

Sigmoid function

$$Y = \frac{1}{1 + e^{-Y}}$$

$(0, 1)$

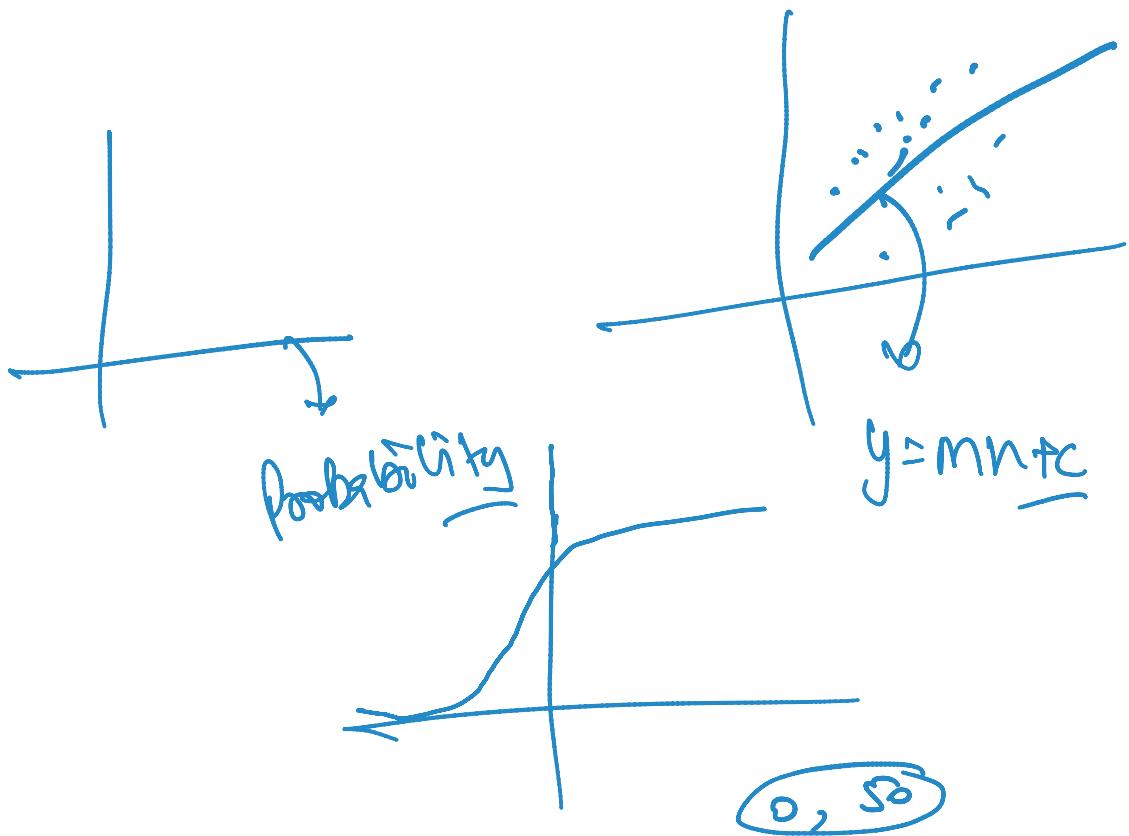
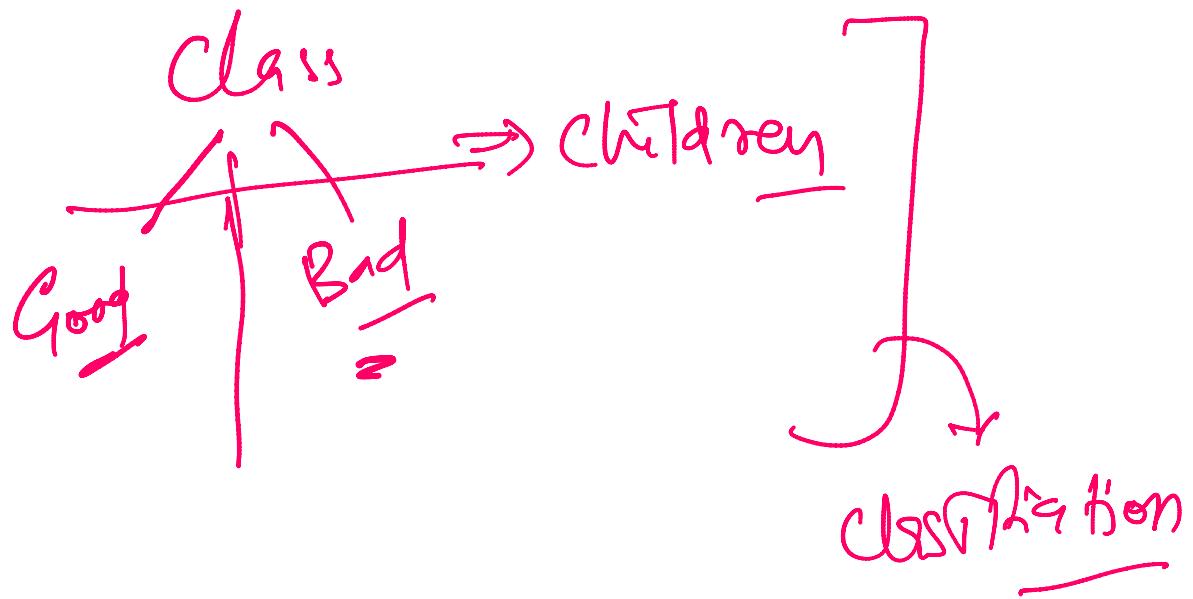
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graph LR; Eq["Y = 1 / (1 + e^-Y)"] --> Range["(0, 1)"]
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Similarity

