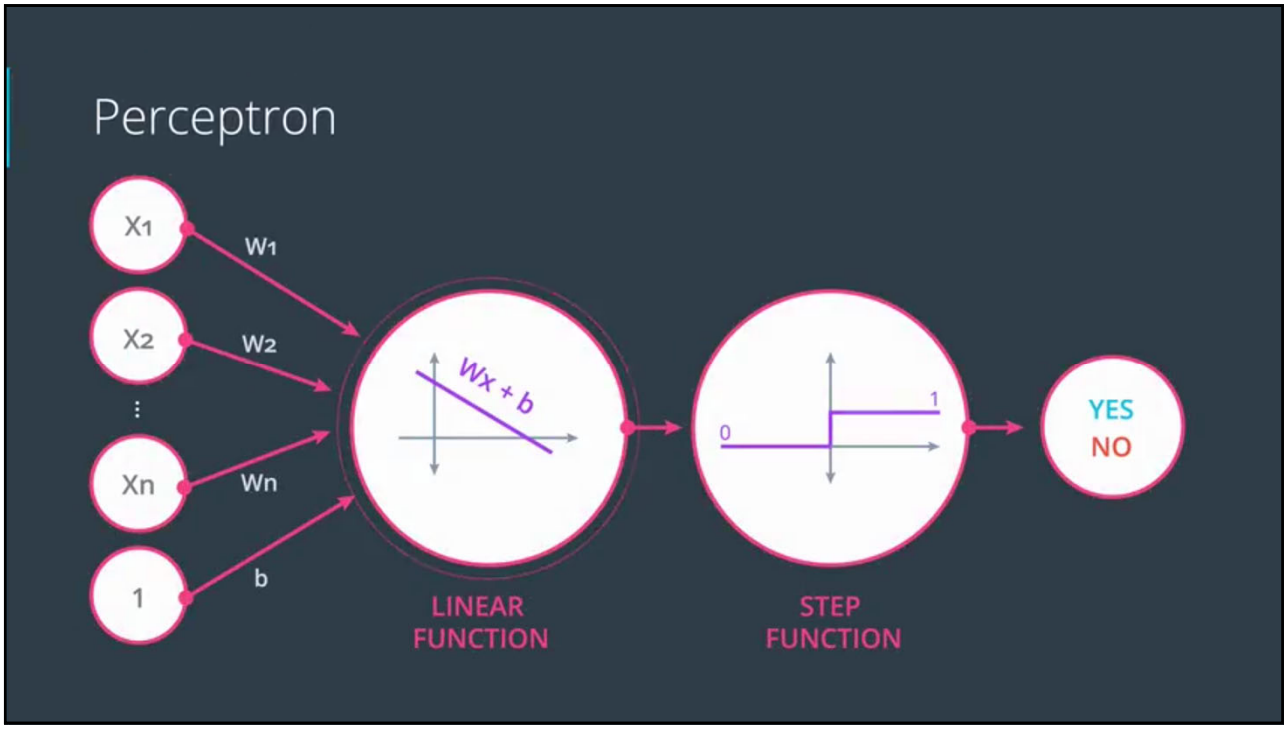
Score=
2*Test + 1*Grades -18

PREDICTION:
Score ≥ 0 Accept
Score < 0 Reject

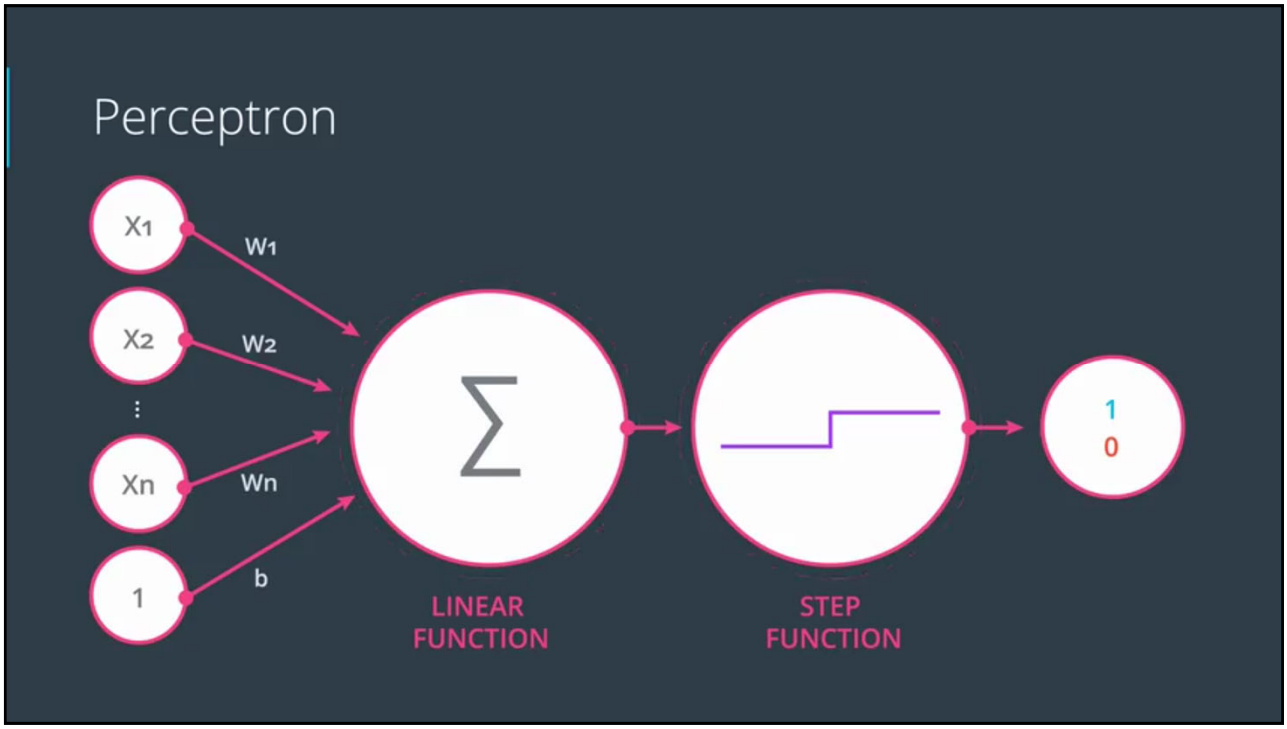
14


Perceptron
X1
X2
Xn
1
W1
W2
Wn
b
Wx + b = ∑WiXi +b
n
i =1
Wx + b ≥ 0?
YES: 1
NO: 0

