Neural Networks

Exemple

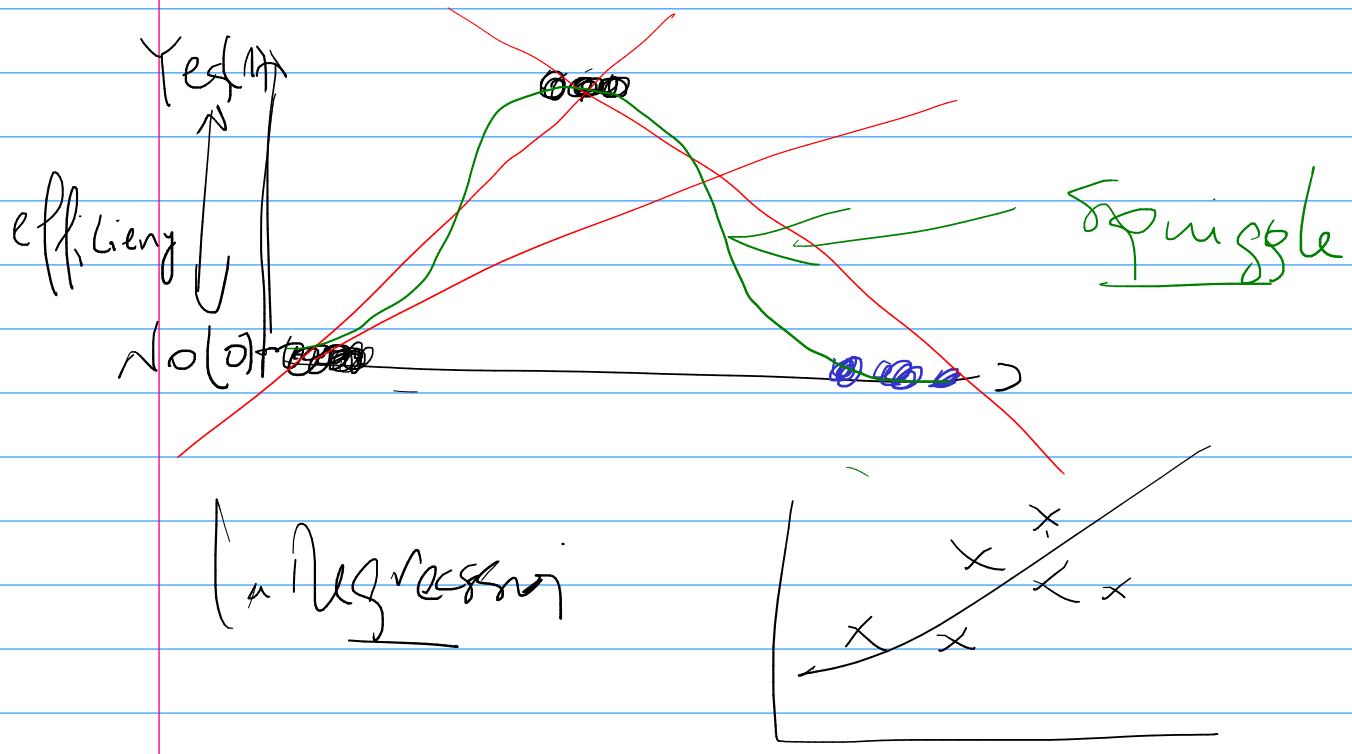
drug — 3 persons

→ Dosage (

→ light Dosage

→ medium Dosage

→ High Dosage

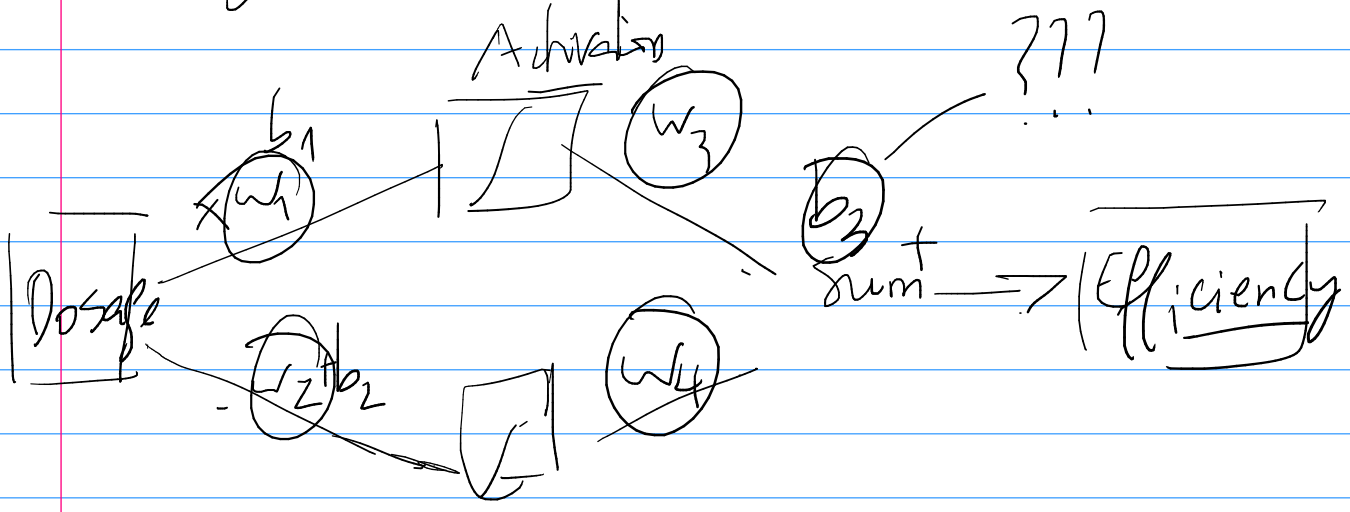


Linear Regression

Regression Linéaire Simple → Type de Neural Network

Regression linear : (Input (n)
simple output (1)

