PENGANTAR ARTIFICIAL NEURAL NETWORK

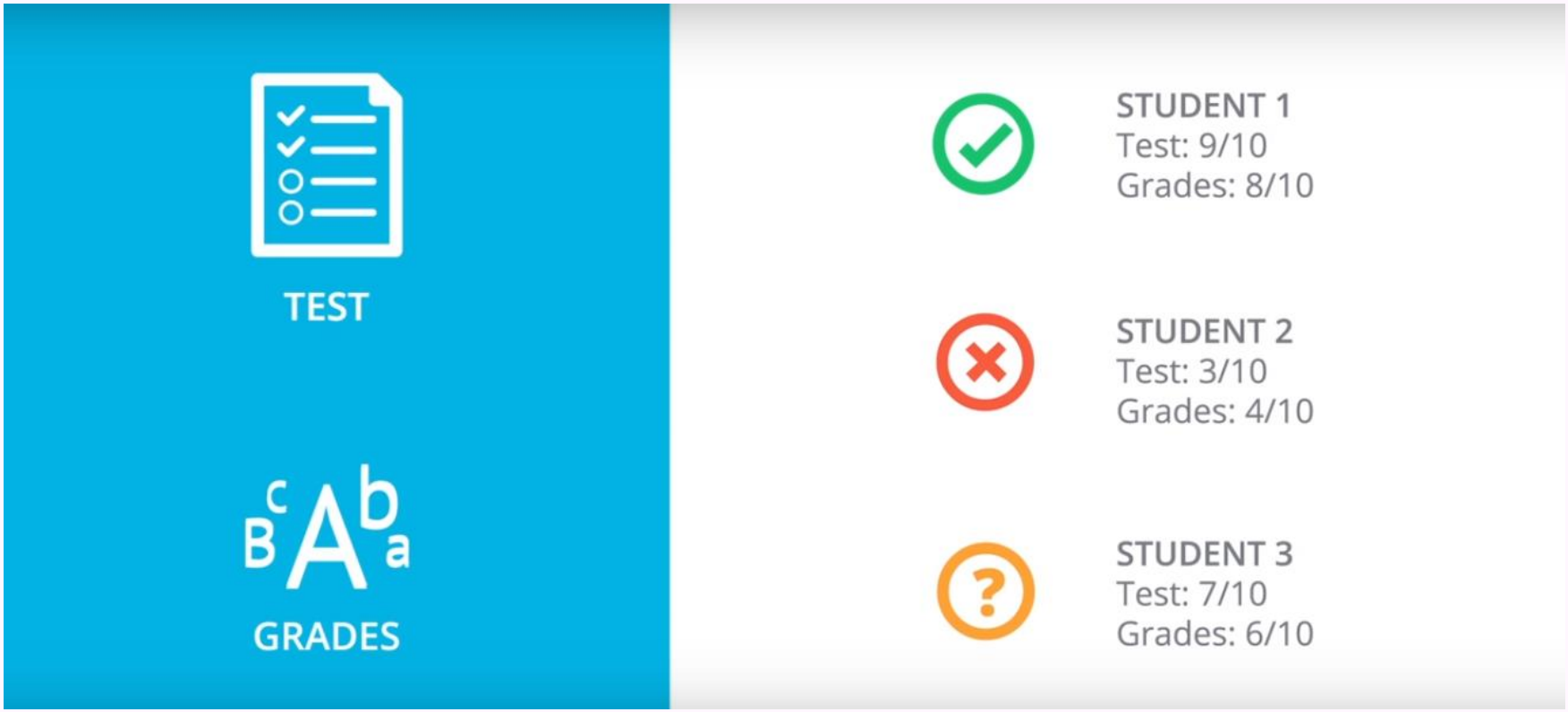
Isram Rasal, S.T., MMSI., M.Sc

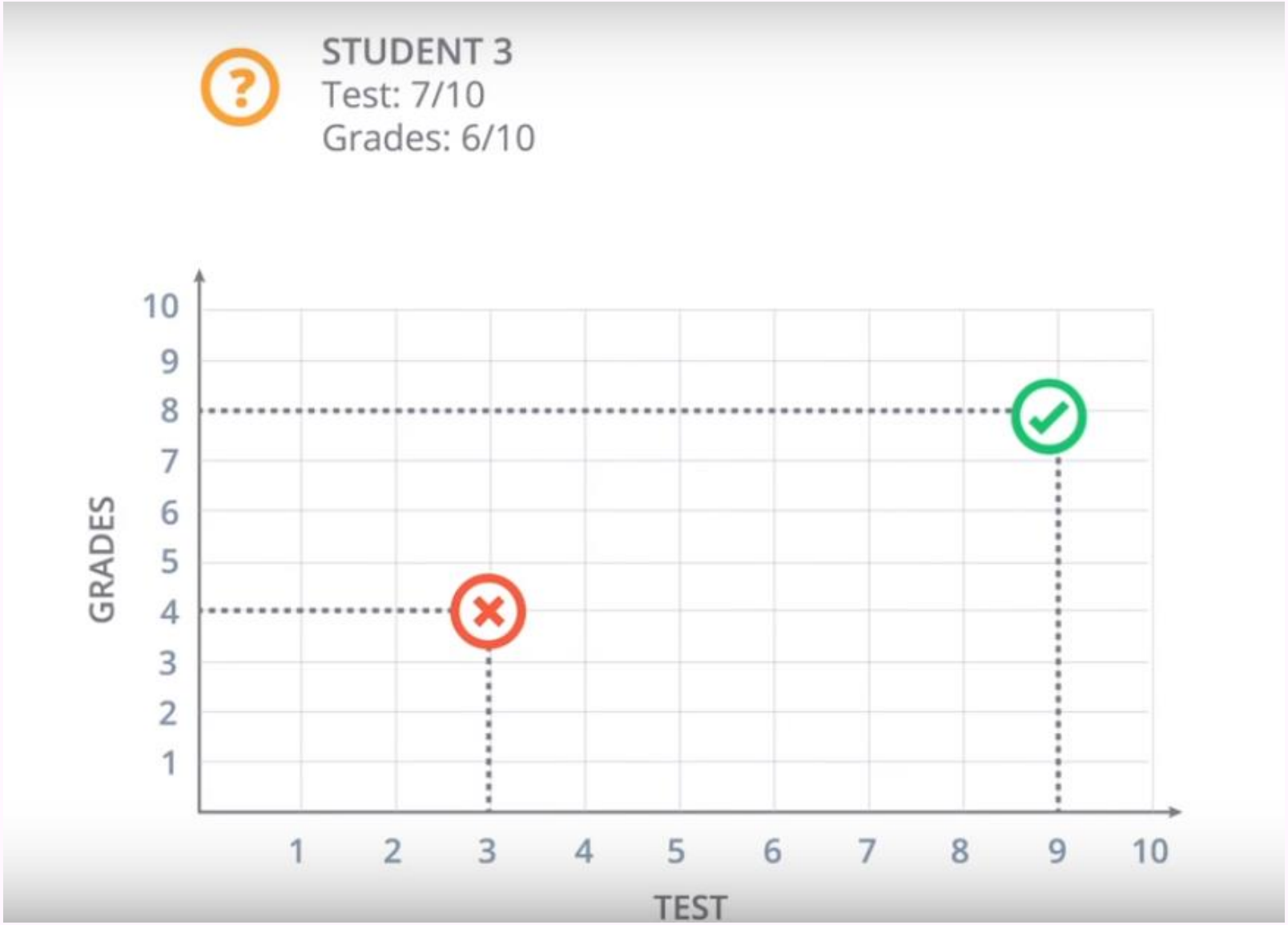
Machine Learning Course

