Introduction to Robotics

CSE 461

Lecture 12: Introduction to Machine Learning and Neural Networks

Niloy Irtisam
Lecturer, Dept. of Computer Science and Engineering
Brac University

Tumor Size	Condition
10	malignant
2	benign
1	benign
5	malignant

Tumor Size	Condition
10	malignant
2	benign
1	benign
5	malignant

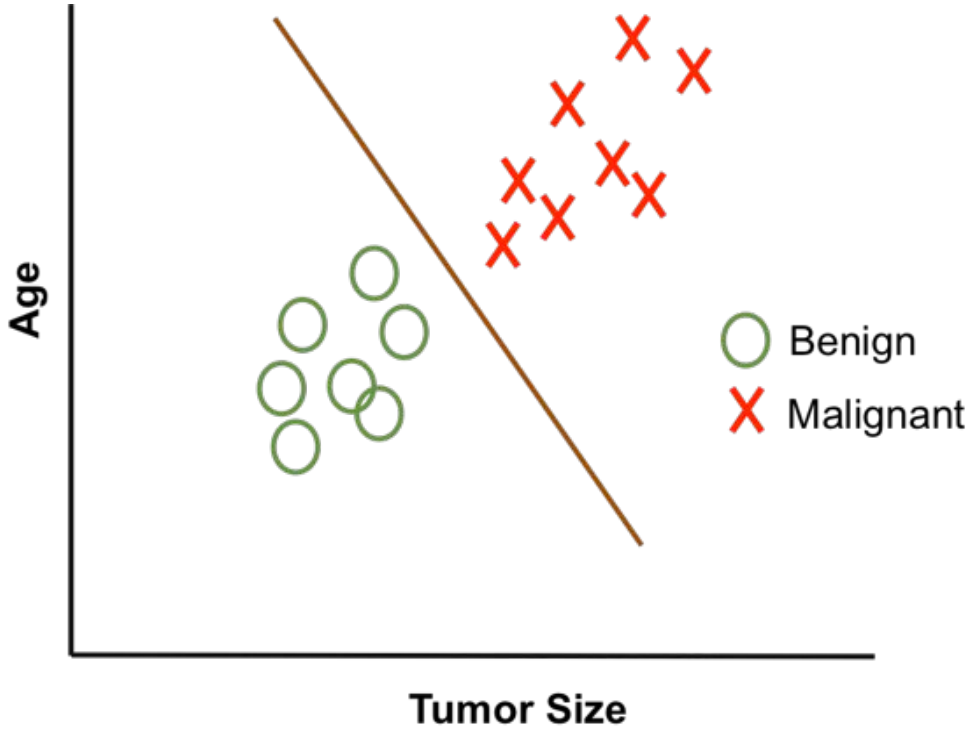
Tumor Size	Condition
10	malignant
2	benign
1	benign
5	malignant

Tumor Size	Condition
10	malignant
2	benign
1	benign
5	malignant

4

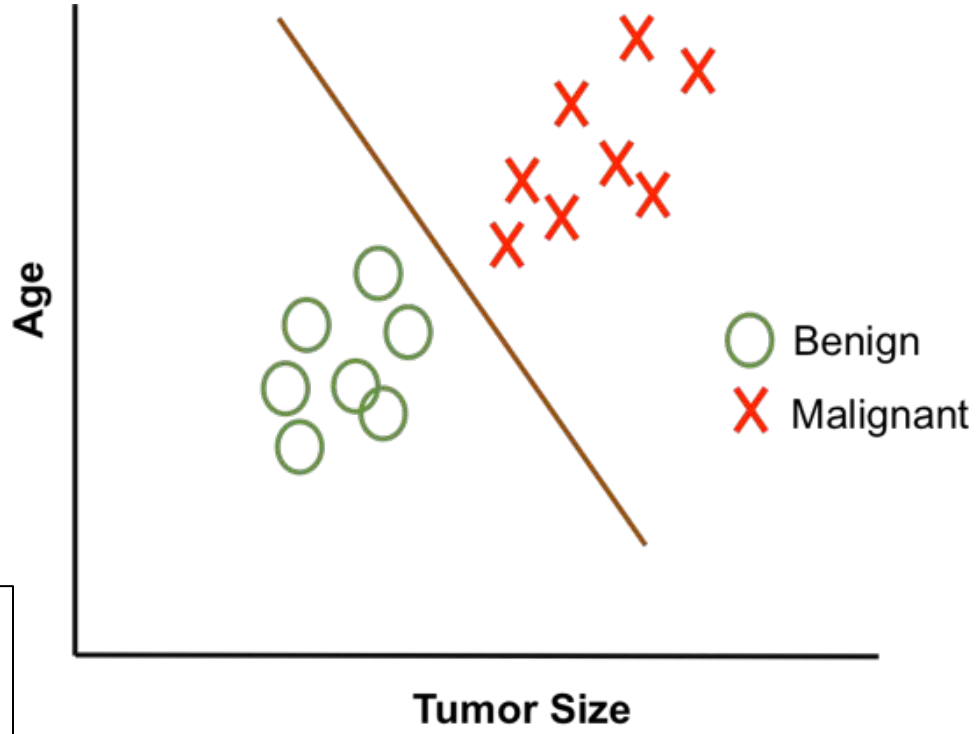
Tumor Size	Age	Condition
10	50	malignant
2	30	benign
1	45	benign
5	40	malignant

