Introduction to Robotics
CSE 461

Class Topic: Introduction to Machine Learning and Neural Network

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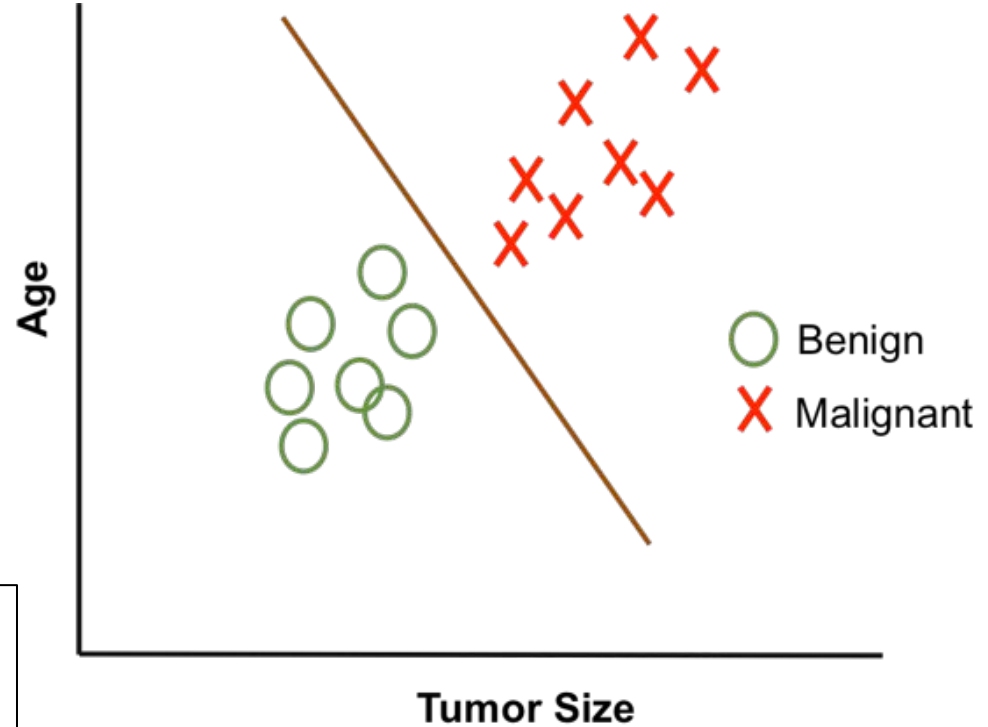
$$0.9*10 + 0.1*50 = 9 + 5 = 14$$
$$0.9*2 + 0.1*30 = 1.8 + 3 = 4.8$$
$$0.9*1 + 0.1*45 = 0.9 + 4.5 = 5.4$$
$$0.9*5 + 0.1*40 = 4.5 + 4 = 8.5$$