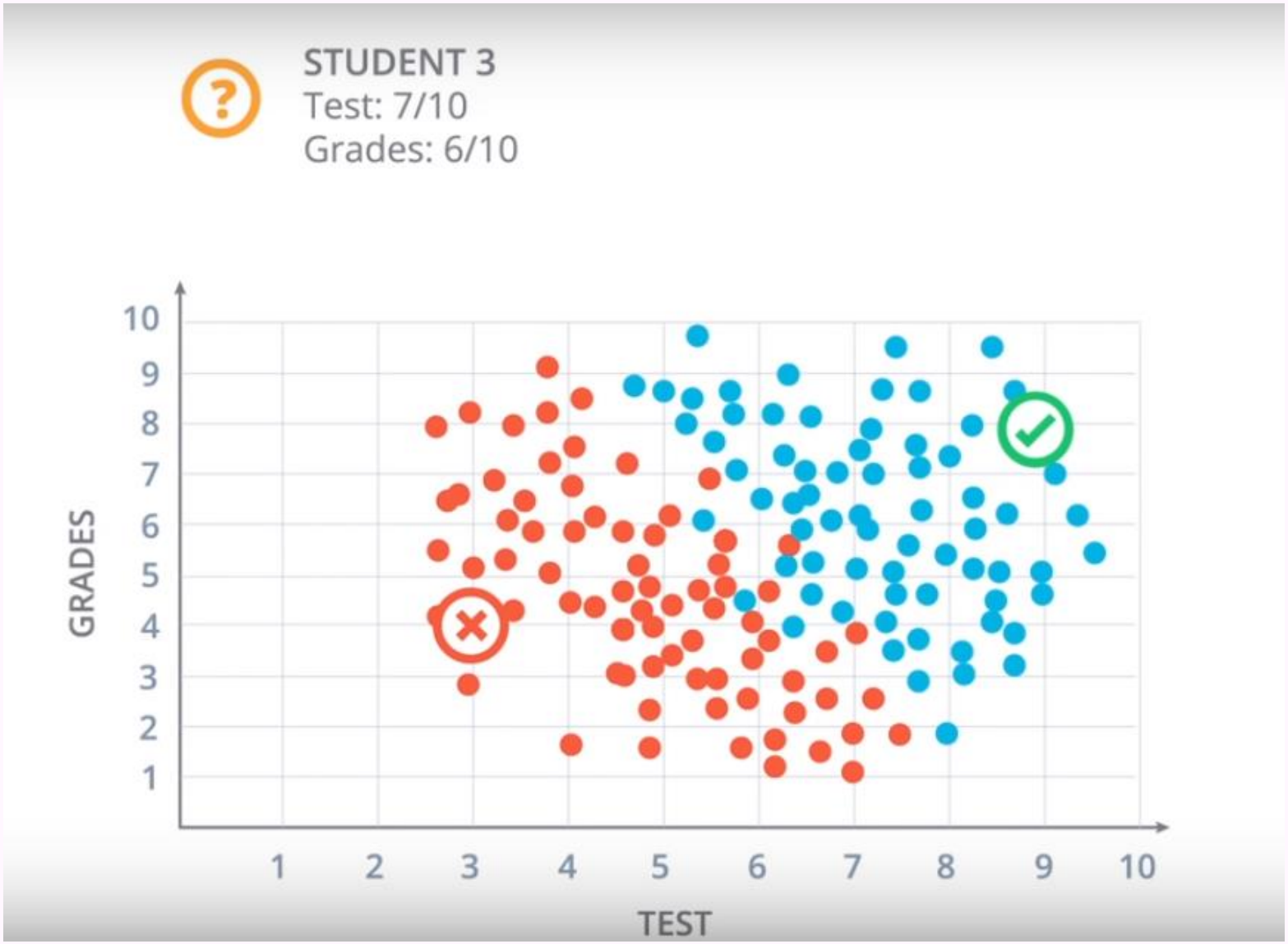
17/02/2019

Masalah pada Klasifikasi

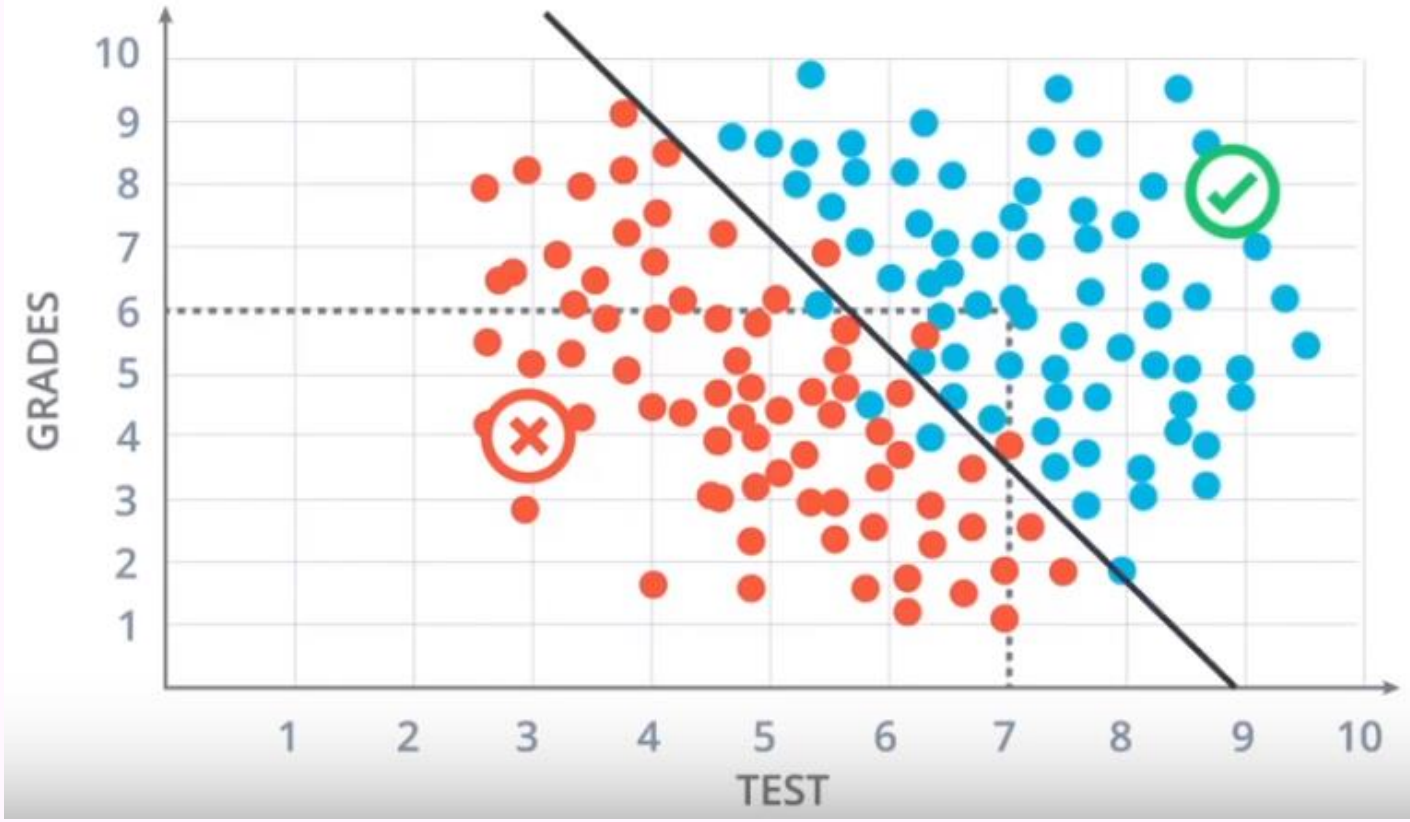

Acceptance at
a University
TEST
GRADES


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


