CH-1 Machine Learning Steps

1 → Define problem Zone

2 → Chose The Solution Model

3 → Data pre-processing

4 → Run & Evaluate

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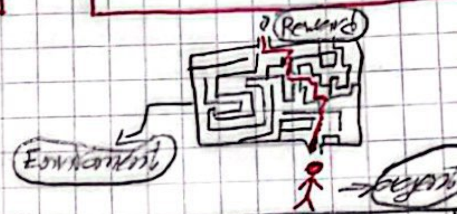
1) [Define a problem zone

Machine Learning

- **Supervised Learning**
  - Dataset // Database
  - Training
- **Unsupervised Learning**
  - Know the relationship
- **Reinforcement Learning**



Artificial Intelligence — Any tecnique that enables computers to mimic human intelligence.

1950's

Machine Learning — A subset of AI that includes statistical Algorithms with the ability to learn without being explicitly programming.

1980's

Deep Learning — A Subset of ML that mimic human brain Perceptrons by using Artificial Neural Networks to adapt and works with big amount of data.

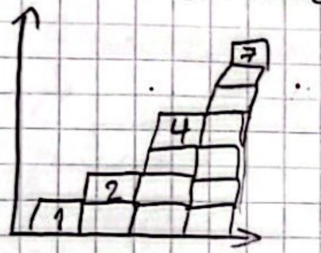
2010's

① [Define a problem zone

Supervised Learning

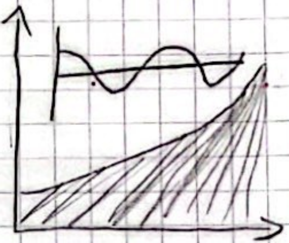
Classification (Discrete output)

Discrete Growth (2^n)



Regression (continues output)

Continues Growth (e^x)



Regression

Univariate-Input Regression

Area	price (K)
100	220K
200	44K
235	495K

Multivariate-Input Regression

Year	Assets	Inventory	profit
2010	13.5	55	120
2011	22.2	68.5	122.2
2012	44.3	77.8	135.7