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

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

Age

Tumor Size

○ Benign
✕ Malignant

6.5

Tumor Size	Age	Condition
10	50	malignant
2	30	benign
1	45	benign
5	40	malignant
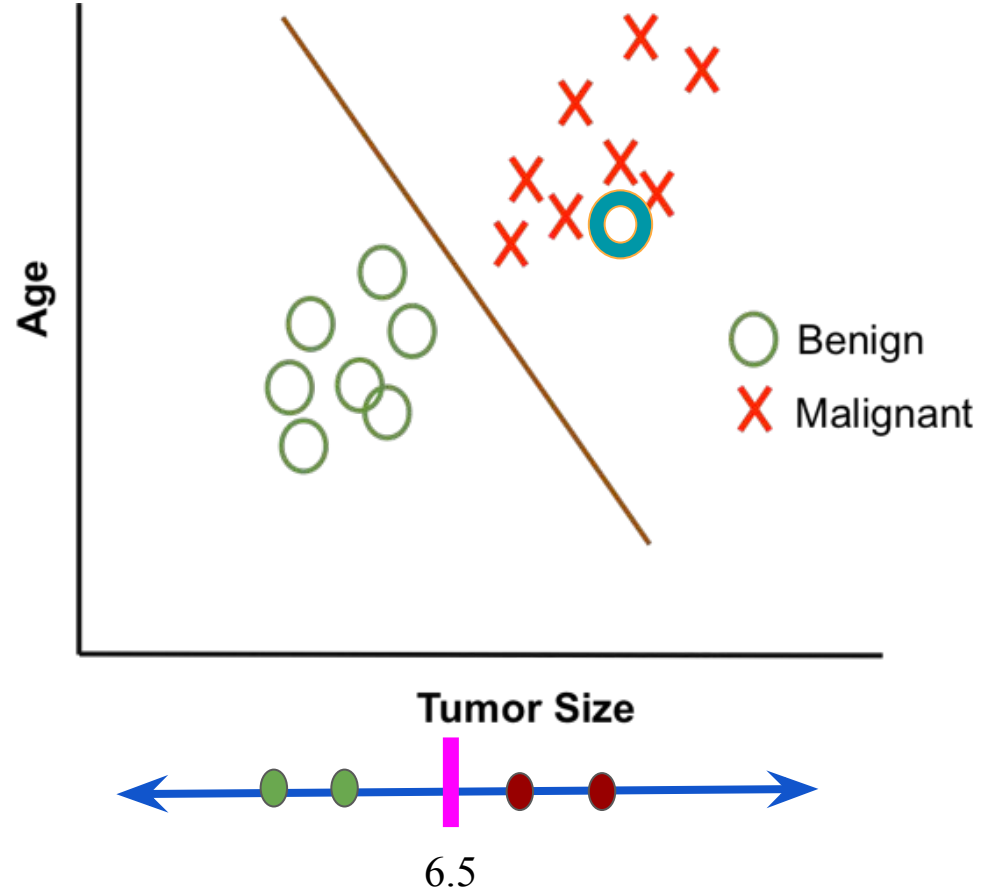
Tumor Size = 9
Age = 42

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

Tumor Size = 9
Age = 42
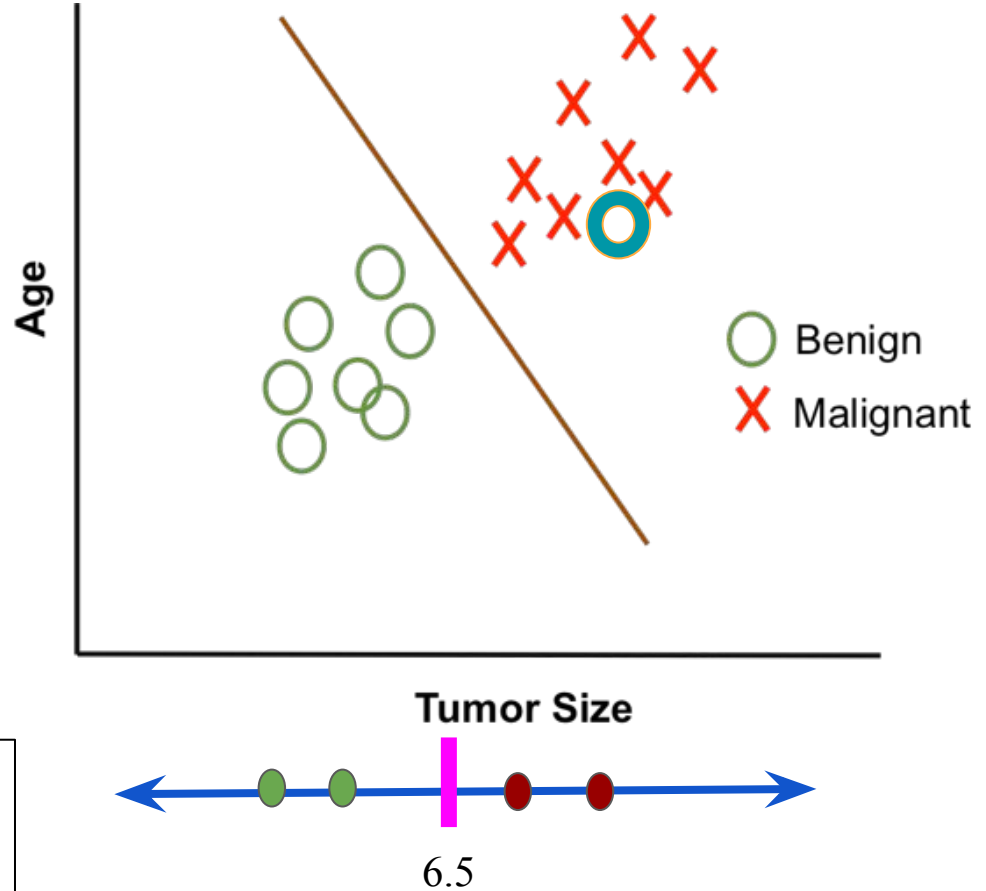
$0.9*9 + 0.1*42 = 8.1 + 4.2 = 12.3$

