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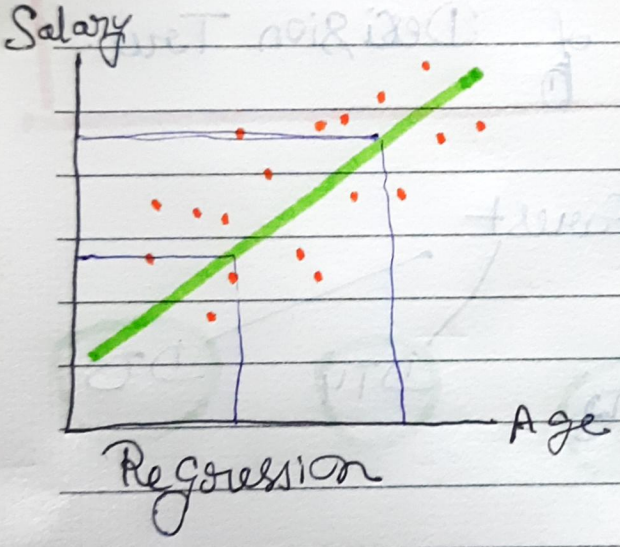
Classification Algorithm-

① Logistic Regression-

Why is it Classification Algorithm?



Regression

in Regression-

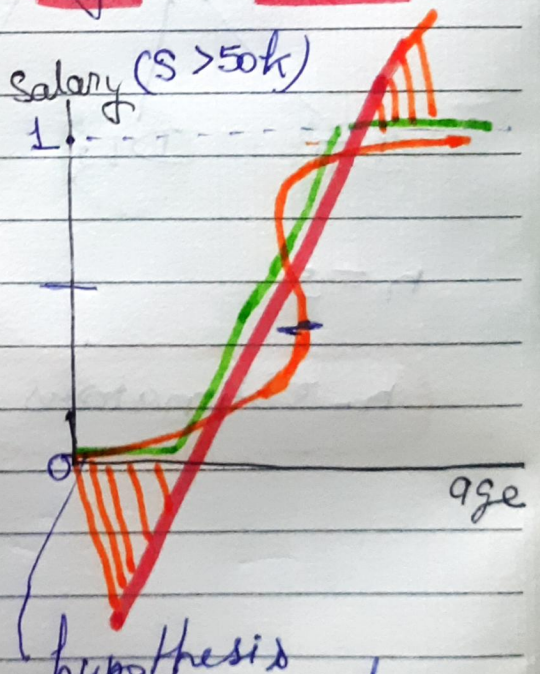
Age	Salary
—	—
—	—
—	—
—	—

(Exact value)

(Continuous parameter)

Classification- (discrete value)

Employee is earning high or low.



hypothesis Salary between (0-1)

Sigmoid function

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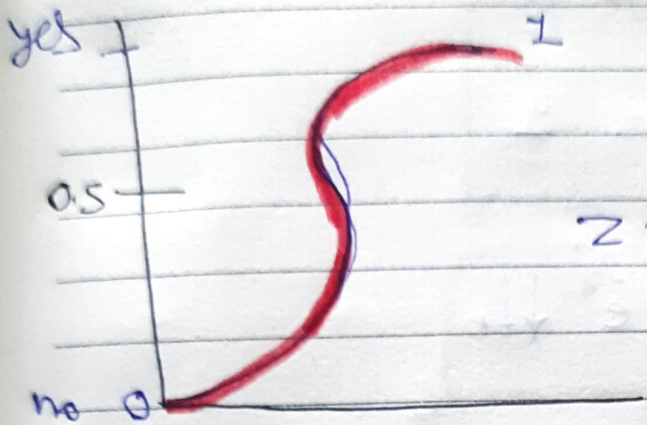

$$g(z) = \frac{1}{1+e^{-z}}$$

in linear Regression -

$$z = y = mx+c$$

$$\sigma(y) = \frac{1}{1+e^{-(mx+c)}}$$

#(Linear hypothesis converted into Sigmoid)

Linear Regression $\Rightarrow y = mx+c$

Logistic Regression $\Rightarrow \sigma(f(x)) = \frac{1}{1+e^{-y}}$

$$= \frac{1}{1+e^{-(mx+c)}}$$

(Linear R. + Logic (Sigmoid)

⇓

Logistic Regression

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if $\hat{y}$ is very large -

$$\sigma(\hat{y}) = \frac{1}{1+e^{-\hat{y}}} \simeq 1$$

$\Rightarrow$ $\hat{y} \uparrow\uparrow \quad -\hat{y} \downarrow\downarrow \quad e^{-\hat{y}} \downarrow\downarrow$

if $\hat{y}$ is very small -

$$\sigma(\hat{y}) = \frac{1}{1+e^{-\hat{y}}} \simeq 0$$

$\Rightarrow$ $\hat{y} \downarrow\downarrow \quad -\hat{y} \uparrow\uparrow \quad e^{-\hat{y}} \uparrow\uparrow$

Cost function -

$$J = \text{Cost} = \frac{1}{n} \sum_{i=1}^{n} \left[L(y_i, \hat{y}_i) \right]$$

where the values are of L.

$$\text{Loss, } L = \left[-y \log g(\hat{y}) + (1-y) \log (1-\hat{y}) \right]$$

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Case 1 :- if $y = 1$

$$L = -y \log \hat{y}$$

$$\boxed{L = -\log \hat{y}}$$

if we want loss to be minimum

$\Rightarrow \log \hat{y} \uparrow\uparrow$

$\Rightarrow \boxed{\hat{y} \uparrow\uparrow \Rightarrow 1}$

Case 2 - if $y = 0$

$$L = -(1-y) \log (1-\hat{y})$$

$$\boxed{L \Rightarrow -\log(1-\hat{y})}$$

loss to be minimum -

$\Rightarrow \log(1-\hat{y}) \uparrow\uparrow$

$\Rightarrow (1-\hat{y}) \uparrow\uparrow$

$\Rightarrow \hat{y} \downarrow\downarrow$

$\Rightarrow \boxed{0}$

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Gradient -

$$\sigma(\hat{y}) = \frac{1}{1+e^{-(mx+c)}}$$

- there are still parameter (m & c) then gradient descent -

$$m' = m - \alpha \frac{\partial J}{\partial m}$$

$$c' = c - \alpha \frac{\partial J}{\partial c}$$