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

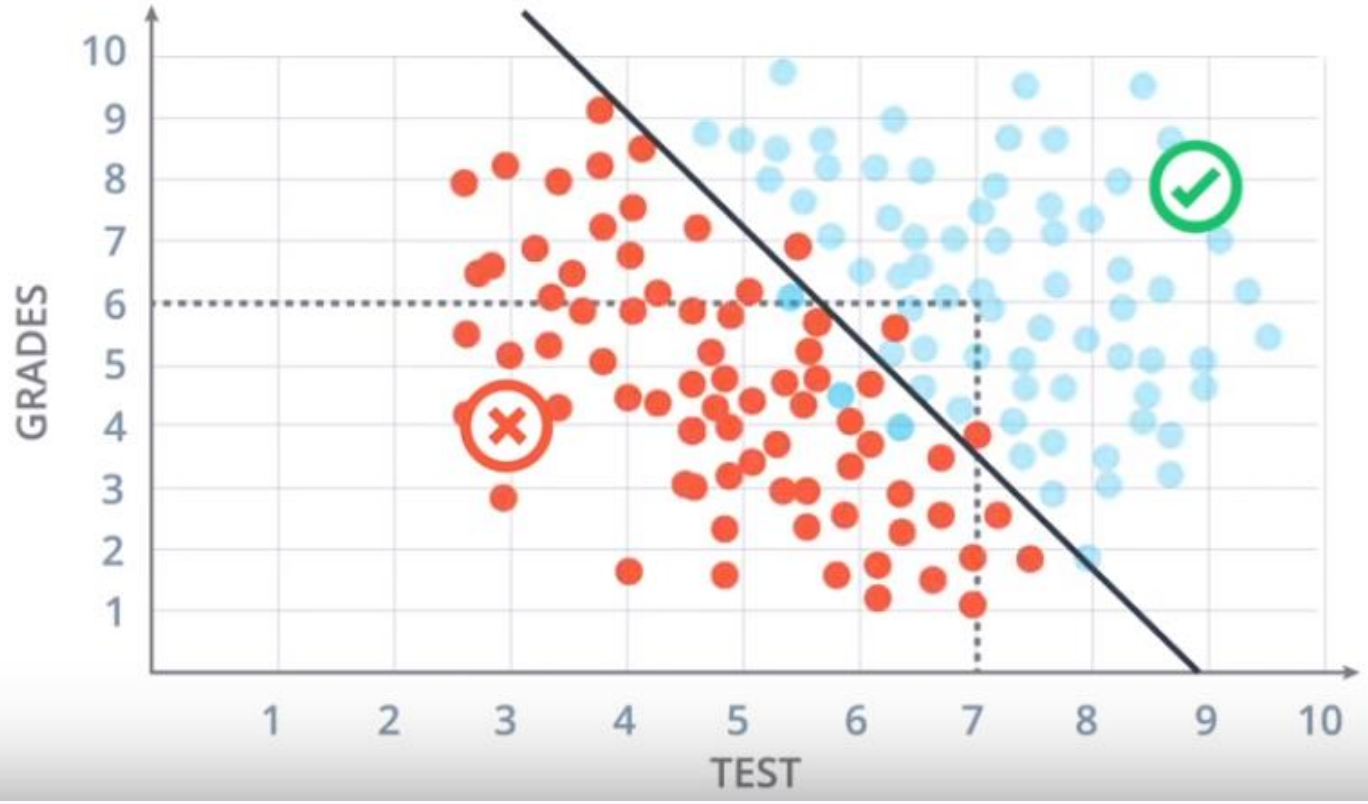

STUDENT 3
Test: 7/10
Grades: 6/10
GRADES
10
9
8
7
6
5
4
3
2
1
1
2
3
4
5
6
7
8
9
10
TEST