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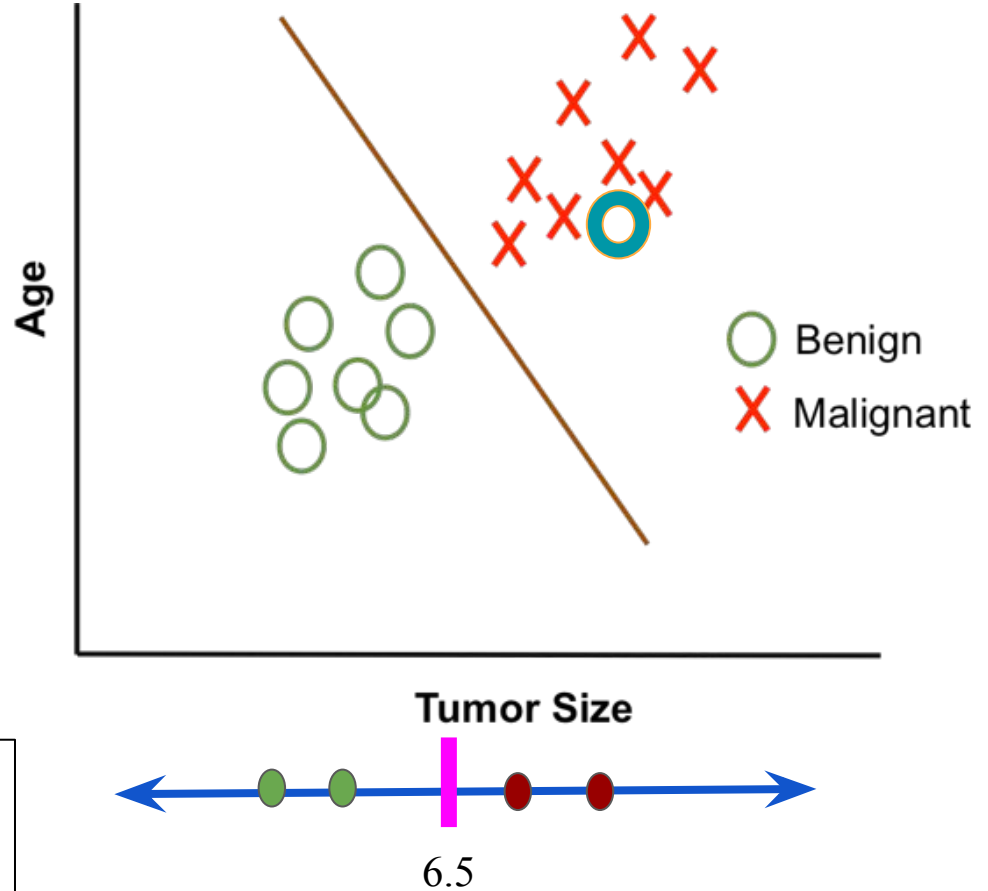
x1	x2	y
Tumor Size	Age	Condition
10	50	malignant
2	30	benign
1	45	benign
5	40	malignant

