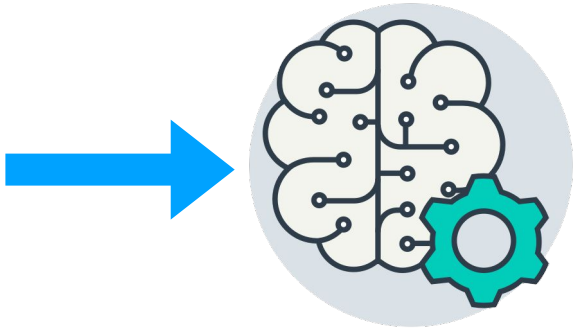
Linear Problem

Machine Learning

What would be the grade if I study 4 hours?

4 hours



? points

Prediction

Hours (x)	Points (y)
1	2
2	4
3	6
4	?

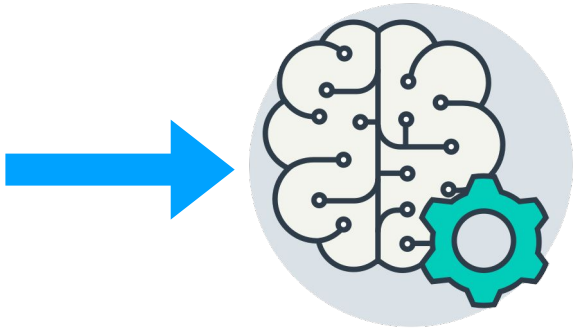
Training dataset

Test dataset

Machine Learning

What would be the grade if I study 4 hours?

4 hours



? points

Prediction

Hours (x)	Points (y)
1	2
2	4
3	6
4	?

Training dataset

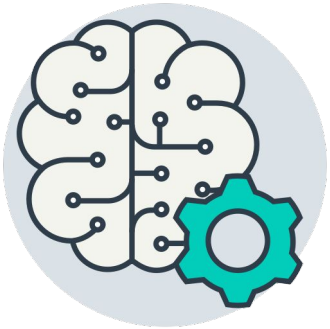
Test dataset

Supervised learning

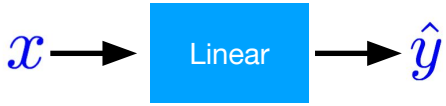
Model design

What would be the best model for the data? Linear?

Hours (x)	Points (y)
1	2
2	4
3	6
4	?



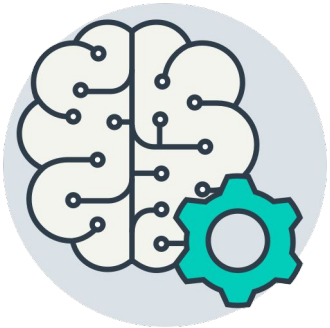
$$\hat{y} = x * w + b$$



Model design

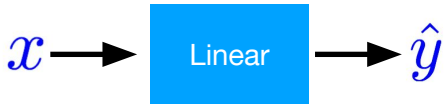
What would be the best model for the data? Linear?

Hours (x)	Points (y)
1	2
2	4
3	6
4	?



$$\hat{y} = x * w$$

$$\hat{y} = x * w + b$$

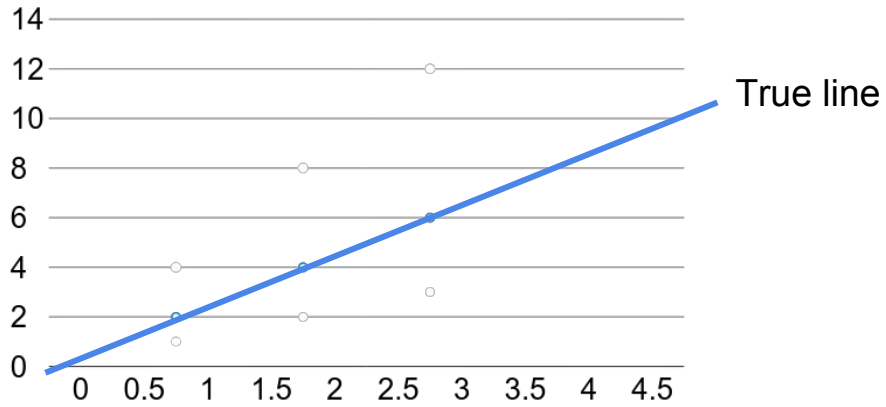


Linear Regression

$$\hat{y} = x * w$$

* The machine starts with **a random guess**, w=random value

Hours (x)	Points (y)
1	2
2	4
3	6

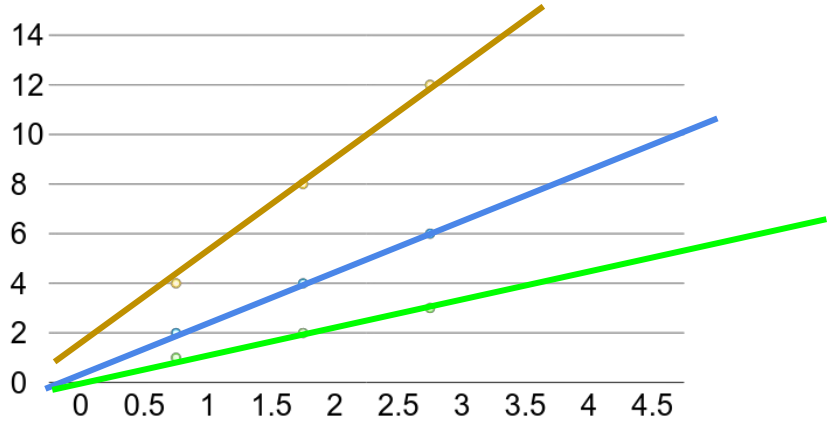


Linear Regression error?