Tumor Size	Age	Condition
10	50	malignant
2	30	benign
1	45	benign
5	40	malignant



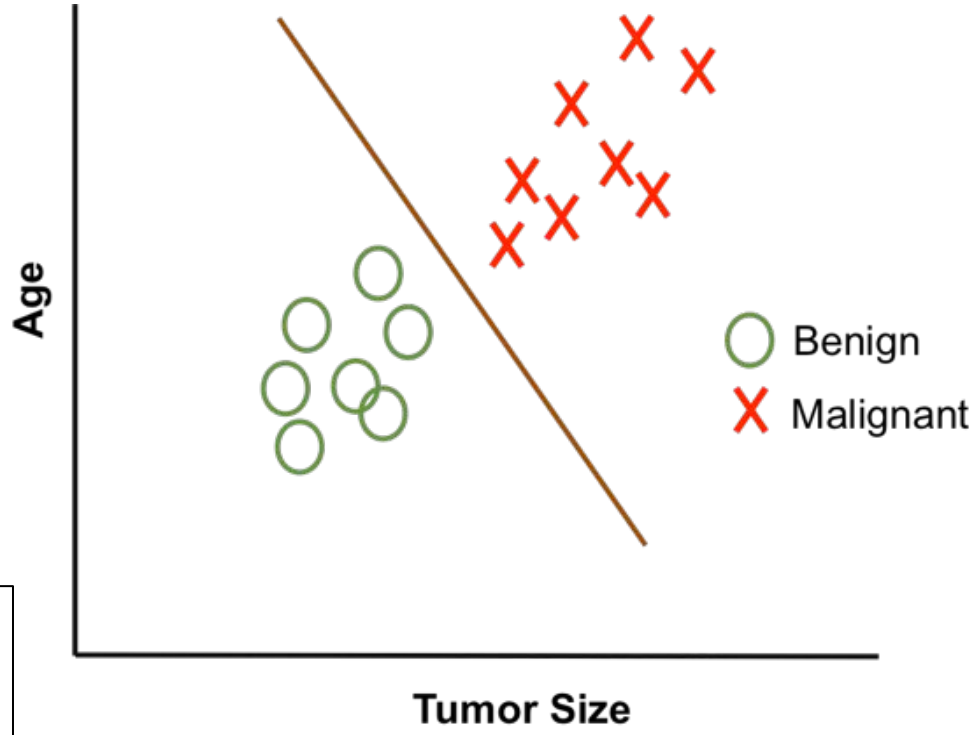
Tumor Size	Age	Condition
10	50	malignant
2	30	benign
1	45	benign
5	40	malignant

$$0.9*10 + 0.1*50 = 9 + 5 = 14$$



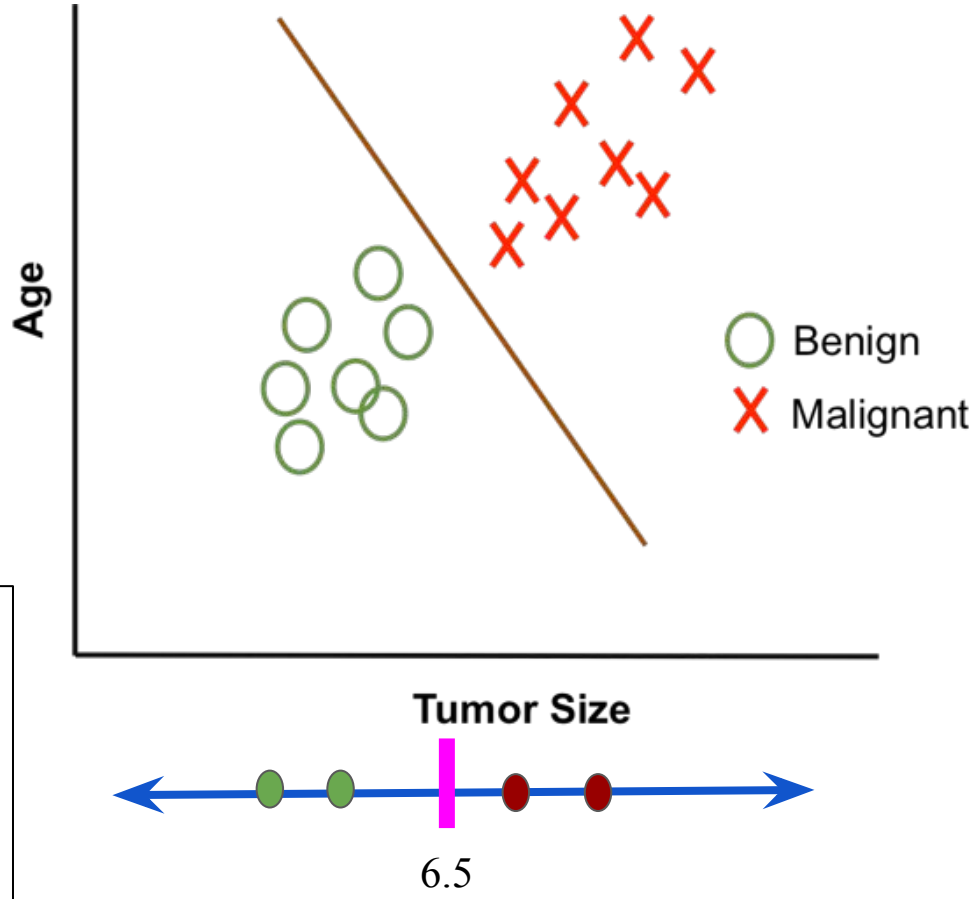
Tumor Size	Age	Condition
10	50	malignant
2	30	benign
1	45	benign
5	40	malignant