① Define problem Zone

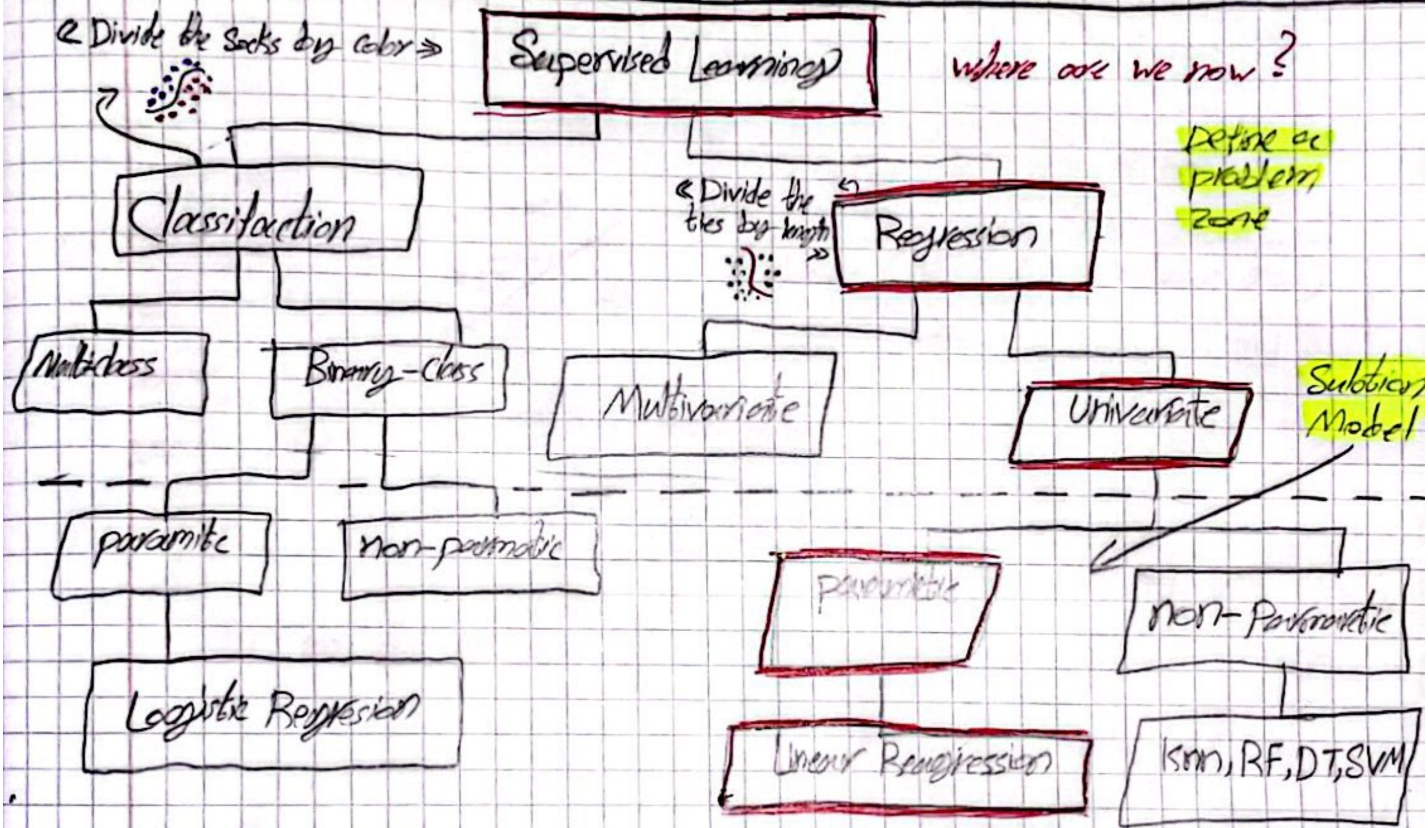
Classification problem

Binary-Class

Hours	Pass
5	Y
2	N
1.5	N

Multi-class

Hours	pass
5	A+
2	B
1.5	B-



1# Linear Regression Attack plan

① Linear Model
② Error function
③ Gradient Descent
④ Model Evaluation
⑤ Advanced Topics

2) # Solution Model | Linear Regression

① ② Linear model & Error function

X: Area	y: Price(k)
100	200
150	400
200	450
250	550
300	450

Parametric Solution

$y = mx + b$

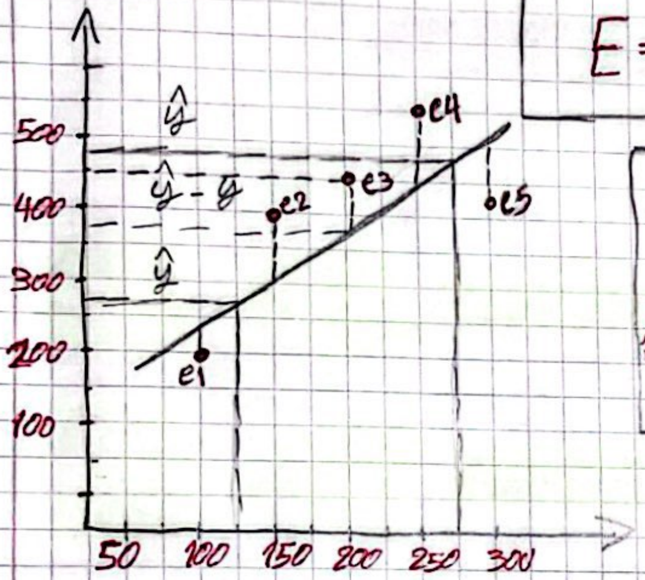
$y = W_0 + W_1 X \rightarrow (1)$

Error (Standard Error)