Acceptance at a University

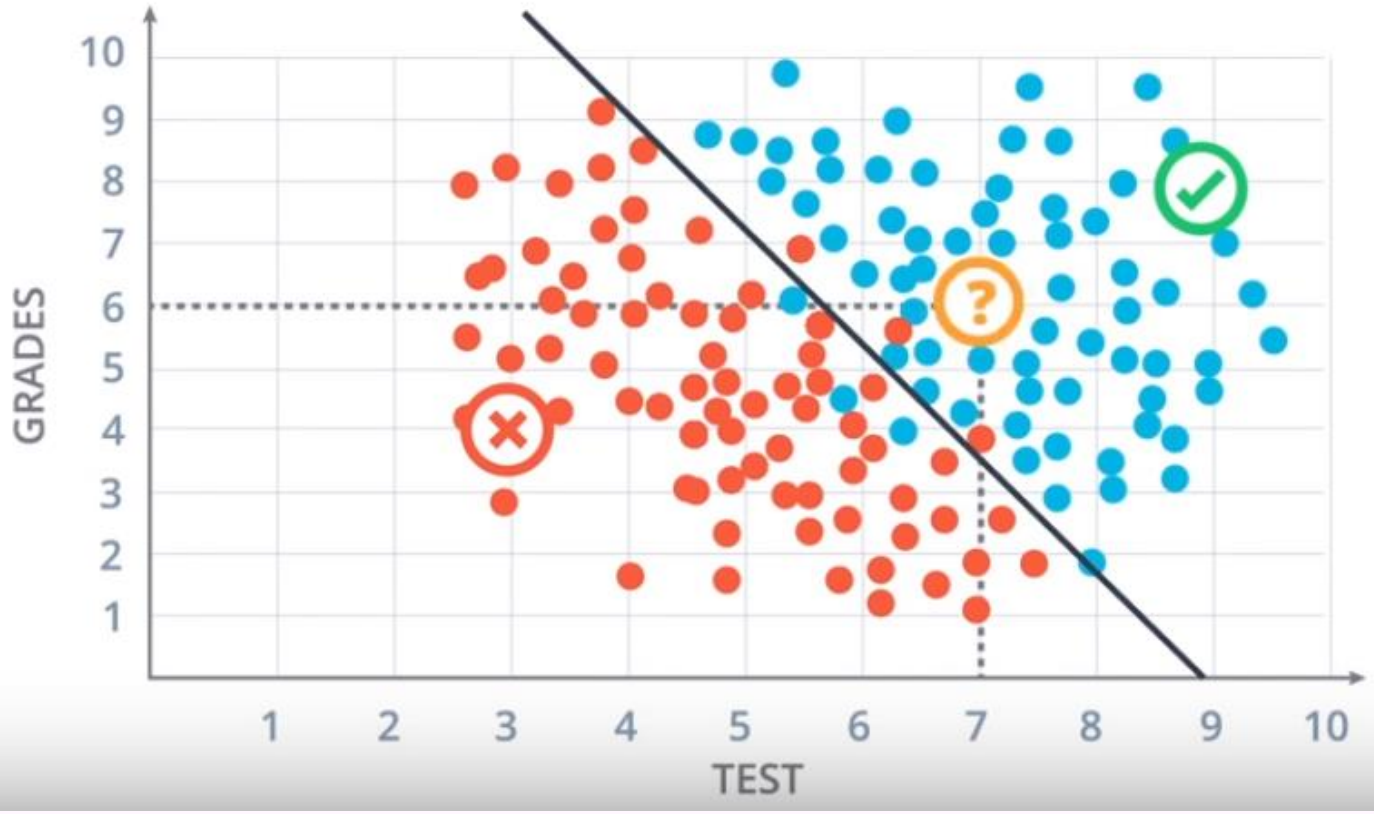


Acceptance at a University

Acceptance at a University



Acceptance at a University



Acceptance at a University

BOUNDARY:
A LINE

$2x_1 + x_2 - 18 = 0$

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

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:

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

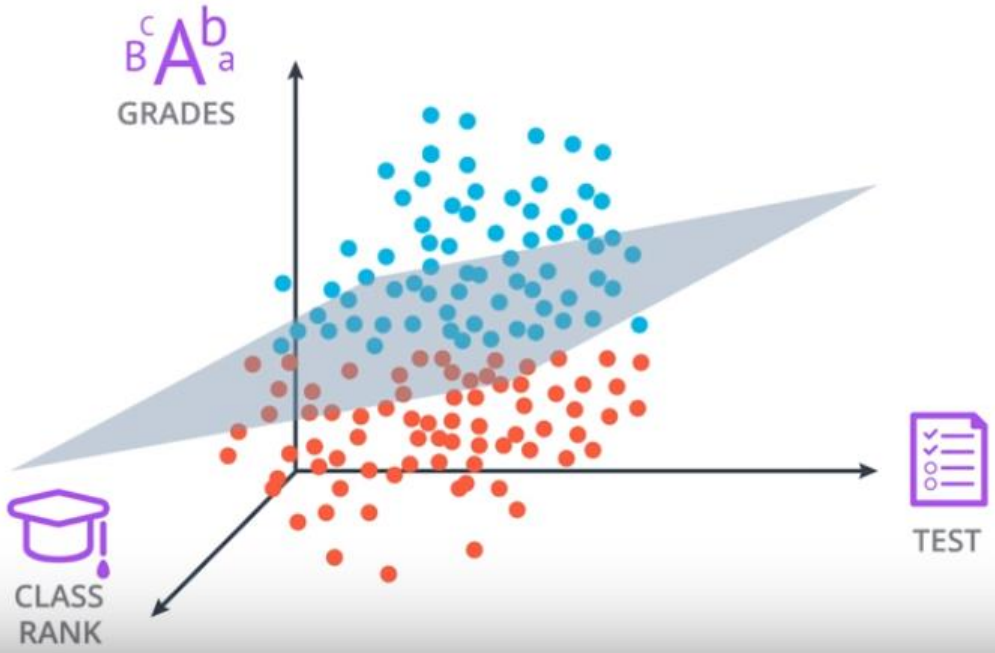
Acceptance at a University

GRADES

TEST

CLASS RANK

Acceptance at a University



BOUNDARY:

A PLANE

$w_1x_1 + w_2x_2 + w_3x_3 + b = 0$

$Wx + b = 0$

PREDICTION:

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

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:

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

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

$w_1x_1 + w_2x_2 + w_nx_n + b = 0$

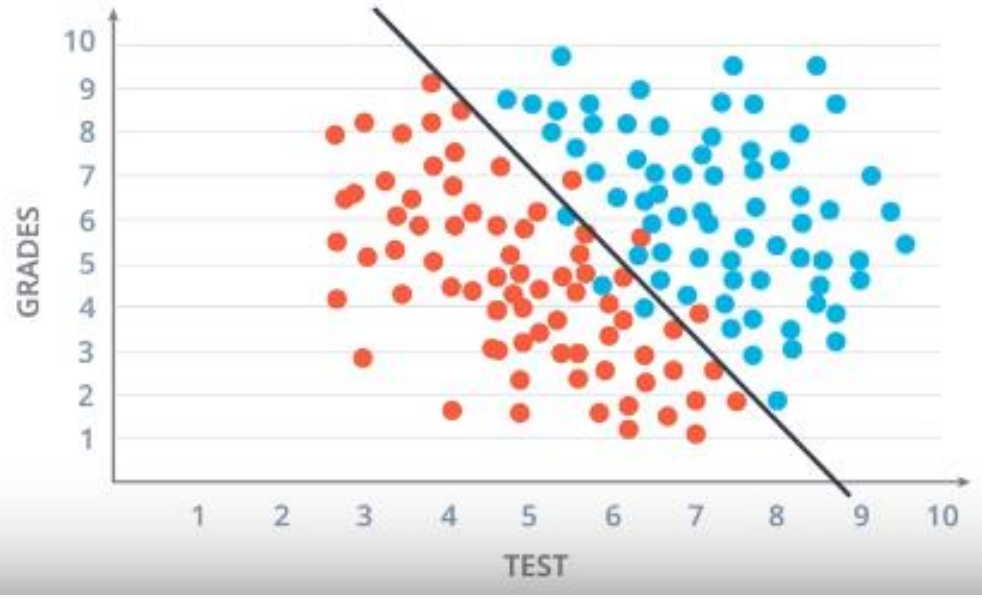
$Wx + b = 0$

PREDICTION:

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

Perceptron

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

Perceptron

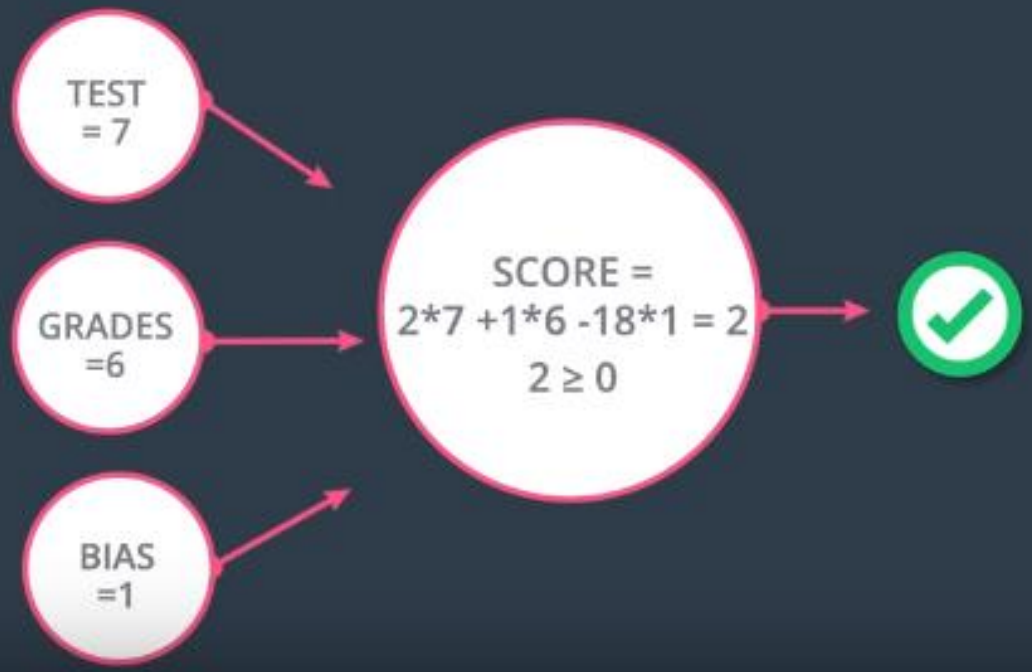
Score=
2*Test + 1*Grades -18

Perceptron

Score=
2*Test + 1*Grades -18

PREDICTION:
Score ≥ 0 Accept
Score < 0 Reject

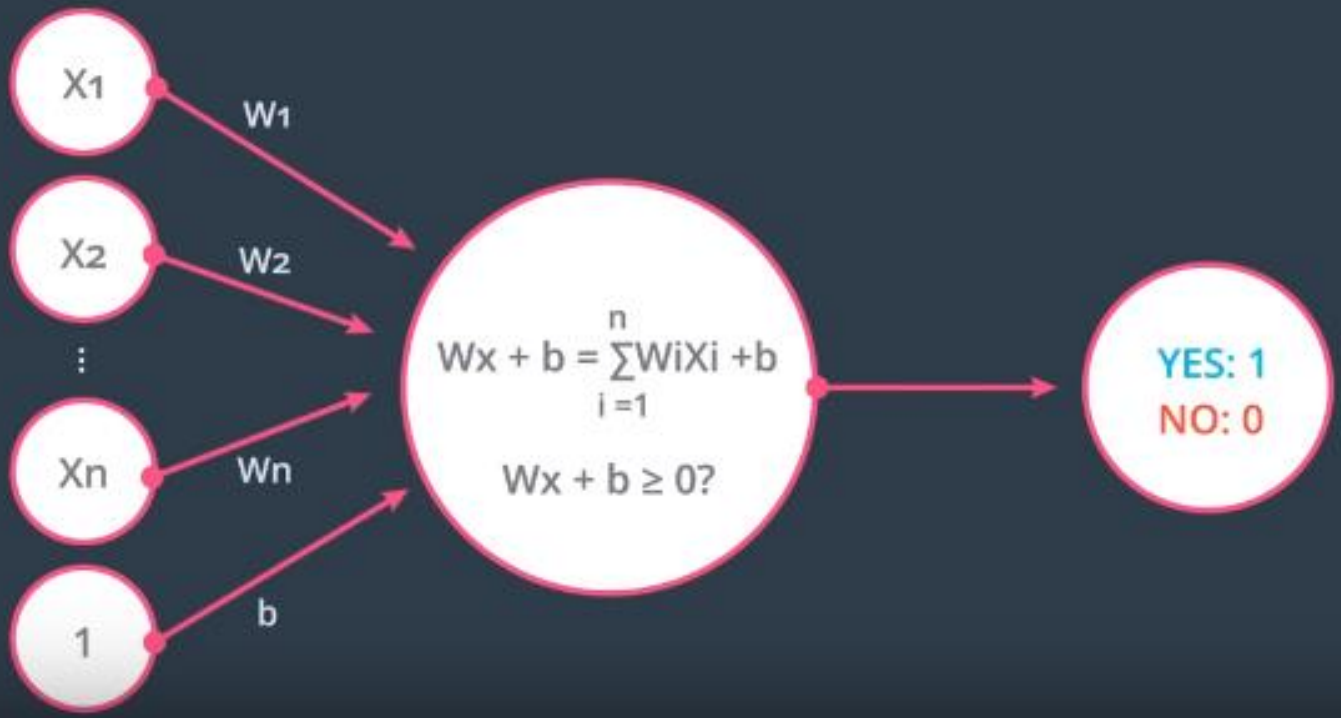
Perceptron



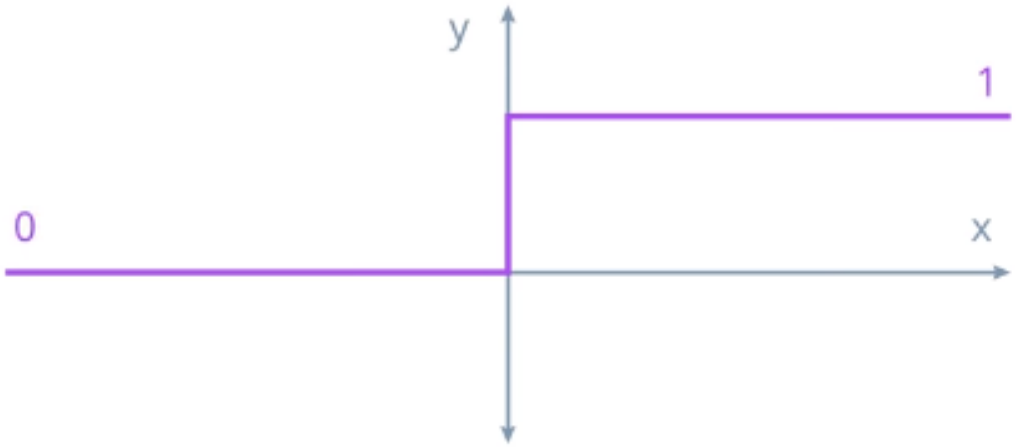
Score=
2*Test + 1*Grades -18

PREDICTION:
Score ≥ 0 Accept
Score < 0 Reject