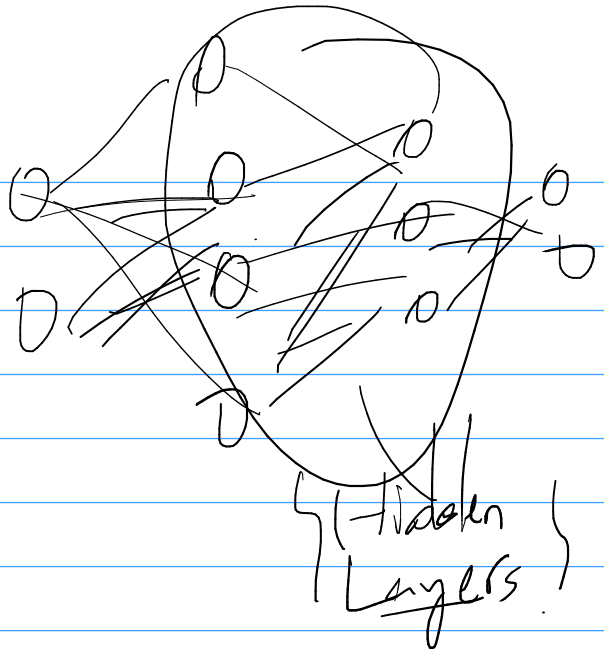
Classification



Activation function : ReLU
Sigmoid

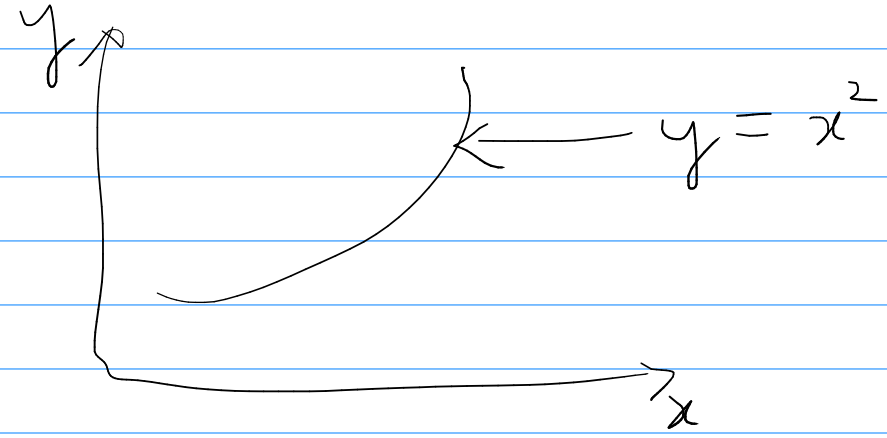
$ReLU = \max(0, x)$

$Sigmoid = \log(1 + e^x)$

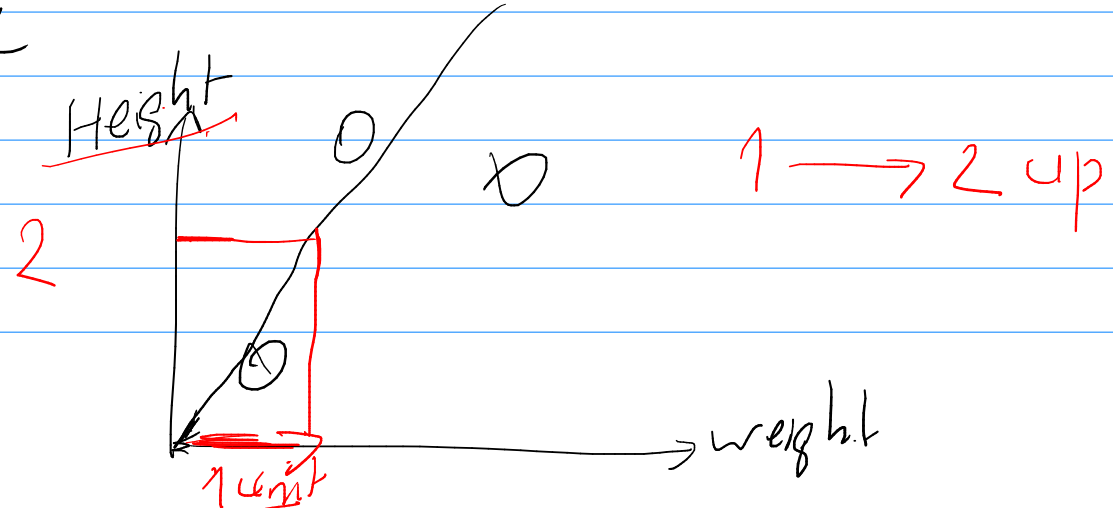


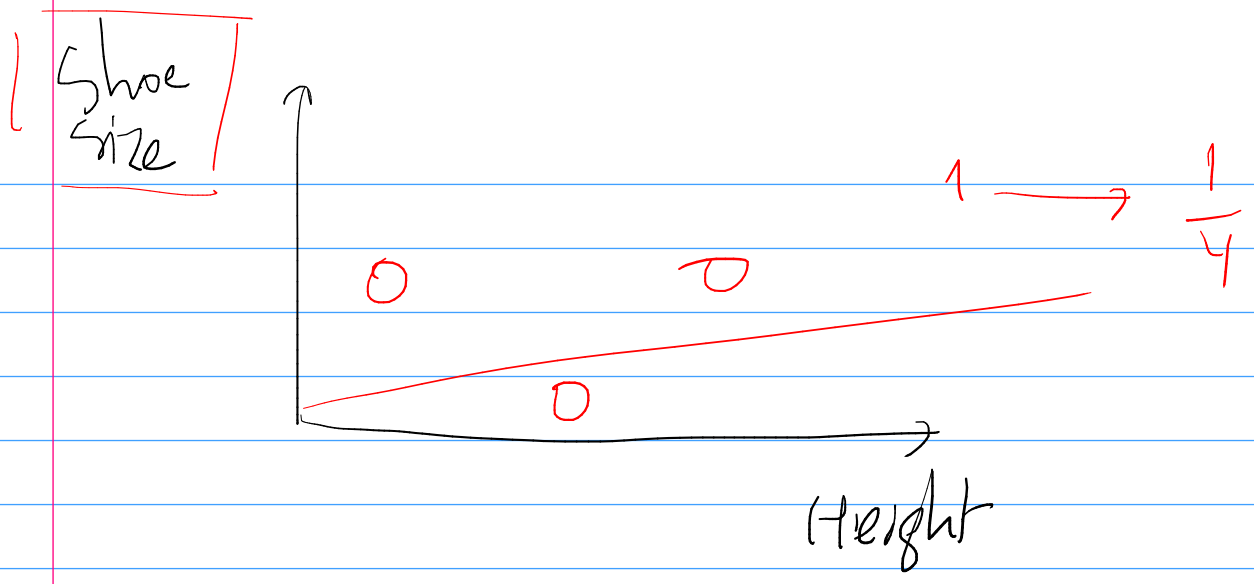
Back-propagation principle

Chain Rule + Gradient Descent



$$\frac{dy}{dx} = 2x$$





$$\text{Slope} = \frac{2}{1} = 2 = \frac{d\,\text{Height}}{d\,\text{weight}} = 2$$

$$\text{Height} = \frac{d\,\text{Height}}{d\,\text{weight}} \times \text{weight}$$

$$\frac{\text{Height}}{\text{weight}} = \frac{d\,\text{Height}}{d\,\text{weight}}$$