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

0.9*9 + 0.1*42 = 8.1 + 4.2 = 12.3
malignant
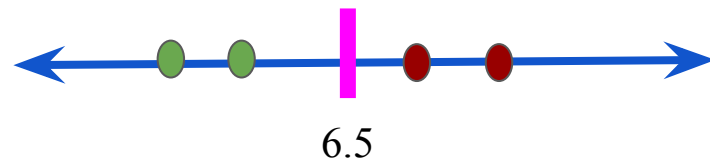
6.5

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

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

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	x5	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

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

Two Types

1. Regression
2. Classification

Machine learning

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

Arthur Samuel (1959)
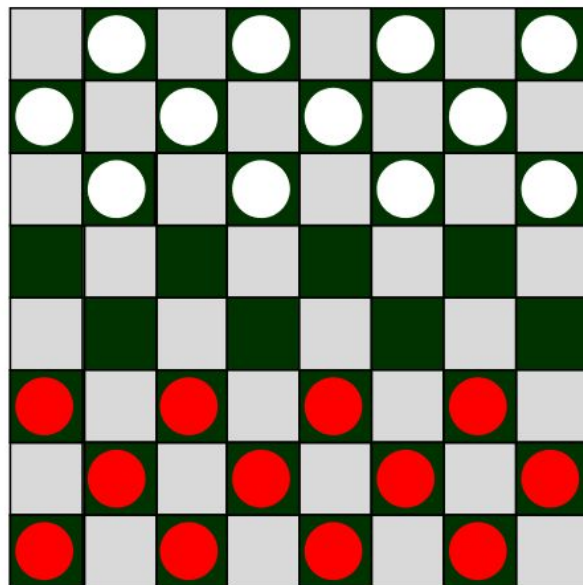
What if x3 is not important?

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

What if x3 is not important?