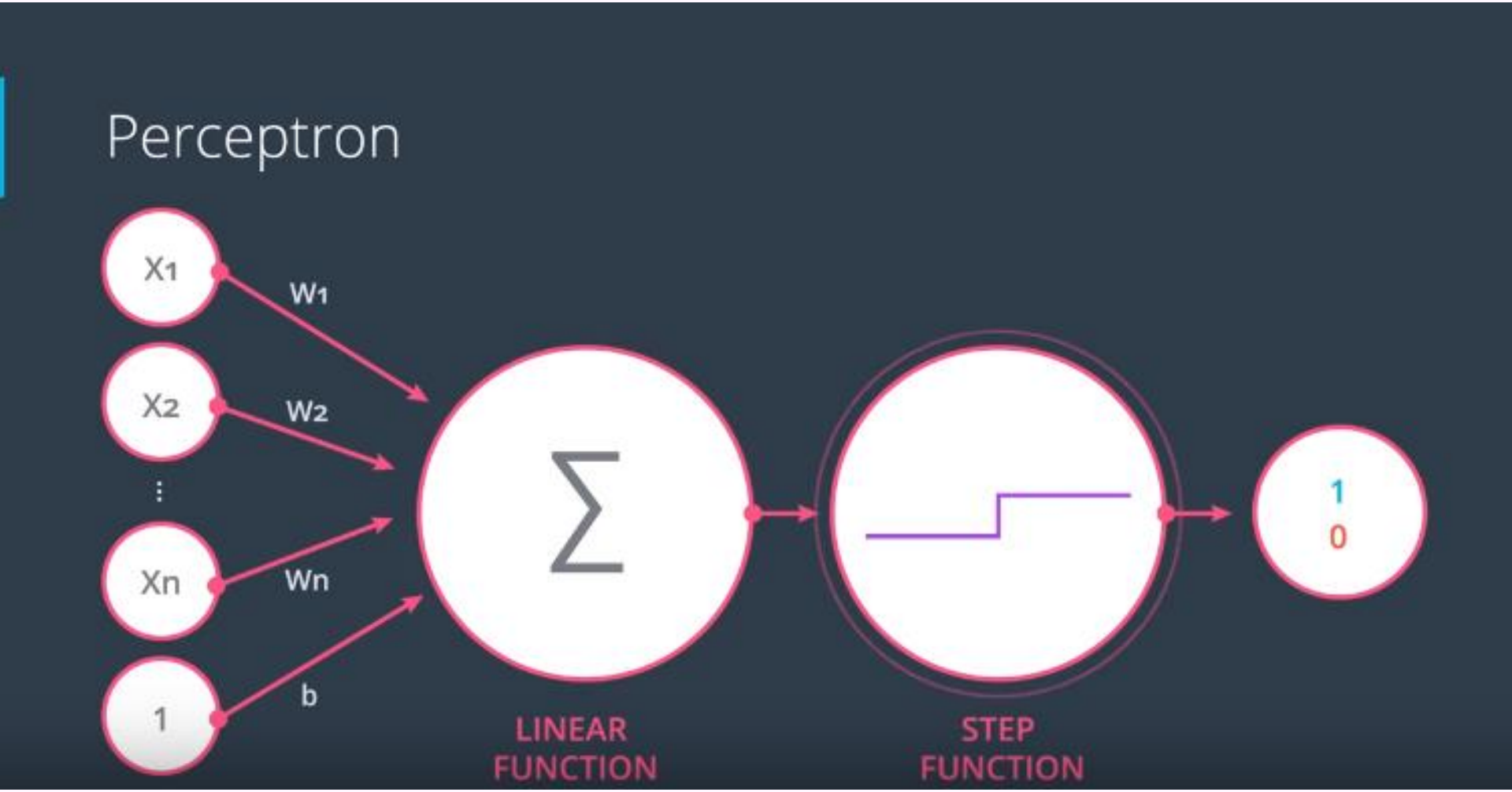
Perceptron



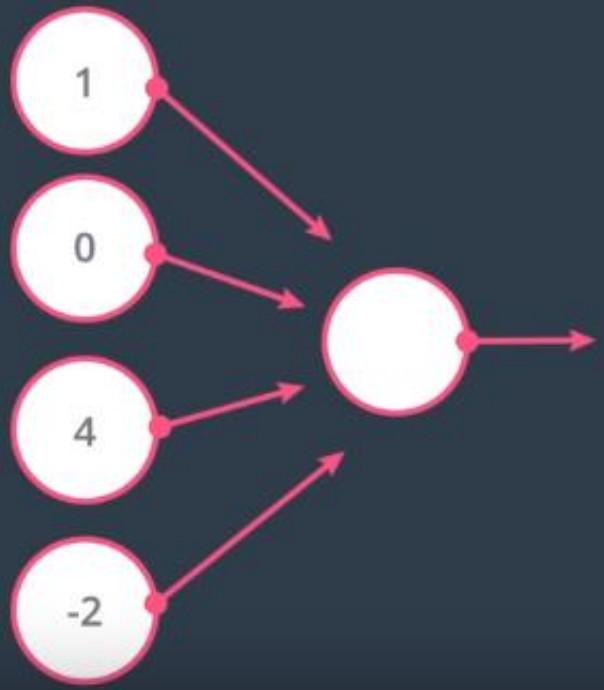
Set Function

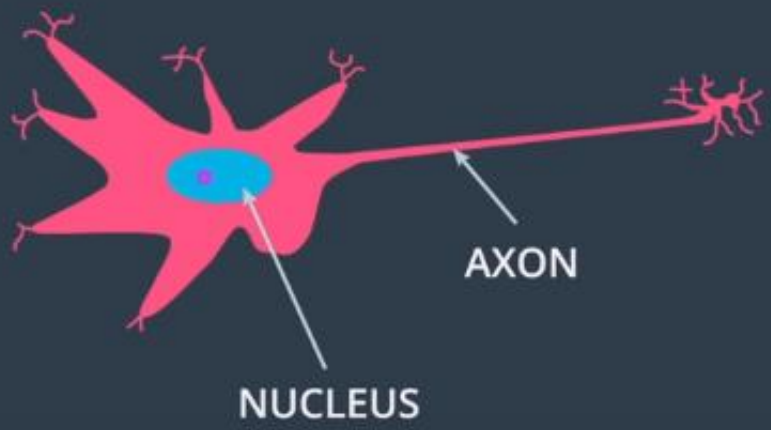


$$y = \begin{cases} 1 \text{ if } x \geq 0 \\ 1 \text{ if } x < 0 \end{cases}$$


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

Perceptron





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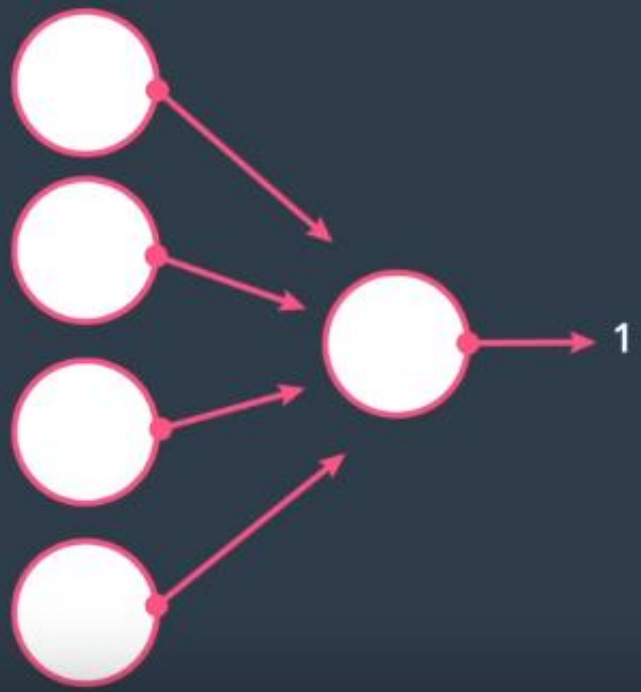
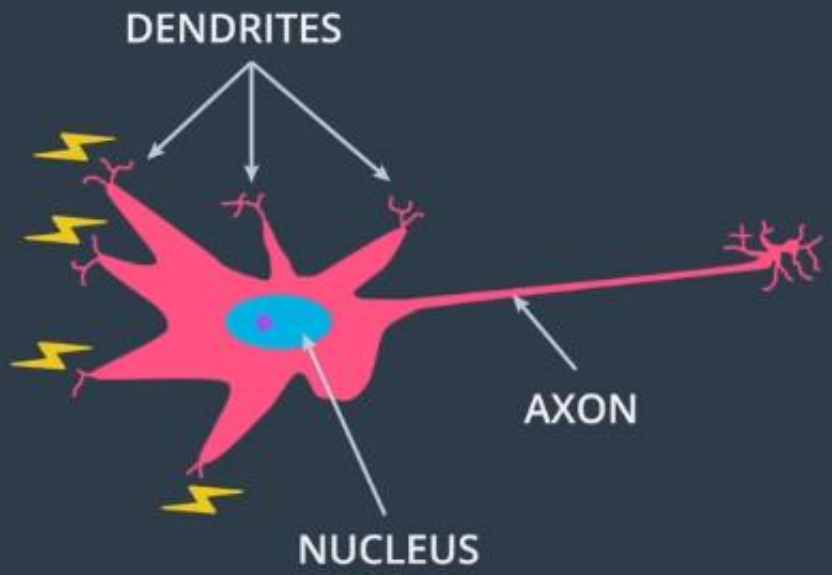
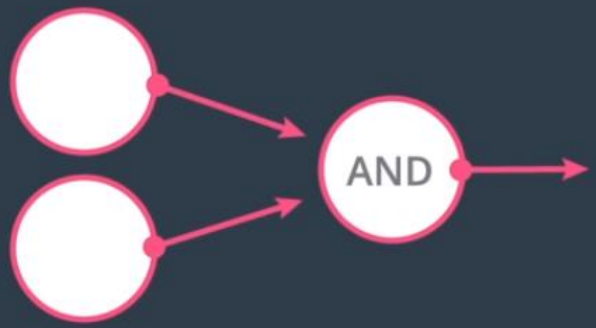