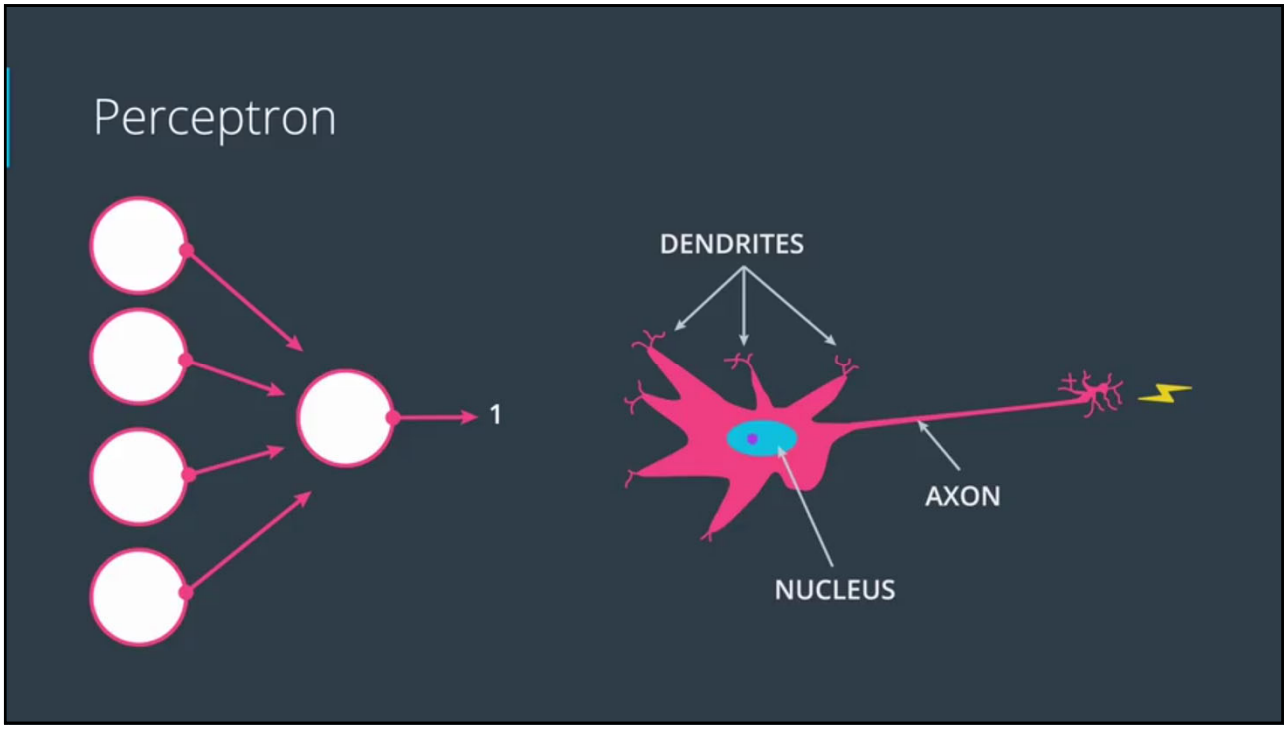
15


Perceptron
X1
X2
Xn
1
W1
W2
Wn
b
Wx + b
0
1
YES
NO
LINEAR FUNCTION
STEP FUNCTION

16

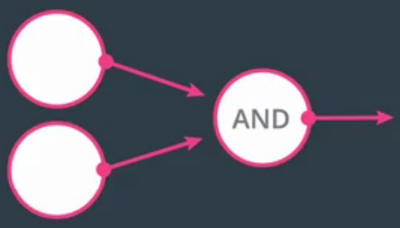

Perceptron
X1
W1
X2
W2
Xn
Wn
1
b
LINEAR FUNCTION
STEP FUNCTION
1
0

17

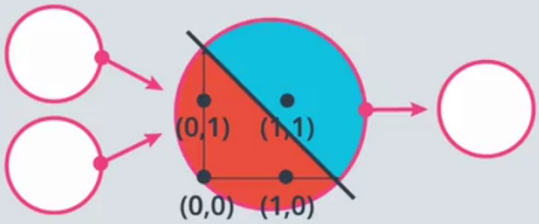

Perceptron
1
DENDRITES
AXON
NUCLEUS

18

AND Perceptron



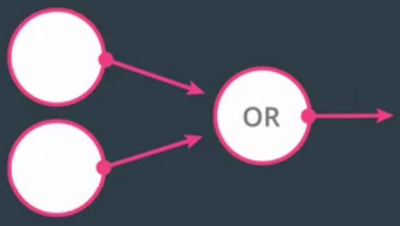
IN	IN	OUT
✓	✓	✓
✓	✗	✗
✗	✓	✗