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

Simply set w3 = 0
$$w1 * x1 + w2 * x2 = y$$

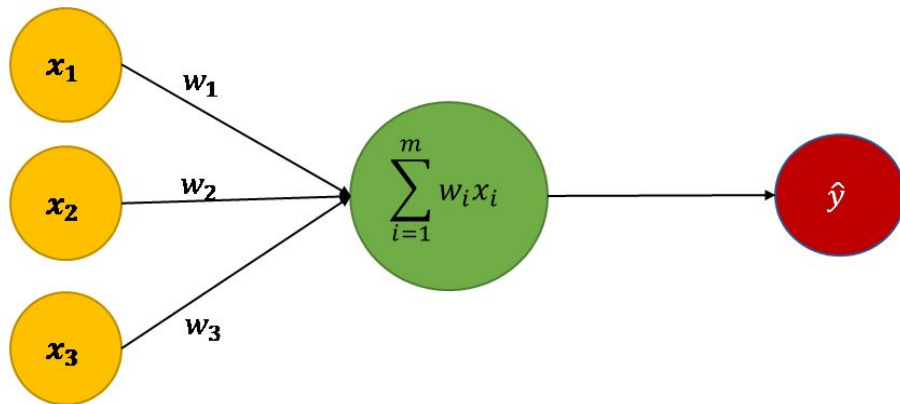# Mother Law of Machine Learning

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

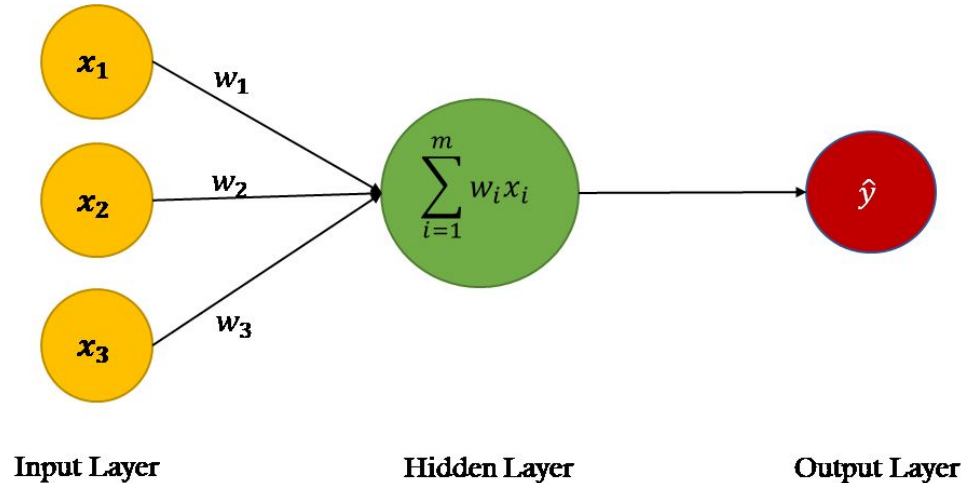# Mother Law of Machine Learning

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

Mother Law of Machine Learning