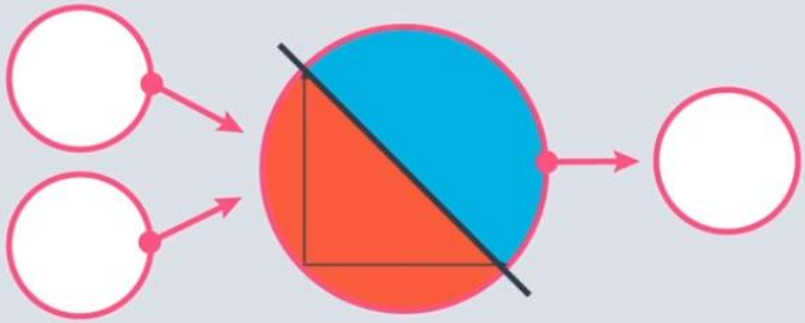




AND Perceptron

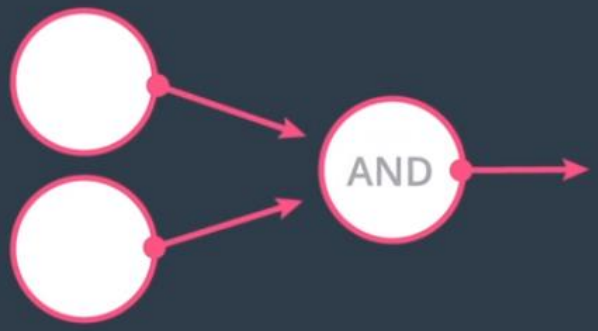


IN	OUT	IN
✓	✓	✓
✓	✗	✗
✗	✓	✗
✗	✗	✗

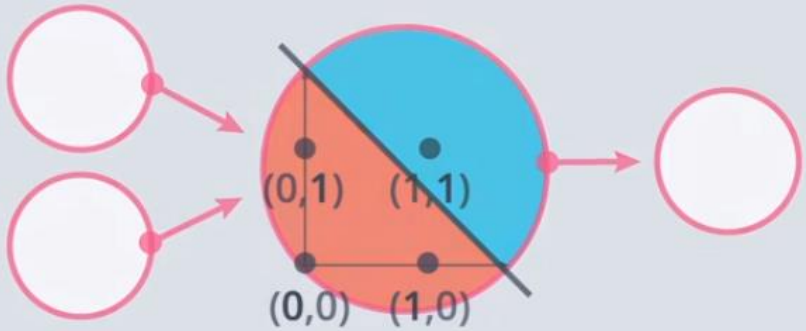


IN	IN	OUT
1	1	1
1	0	0
0	1	0
0	0	0

AND Perceptron

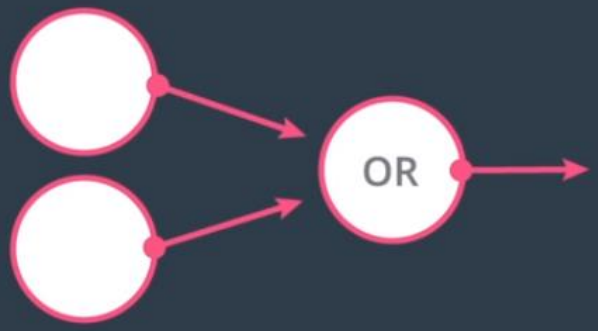


IN	OUT	IN
✓	✓	✓
✓	✗	✗
✗	✓	✗
✗	✗	✗

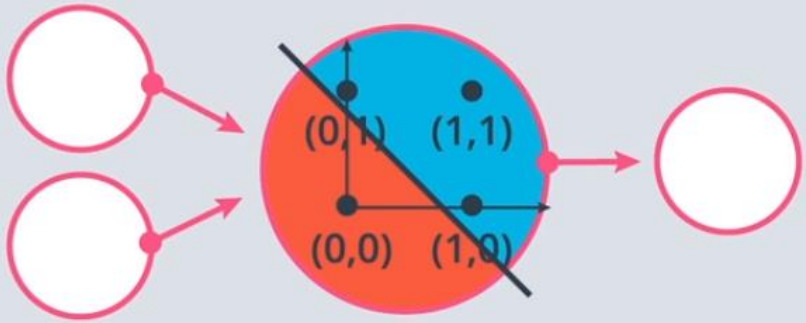


IN	IN	OUT
1	1	1
1	0	0
0	1	0
		0

OR Perceptron



IN	OUT	IN
✓	✓	✓
✓	✗	✓
✗	✓	✓
✗	✗	✗



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