$$0.9*10 + 0.1*50 = 9 + 5 = 14$$
$$0.9*2 + 0.1*30 = 1.8 + 3 = 4.8$$
$$0.9*1 + 0.1*45 = 0.9 + 4.5 = 5.4$$
$$0.9*5 + 0.1*40 = 4.5 + 4 = 8.5$$



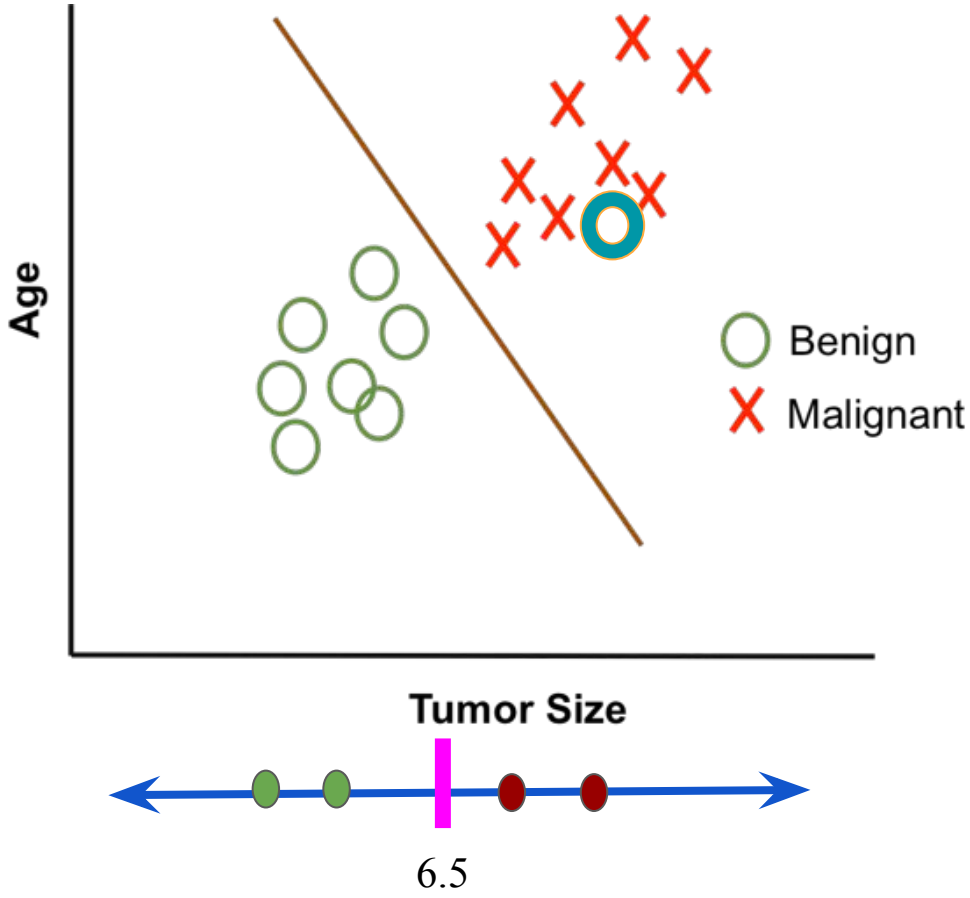
Tumor Size	Age	Condition
10	50	malignant
2	30	benign
1	45	benign
5	40	malignant

$$0.9*10 + 0.1*50 = 9 + 5 = 14$$
$$0.9*2 + 0.1*30 = 1.8 + 3 = 4.8$$
$$0.9*1 + 0.1*45 = 0.9 + 4.5 = 5.4$$
$$0.9*5 + 0.1*40 = 4.5 + 4 = 8.5$$