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

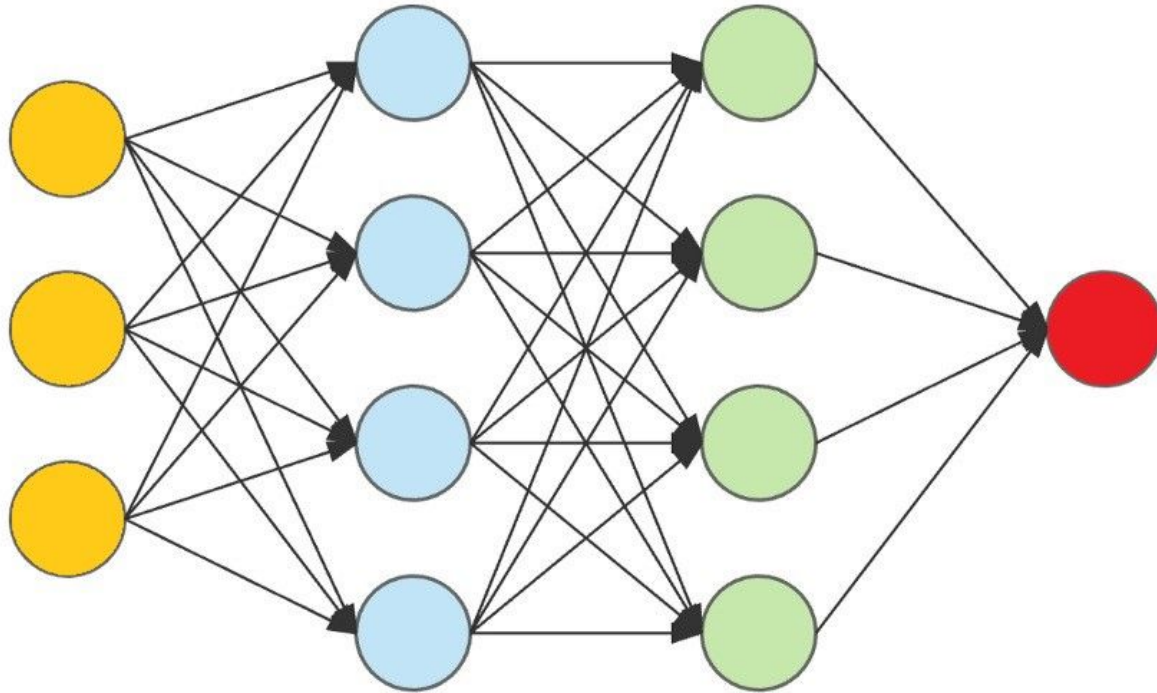# Mother Law of Machine Learning

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

Input Layer   Hidden Layer   Output Layer
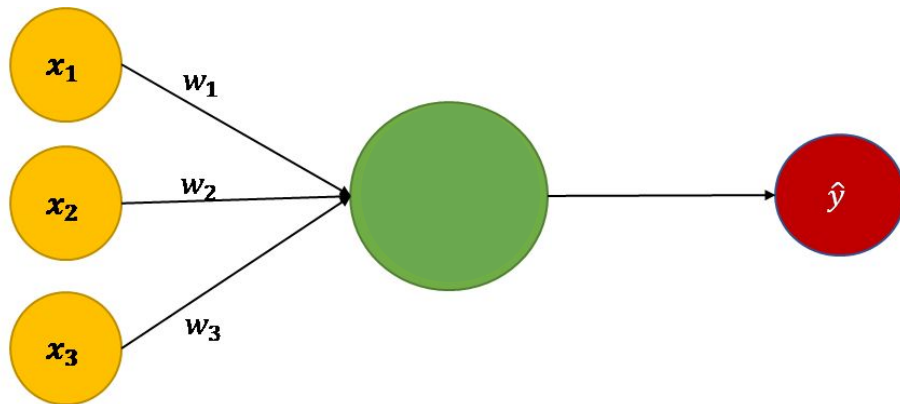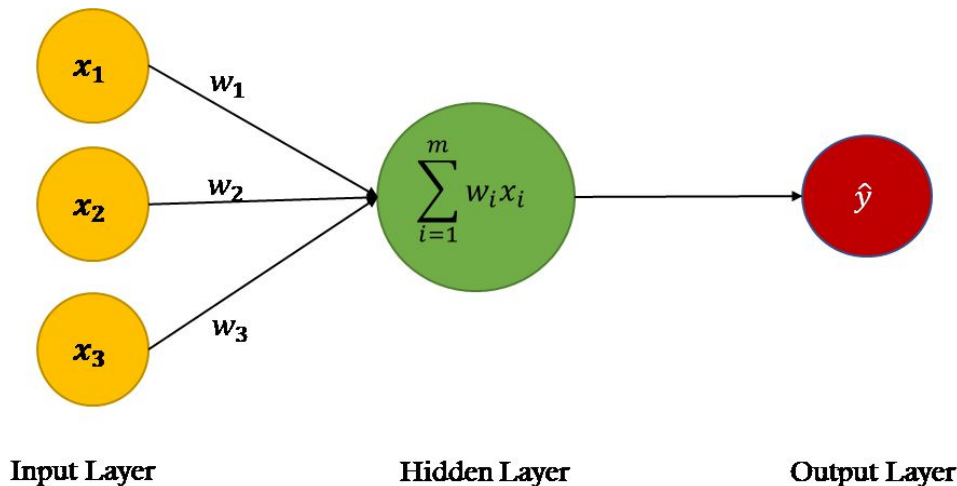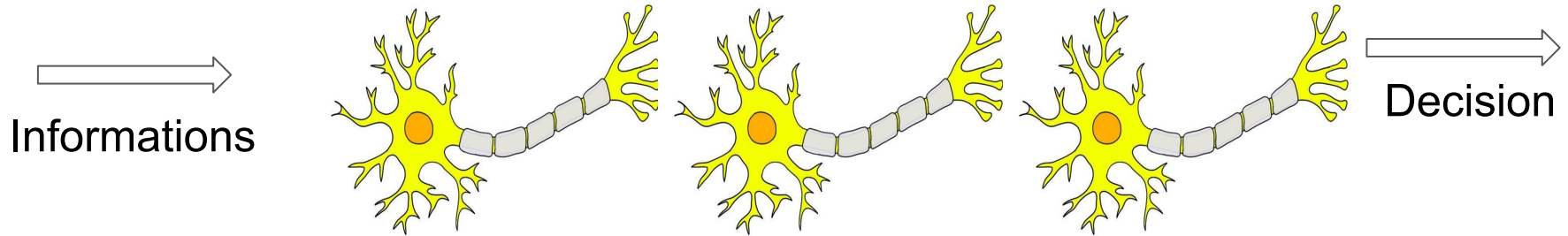
Neural Network