$e = \hat{y} - y$

$e1 + e2 + e3 + e4 + e5$

$$E = \sum_{i=1}^{n} (\hat{y} - y) \rightarrow (2)$$



or

Error (Mean Absolute Error MAE)

$$MAE = \frac{|e1| + |e2| + |e3| + |e4| + |e5|}{5}$$

$$MAE = \frac{1}{n} \sum_{i=1}^{n} |(\hat{y} - y)|$$

or

Error (Mean Square Error MSE)

$$MSE = \frac{(e1)^2 + (e2)^2 + (e3)^2 + (e4)^2 + (e5)^2}{5}$$

$$MSE = \frac{1}{n} \sum_{i=1}^{n} (\hat{y}_i - y_i)^2$$

$$WMSE = \frac{MSE}{w}$$

Error (Root Mean Square Error RMSE)

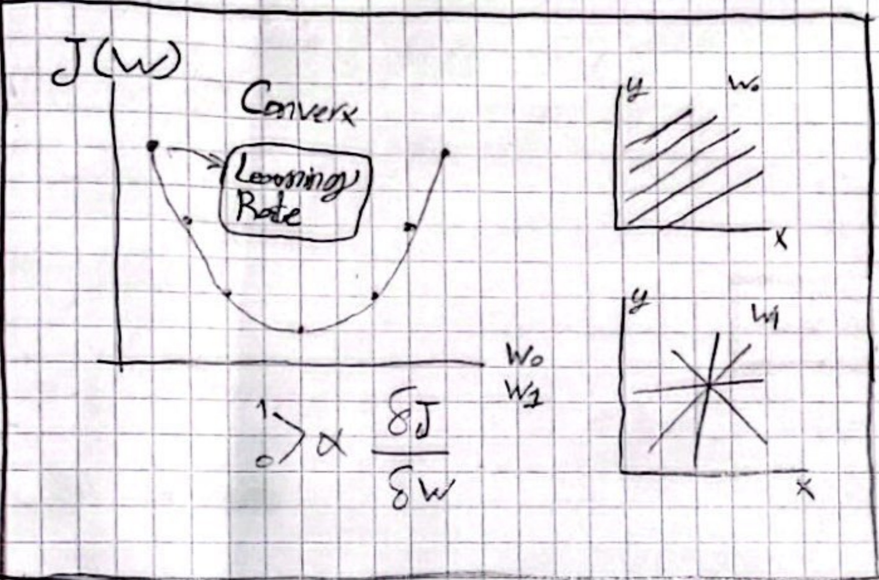
$$RMSE = \sqrt{MSE}$$

2) # Solution model) Linear Regression)

③ Gradient Descent

Linear Model : $\hat{y}_i = h(w) = w_0 + w_1 X$

Cost Function $J(w) := \frac{1}{2n} \sum_{i=1}^{n} (h(w)_i - y_i)^2$



$$\frac{\delta j(w)}{\delta w_0} = \frac{1}{n} \sum_{i=1}^{n} ((w_0 + w_1 X)_i - y_i)$$

$$\frac{\delta j(w)}{\delta w_1} = \frac{1}{n} \sum_{i=1}^{n} ((w_0 + w_1 X)_i - y_i) x_i$$

$$\rightarrow \frac{\delta j(w)}{\delta w} = \sum_{i=1}^{n} ((w_0 + w_1 x)_i - y_i) x$$

Gradient $\boxed{W = W - \alpha \frac{\delta j(w)}{\delta w}}$ Descent

1 [Define a problem zone.

2 [Choose a solution Model.

rember → Machine Learning

- Supervised
- Unsupervised
- reinforcement

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where are we now?