Tumor Size	Age	Condition
10	50	malignant
2	30	benign
1	45	benign
5	40	malignant

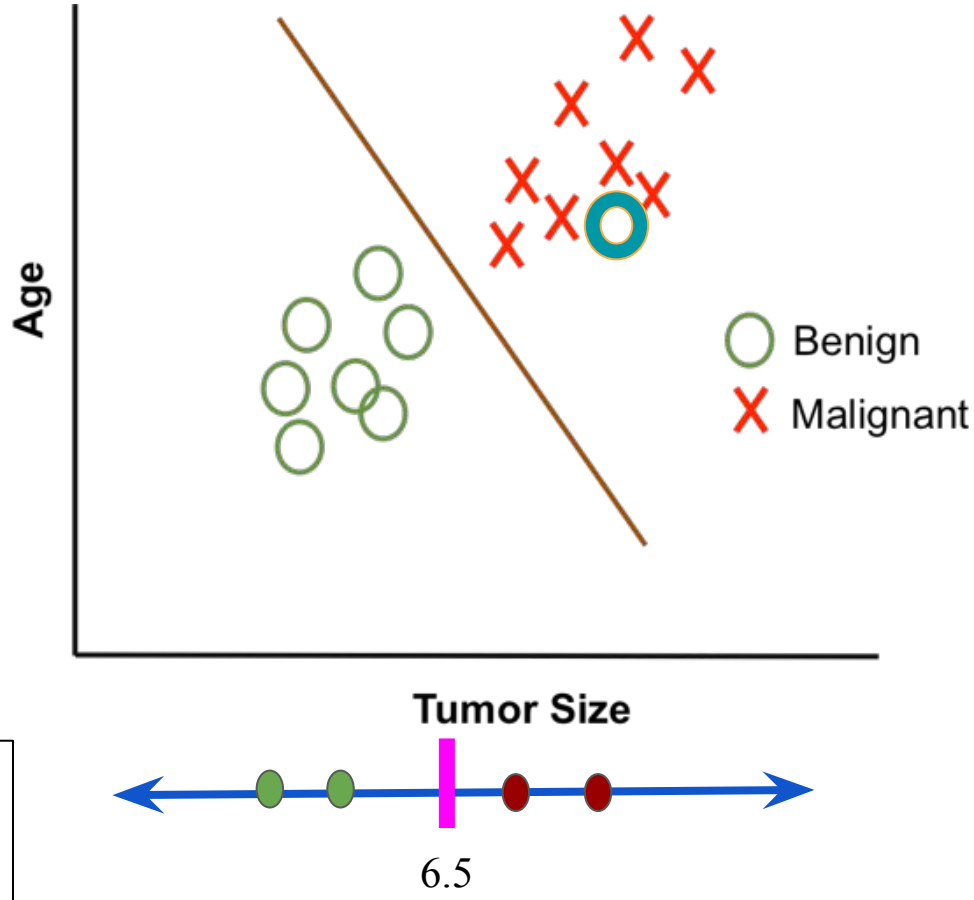
Tumor Size = 9
Age = 42



Tumor Size	Age	Condition
10	50	malignant
2	30	benign
1	45	benign
5	40	malignant

Tumor Size = 9
Age = 42

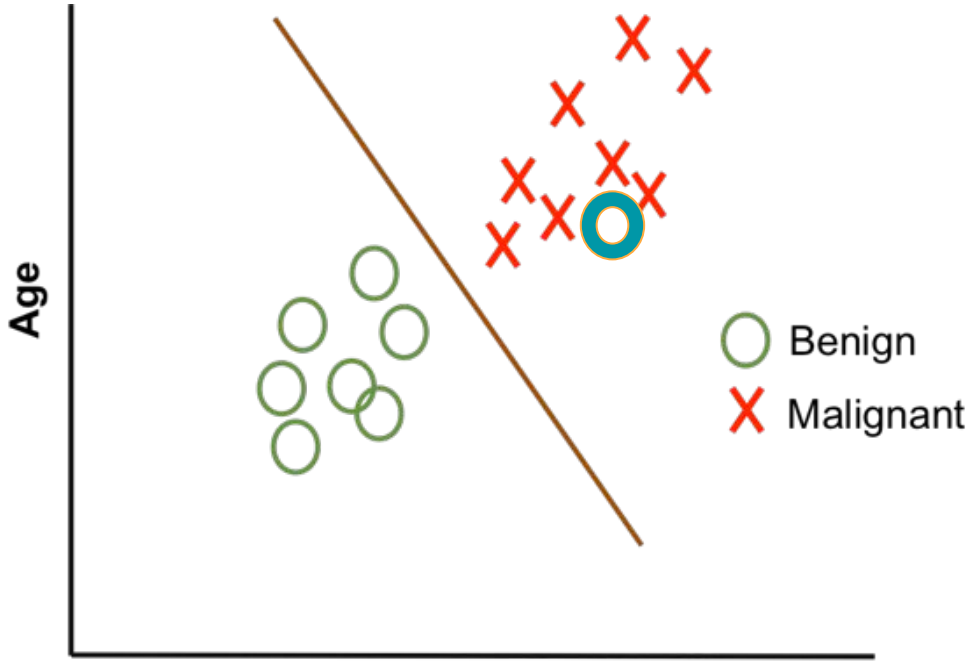
$$0.9*9 + 0.1*42 = 8.1 + 4.2 = 12.3$$

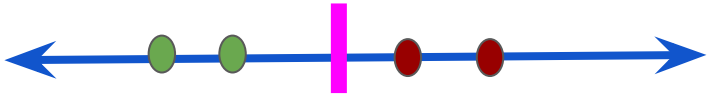


Tumor Size	Age	Condition
10	50	malignant
2	30	benign
1	45	benign
5	40	malignant

Tumor Size = 9
Age = 42

$0.9*9 + 0.1*42 = 8.1 + 4.2 = 12.3$
malignant





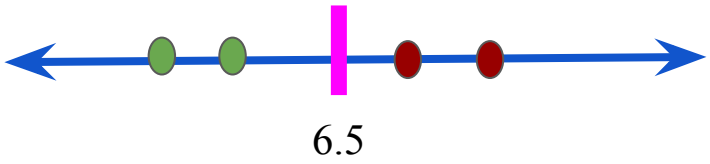
6.5

x1	x2	y
Tumor Size	Age	Condition
10	50	malignant
2	30	benign
1	45	benign
5	40	malignant

$$w1 * x1 + w2 * x2 = y$$

$$0.9*9 + 0.1*42 = 8.1 + 4.2 = 12.3$$

malignant



x1	x2	y
Tumor Size	Age	Condition
10	50	malignant
2	30	benign
1	45	benign
5	40	malignant

$$w1 * x1 + w2 * x2 = y$$

x1, x2, ..., xn = Features

w1, w2, ..., wn = Weights

y = output/ target

x1	x2	y
Tumor Size	Age	Condition
10	50	malignant
2	30	benign
1	45	benign
5	40	malignant

$$w1 * x1 + w2 * x2 = y$$