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

Neural Network

Human Brain

Machine Brain
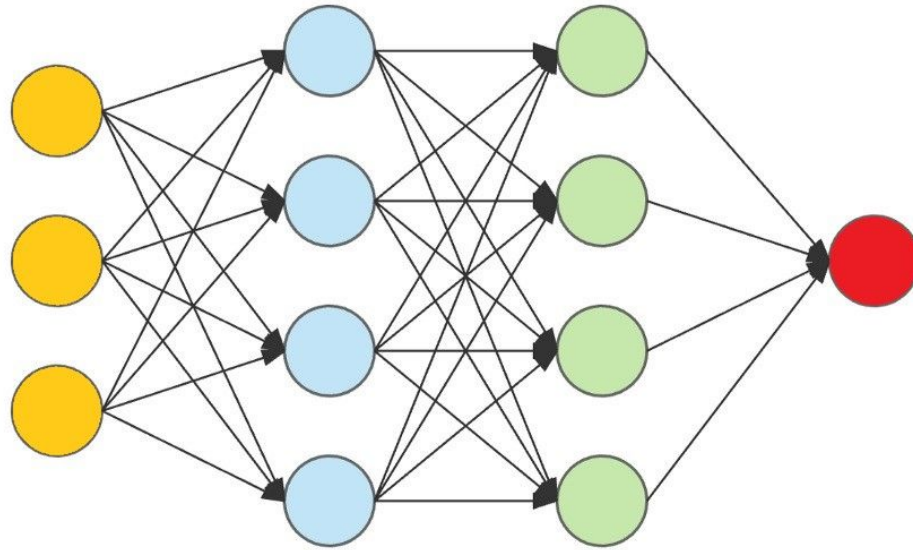

Informations

Decision

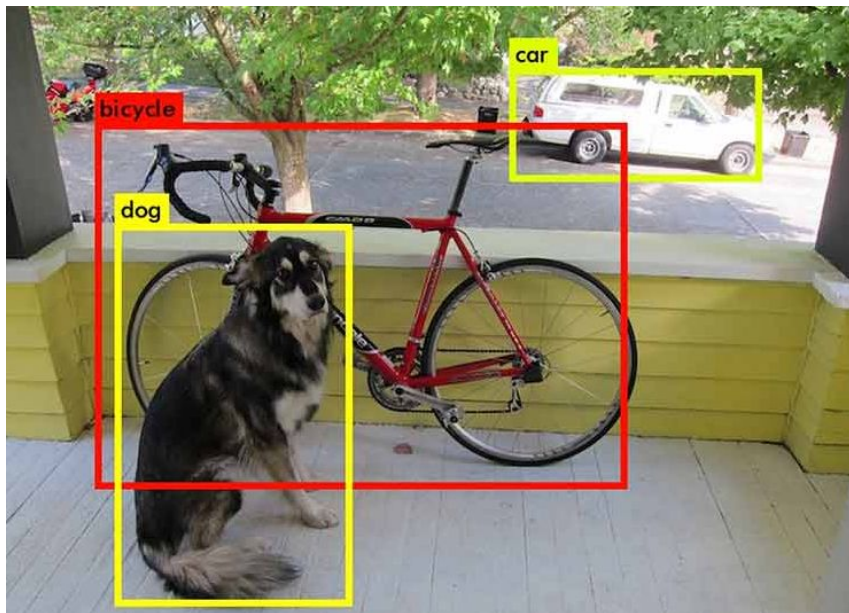# Next Class

CNN, Object Detection using Machine Learning

Thank You So Much