Unsupervised

- **Association**
  « find what clothes I often wear together »

- **Clustering**
  « Split up similar color into a stack »

K means, K Medoids

Data = {2, 3, 4, 10, 11, 12, 20, 25, 30}

K = 2

C = 4

K1 = {2, 3, 4}

Mean1 = 3

K1 = {2, 3, 4, 10}

mean 1 = 4.75 → 5

K1 = {2, 3, 4, 10, 11, 12}

mean 1 = 7

K1 {2, 3, 4, 10, 11, 12}

C = 12

K2 = {10, 11, 12, 20, 25, 30}

Mean 2 = 18

K2 = {11, 12, 20, 25, 30}

mean 2 = 19.6 → 20

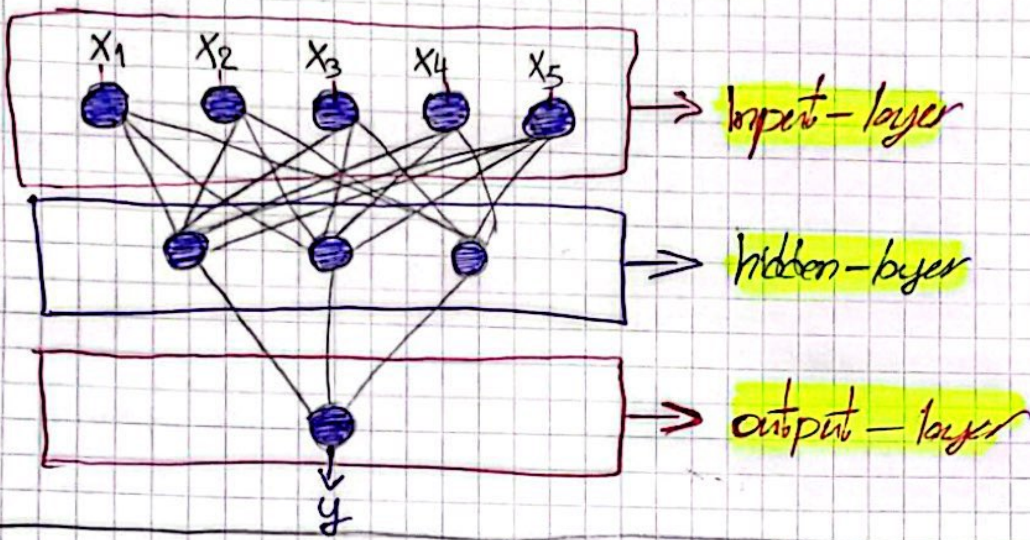
K2 = {20, 25, 30}

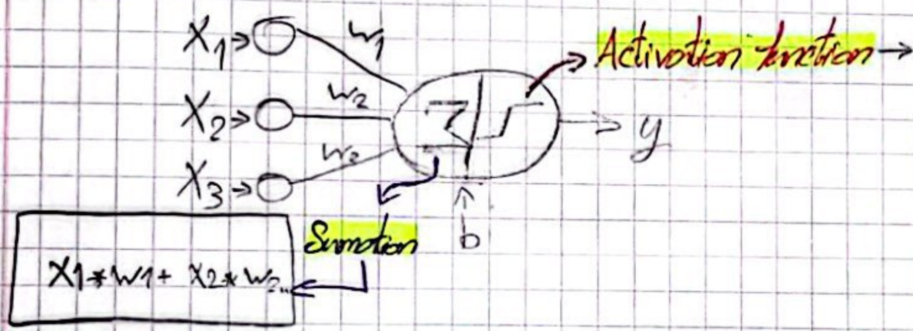
mean 2 = 25

K2 = {20, 25, 30}

Multi-layer Neural Network

Keywords: Input layer - Hidden-layer - output-layer - Activation function - Loss function - Learning rate - weights - nodes - Gradien descent - forward and backward propagation - Epochs - Batch - Iteration





$\tilde{w} = (w^T\ b)^T \quad \tilde{x} = (x^T\ 1)^T$

$\hat{y} = \text{Sign}(\tilde{w}^T \tilde{x})$

Epochs: one Epochs is when an entire dataset is passed forward and backward through the neural network only once.

Baches: number of batches = Iterations.