Let w1 = 0.1 and w2 = 0.9

x1 = 2 and x2 = 5

0.1*2 + 0.9*5 = 0.2 + 4.5 = 4.7

benign

x1	x2	y
Tumor Size	Age	Condition
10	50	malignant
2	30	benign
1	45	benign
5	40	malignant

$$w1 * x1 + w2 * x2 = y$$

Let w1 = 0.1 and w2 = 0.9

x1 = 2 and x2 = 30

0.1*2 + 0.9*30 = 0.2 + 27 = 27.2

malignant

x1	x2	y
Tumor Size	Age	Condition
10	50	malignant
2	30	benign
1	45	benign
5	40	malignant

$$w1 * x1 + w2 * x2 = y$$

Let w1 = 0.1 and w2 = 0.9
x1 = 2 and x2 = 30
0.1*2 + 0.9*30 = 0.2 + 27 = 27.2
malignant

Weights are very important.

Size(sq-feet)	Bedroom	Kitchen	Main road	Balcony	Price(dollar)
1600	4	1	0.2	2	20000
1400	3	1	0.5	1	12000
1600	2	1	0.2	2	10000
2000	4	2	0.1	3	43000

x1	x2	x3	x4	x4	y
Size(sq-feet)	Bedroom	Kitchen	Main road	Balcony	Price(dollar)
1600	4	1	0.2	2	20000
1400	3	1	0.5	1	12000
1600	2	1	0.2	2	10000
2000	4	2	0.1	3	43000

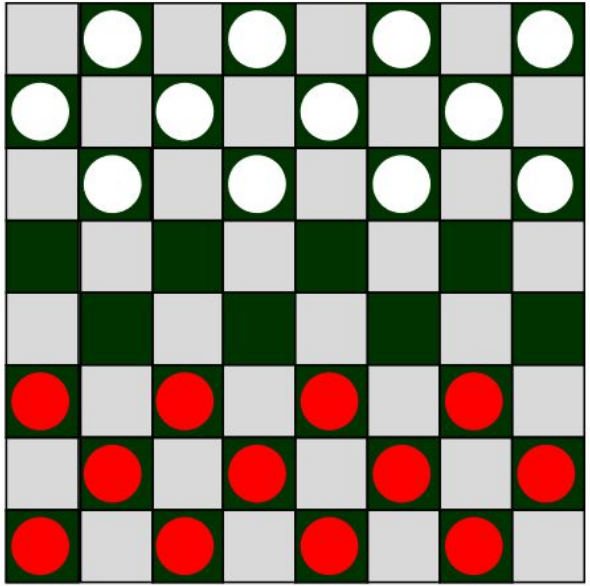
x1	x2	x3	x4	x4	y
Size(sq-feet)	Bedroom	Kitchen	Main road	Balcony	Price(dollar)
1600	4	1	0.2	2	20000
1400	3	1	0.5	1	12000
1600	2	1	0.2	2	10000
2000	4	2	0.1	3	43000