✗	✗	✗



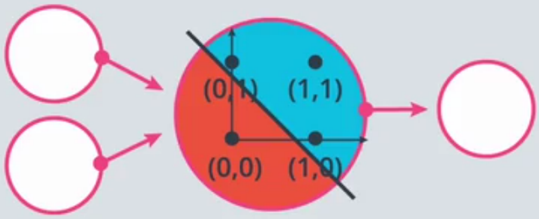
IN	IN	OUT
1	1	1
1	0	0
0	1	0
0	0	0

19

OR Perceptron



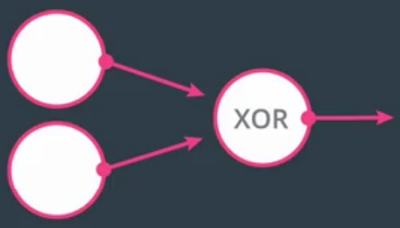
IN	IN	OUT
✓	✓	✓
✓	✗	✓
✗	✓	✓
✗	✗	✗



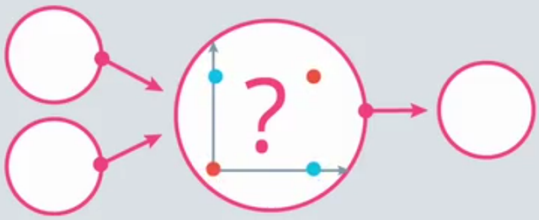
IN	IN	OUT
1	1	1
1	0	1
0	1	1
0	0	0

20

XOR Perceptron



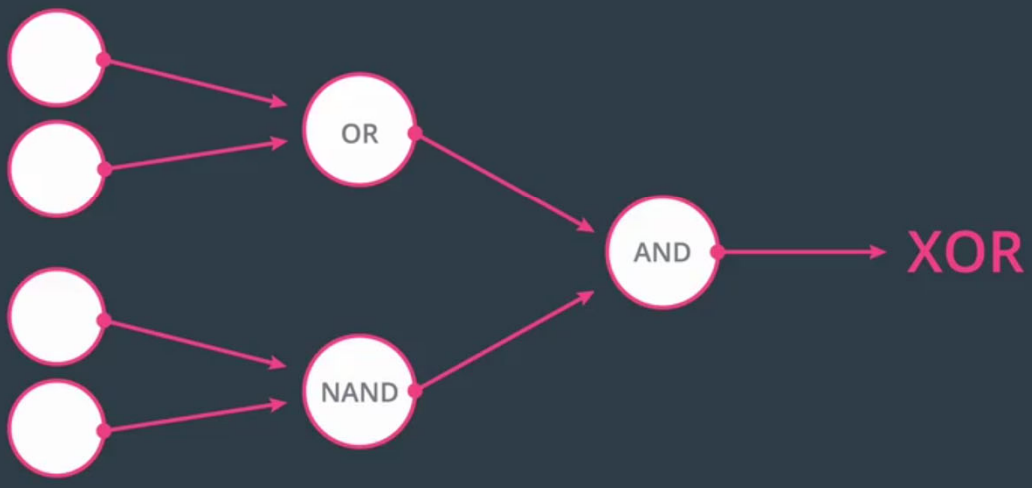
IN	IN	OUT
✓	✓	✗
✓	✗	✓
✗	✓	✓
✗	✗	✗



IN	IN	OUT
1	1	0
1	0	1
0	1	1
0	0	0

21

XOR Neural Network



22