$$\hat{y} = x * w$$

* The machine starts with **a random guess**, w=random value

Hours (x)	Points (y)
1	2
2	4
3	6



Training Loss (error)

$$loss = (\hat{y} - y)^2 = (x * w - y)^2$$

Hours, x	Points, y	Prediction, y^(w=3)	Loss (w=3)
1	2	3	1
2	4	6	4
3	6	9	9
			mean=14/3

Training Loss (error)

$$loss = (\hat{y} - y)^2 = (x * w - y)^2$$

Hours, x	Points, y	Prediction, y^(w=4)	Loss (w=4)
1	2	4	4
2	4	8	16
3	6	12	36
			mean=56/3

Training Loss (error)

$$loss = (\hat{y} - y)^2 = (x * w - y)^2$$

Hours, x	Points, y	Prediction, y^(w=0)	Loss (w=0)
1	2	0	4
2	4	0	16
3	6	0	36
			mean=56/3

Training Loss (error)

$$loss = (\hat{y} - y)^2 = (x * w - y)^2$$

Hours, x	Points, y	Prediction, y^(w=1)	Loss (w=1)
1	2	1	1
2	4	2	4
3	6	3	9
			mean=14/3

Training Loss (error)

$$loss = (\hat{y} - y)^2 = (x * w - y)^2$$

Hours, x	Points, y	Prediction, y^(w=2)	Loss (w=2)
1	2	2	0
2	4	4	0
3	6	6	0
			mean=0

Training Loss (error)

$$loss = (\hat{y} - y)^2 = (x * w - y)^2 \qquad loss = \frac{1}{N}\sum_{n=1}^{N}(\hat{y_n} - y_n)^2$$

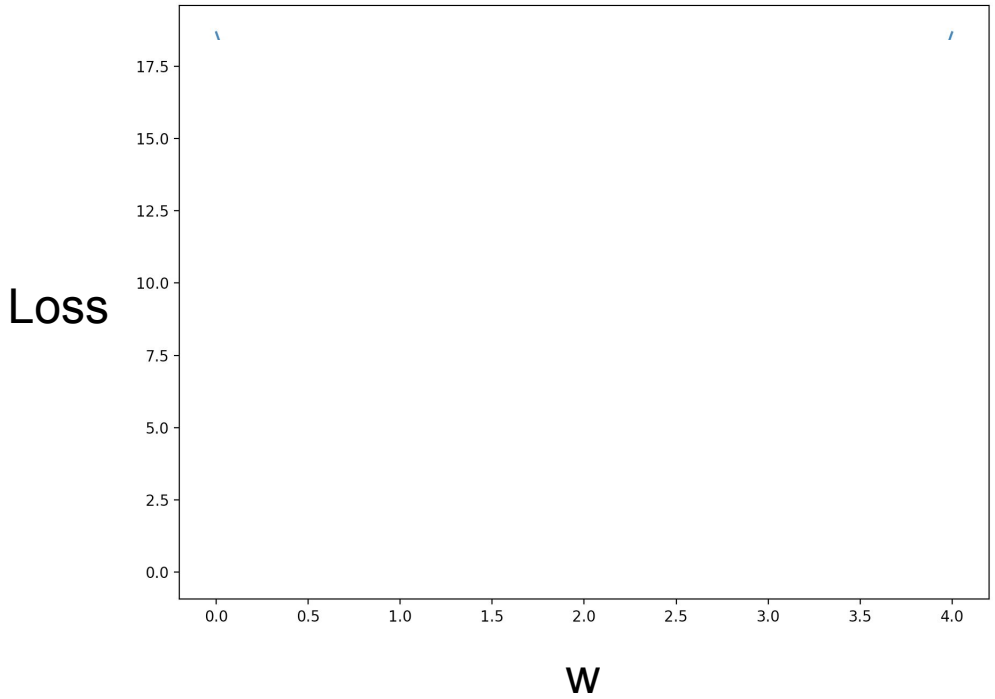
MSE, mean square error

Hours, x	Loss (w=0)	Loss (w=1)	Loss (w=2)	Loss (w=3)	Loss (w=4)
1	4	1	0	1	4
2	16	4	0	4	16
3	36	9	0	9	36
	MSE=56/3=18.7	MSE=14/3=4.7	MSE=0	MSE=14/3=4.7	MSE=56/3=18.7

Loss graph

$$loss = \frac{1}{N}\sum_{n=1}^{N}(\hat{y}_n - y_n)^2$$

Loss (w=0)	Loss (w=1)	Loss (w=2)	Loss (w=3)	Loss (w=4)
mean=56/3=18.7	mean=14/3=4.7	mean=0	mean=14/3=4.7	mean=56/3=18.7



Loss graph

$$loss = \frac{1}{N}\sum_{n=1}^{N}(\hat{y}_n - y_n)^2$$

Loss (w=0)	Loss (w=1)	Loss (w=2)	Loss (w=3)	Loss (w=4)
mean=56/3=18.7	mean=14/3=4.7	mean=0	mean=14/3=4.7	mean=56/3=18.7