$$w1 * x1 + w2 * x2 + \ldots + w4 * x4 = y$$

Machine learning

"Field of study that gives computers the ability to learn without being explicitly programmed."

Arthur Samuel (1959)



Two Types

1. Regression
2. Classification

What if x3 is not important?

$$w1 * x1 + w2 * x2 + w3 * x3 = y$$

What if x3 is not important?

$$w1 * x1 + w2 * x2 + w3 * x3 = y$$

Simply set w3 = 0

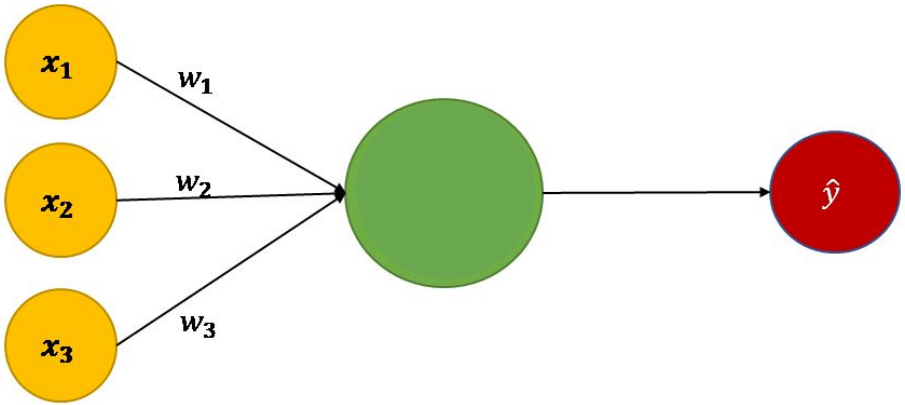