Hour Price \rightarrow 20.1 $\xrightarrow{\text{?}}$ Regression

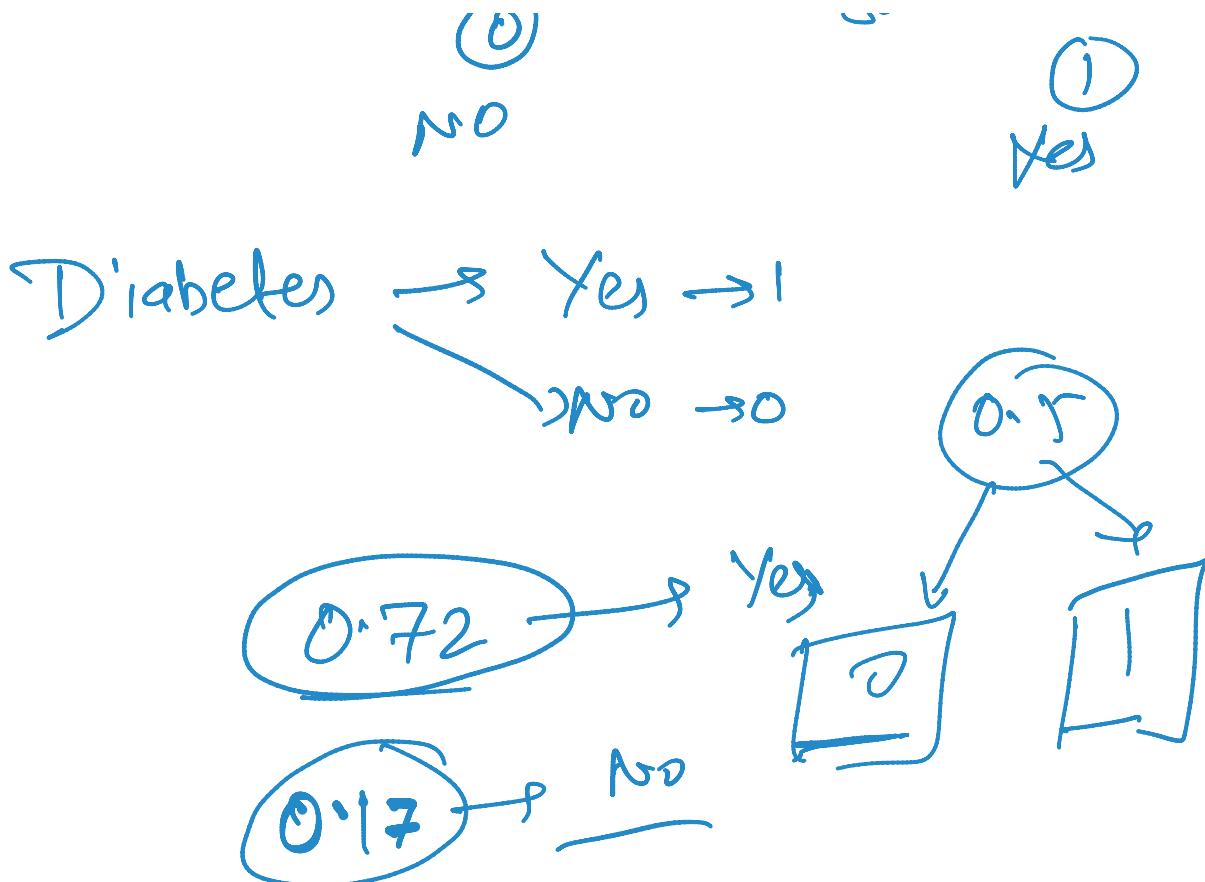
\rightarrow 20.412

Classification \rightarrow Classiffr



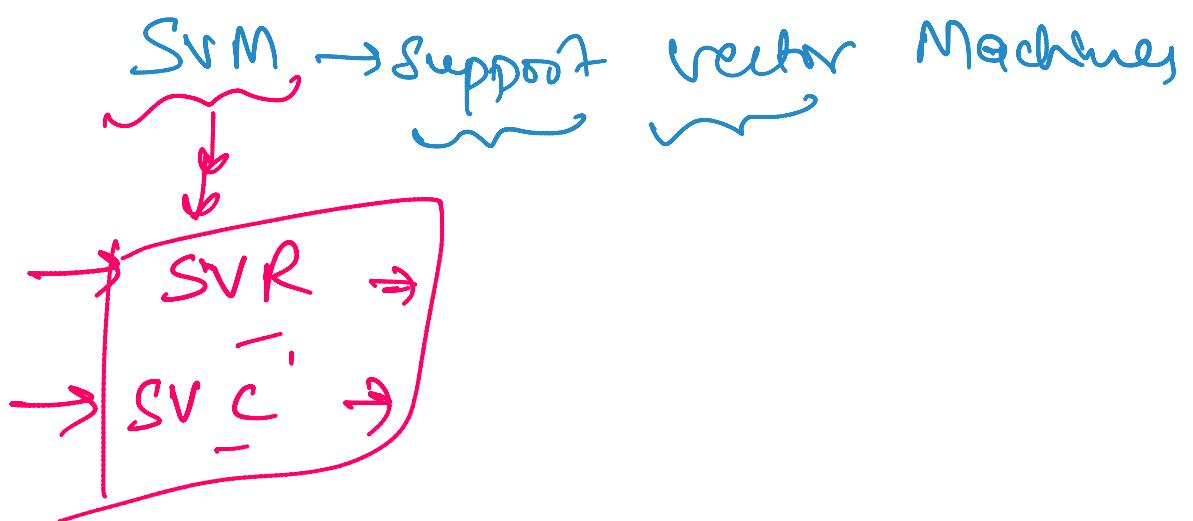
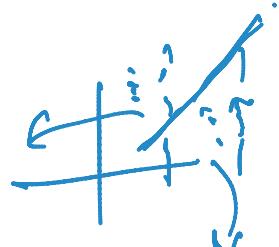
0

50% \rightarrow 1



$$\frac{1}{1 + e^{-y}}$$

$$y = mx + c$$



From ~~sklearn~~ sklearn.svm import T l,

I
↓

I
↓
SvF
SvC

$$\text{cost} = \min_{\omega} \left(\frac{\|\omega\|}{2} + C \sum_{i=1}^m (\xi_i) \right)$$

minimize error

Lagrange function

SVM

$$f(u_i) = \omega^\top u_i + b, f(u_i) = \sum_{j=1}^m d_j y_j u_i^\top u_j + b$$

Δ d for support vectors > 0
else $= 0$

$$d = \dots$$

$$d = 0$$

$$d < 0$$



$$\text{linear } K(a, b) = a^\top b$$

$$\text{RBF } K(a, b) = (a^\top b + r)^d$$

RBF
signal

$$u_i = \begin{bmatrix} a \\ b \end{bmatrix}^\top \begin{bmatrix} 1 \\ e \end{bmatrix}$$

$$m_j = c - f$$

$$\begin{bmatrix} a & b & c \end{bmatrix} \begin{bmatrix} d \\ e \\ f \end{bmatrix}$$

$$y_i: (\omega^\top u_i + b) \geq 1 \quad \text{Correctly}\\ y_i: (\omega^\top u_i + b) \leq 1 \quad \text{Wrong}$$