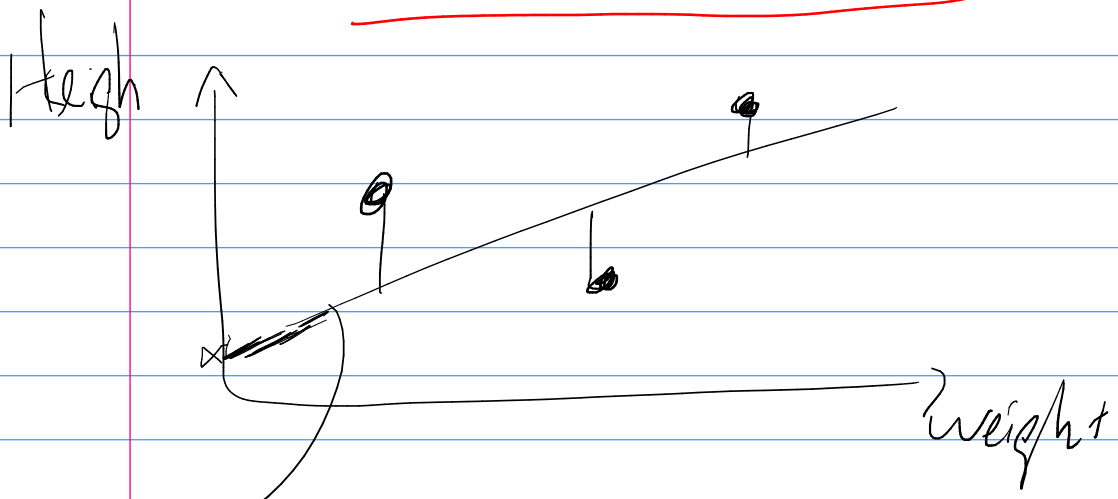
$$\frac{d\,\text{shoesize}}{d\,\text{Height}} = \frac{1}{4}$$

$$\text{Shoe size} = \frac{d\,\text{size}}{d\,\text{Heigh}} \times \text{Height}$$

$$\text{Size} = \frac{d\,\text{size}}{d\,\text{Height}} \times \frac{d\,\text{Height}}{d\,\text{weight}} \times \text{weight}$$

$$\frac{dy}{dx} = \frac{dy}{dz} \times \frac{dz}{dx}$$

Gradient Descent

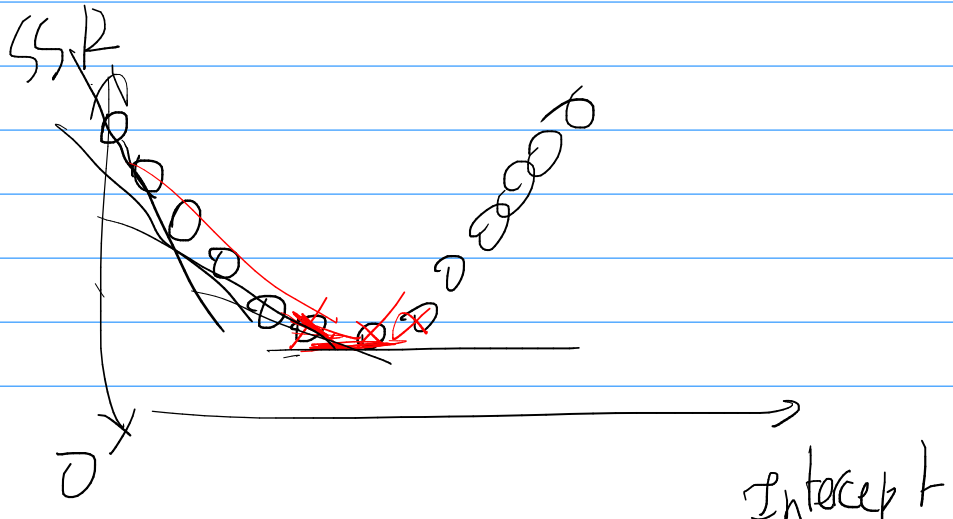


Predicted = Intercept + Slope × Weight

Evaluation SSR: SSR = $\sum$ Residual^2

Residual = Observed − Predicted

Intercept?