$$w1 * x1 + w2 * x2 = y$$

Mother Law of Machine Learning

$$w1 * x1 + w2 * x2 + w3 * x3 = y$$

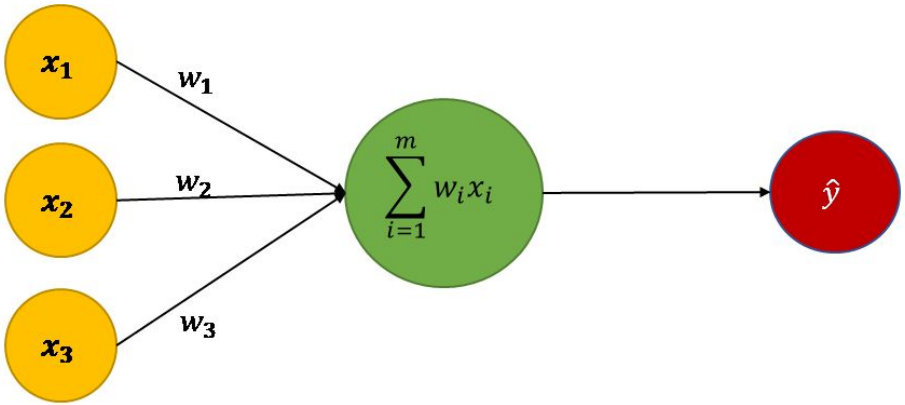
Mother Law of Machine Learning

$$w1 * x1 + w2 * x2 + w3 * x3 = y$$



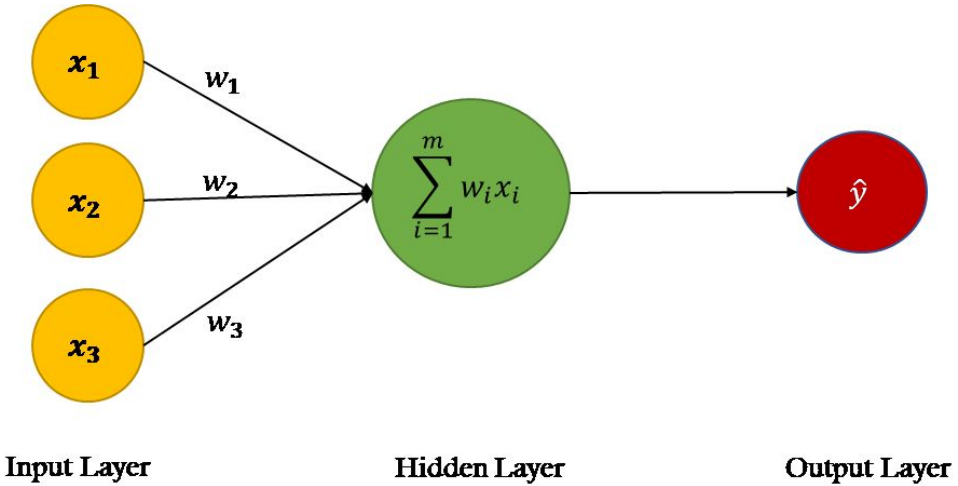
Mother Law of Machine Learning

$$w1 * x1 + w2 * x2 + w3 * x3 = y$$



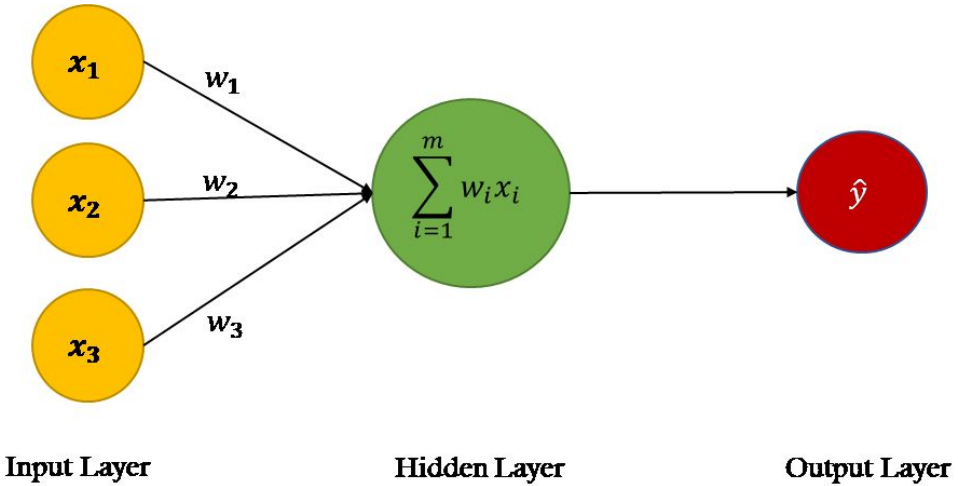
Mother Law of Machine Learning

$$w1 * x1 + w2 * x2 + w3 * x3 = y$$

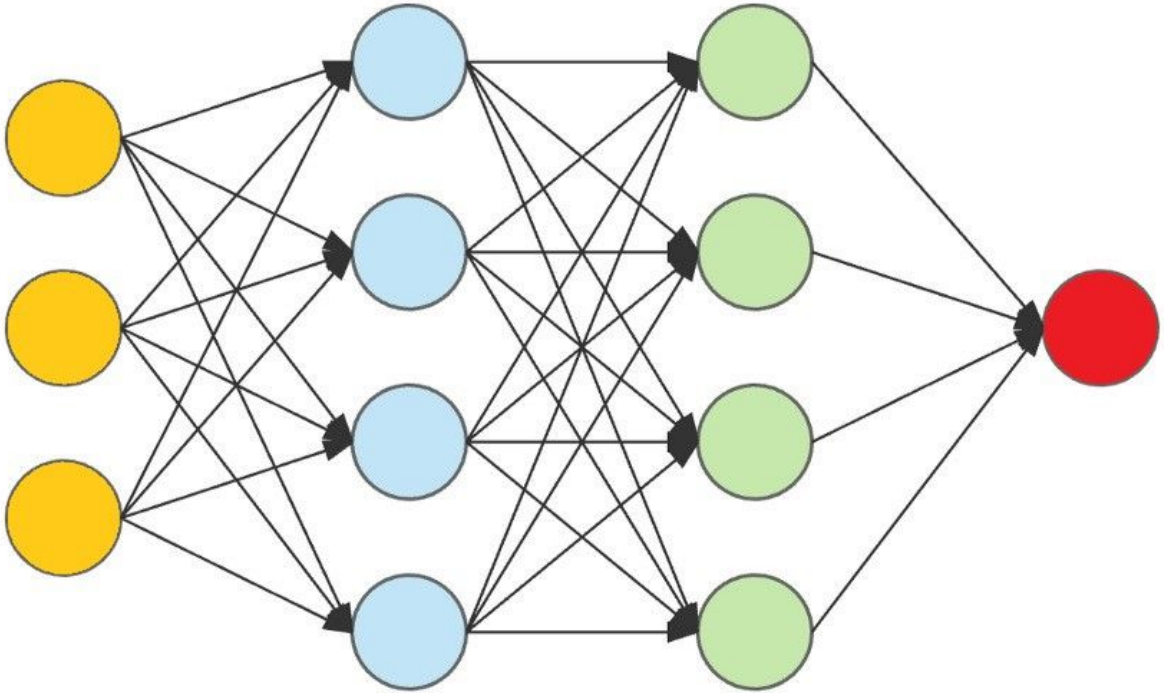


Neural Network

$$w1 * x1 + w2 * x2 + w3 * x3 = y$$

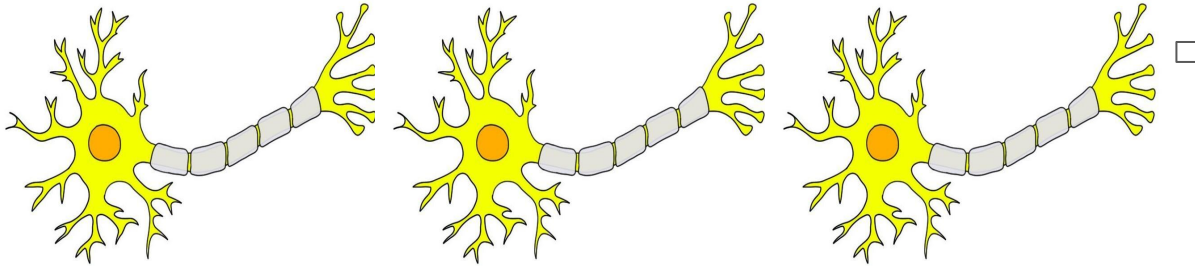


Neural Network



Human Brain

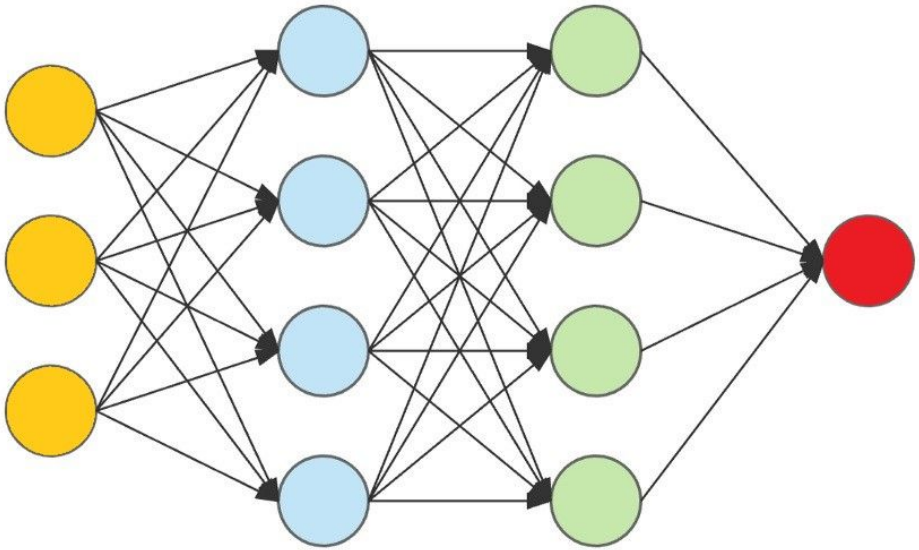
Informations



Decision

Machine Brain

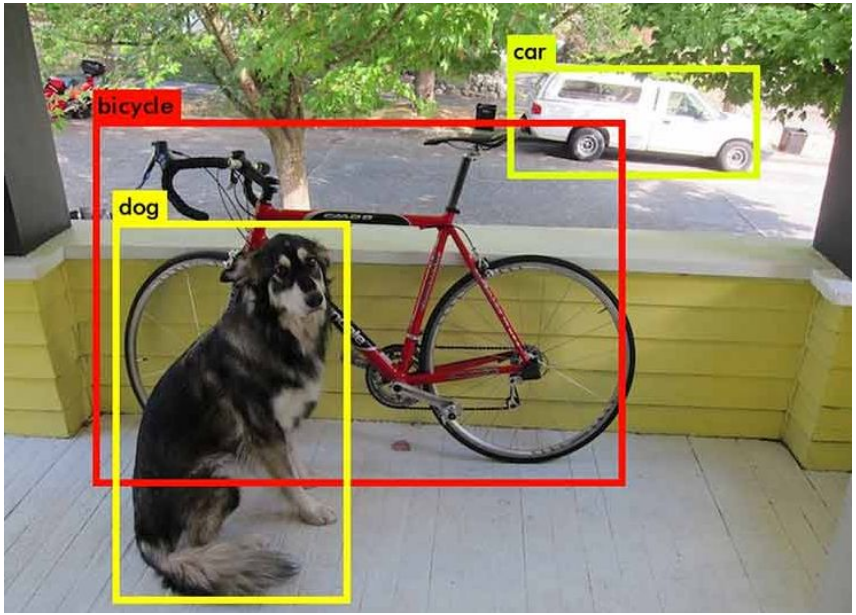
Informations



Decision

Next Class

Object Detection using Machine Learning



THANK YOU