$$SSR = \sum (\text{Residuals}^2$$

$$= \sum (\text{observed} - \text{Predicted})^2$$

$$\frac{d SSR}{d \text{Intercept}} = \frac{d SSR}{d \text{Predicted}} \times \frac{d \text{Predicted}}{d \text{Intercept}}$$

$$\frac{d SSR}{d \text{Predicted}} = -\sum 2 (\text{observed} - \text{Predicted})$$

$$\frac{d \text{Predicted}}{d \text{Intercept}} = 1$$

$$\frac{d SSR}{d \text{Intercept}} = -\sum 2 (\text{observed} - \text{Predicted})$$

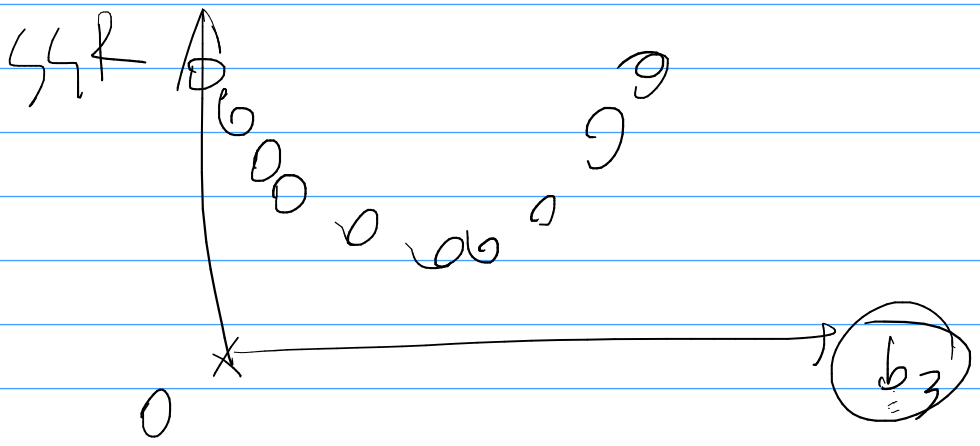
$$= -\sum_{1}^{2} 2 (\text{observed} - (\text{Intercept} + \text{Slope} \times \text{weight}))$$

$$= -5.7$$

$$\text{Step size} = -5.7 \times \text{Learning rate} = -0.57$$

$$\text{New Intercept} = \text{Old Intercept} - \text{Step Size}$$

Leaps less steps ⟹ small steps



Petal width

Sepal width

Black box

Setosa 1,0 0

Versicolor 2,3 1

Virginica 1,4 0

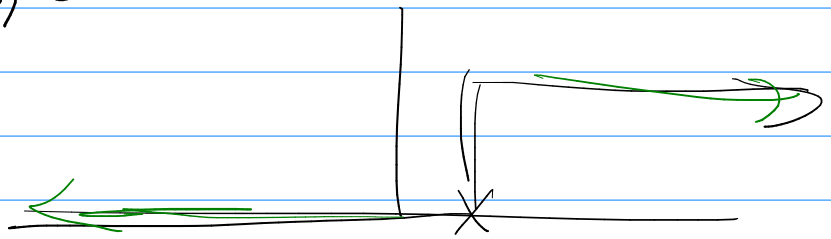
Argmax

Vs Softmax

Largest value ⇒ 1

other ⇒ 0

X SSR



Softmax

$$\text{Softmax}_{\text{setosa}}(\text{output value}) = \frac{e^{\text{setosa}}}{e^{\text{setosa}} + e^{\text{verde}} + e^{\text{virginica}}}$$

$$\text{Softmax}_i(\text{output value}) = \frac{e^i}{\sum e^j}$$

Cross Entropy (=2 types of Loss Function 싸움)

(Softmax)

Petal	Sepal	Species	P	CrossEntropy
0,04	0,45	나	0,63	
기	0,64	V	0,4	
기	0,6	V	0,2	

$$\text{Cross Entropy} = -\log(\text{Predicted}_{\text{setosa}})$$

$$= -\sum \text{observed}_i \times \log(\text{Predicted}_i)$$

Loss Function = [Cross Entropy

SSR =