$$+1 \\ -1$$

$$d_1, x_1 \rightarrow \text{...}$$

$$d_2, x_2$$

$$d_3, x_3$$

$$d_4, x_4$$

$$d_5, x_5$$

$$d_6, x_6$$

$$d_7, x_7$$

$$d_8, x_8$$

$$d_9, x_9$$

$$d_{10}, x_{10}$$

$$d_{11}, x_{11}$$

$$d_{12}, x_{12}$$

$$d_{13}, x_{13}$$

$$d_{14}, x_{14}$$

$$d_{15}, x_{15}$$

$$d_{16}, x_{16}$$

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$$d_{187}, x_{187}$$

$$d_{188}, x_{188}$$

$$d_{189}, x_{189}$$

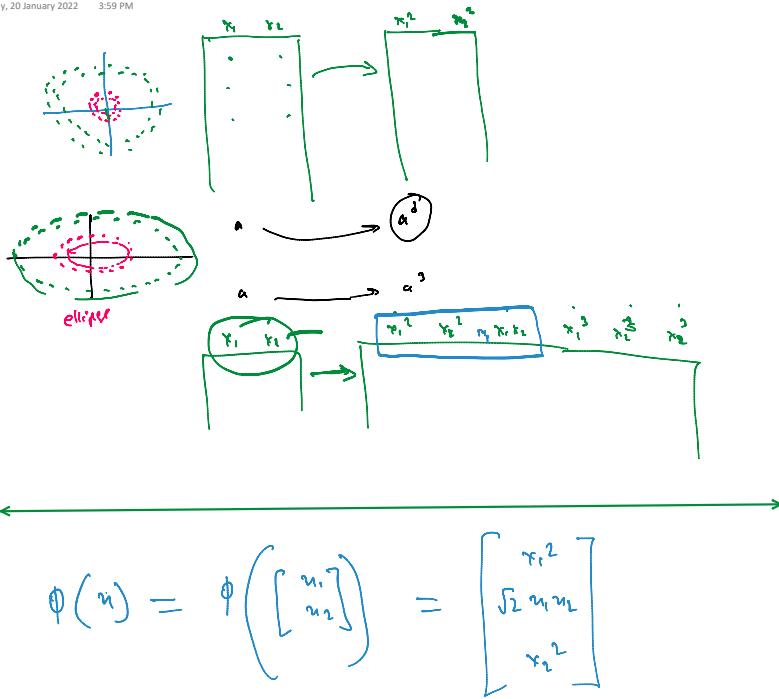
$$d_{190}, x_{190}$$

$$d_{191}, x_{191}$$

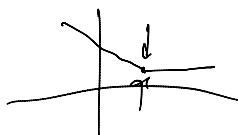
$$d_{192}, x_{192}$$

$$d_{193}, x_{193}$$

$$d_{194}, x_{19$$



$$\begin{aligned}
 \Phi(a)^T \Phi(b) &= \begin{bmatrix} a_1^2 \\ \sqrt{2}a_1a_2 \\ a_2^2 \end{bmatrix}^T \begin{bmatrix} b_1^2 \\ \sqrt{2}b_1b_2 \\ b_2^2 \end{bmatrix} \\
 a = [a_1, a_2] & \\
 &= a_1^2 b_1^2 + 2a_1 a_2 b_1 b_2 + a_2^2 b_2^2 \\
 &= (a_1 b_1)^2 + 2a_1 a_2 b_1 b_2 + (a_2 b_2)^2 \\
 &= (a_1 b_1 + a_2 b_2)^2 \\
 &= \left(\begin{bmatrix} a_1 \\ a_2 \end{bmatrix}^T \begin{bmatrix} b_1 \\ b_2 \end{bmatrix} \right)^2 \\
 &= (a^T \cdot b)^2
 \end{aligned}$$



Mercer's Theorem

$k(a, b)$

- Continuous
- Symmetric

$$k(a, b) = k(b, a)$$

$\phi(a, b)$ exists \Rightarrow (

high
dimensional

\emptyset (a, b) exists \Rightarrow ()
not distinct

$$k(a,b) = (a^T b + r)^d$$

$$(a \times b + \frac{r}{2})^d = a^T b^2 + \frac{1}{a} + ab$$

$$= \begin{bmatrix} a^T & \frac{1}{2} & a \end{bmatrix}^T \cdot \begin{bmatrix} b^2 & \frac{1}{2} & b \end{bmatrix} \quad \begin{bmatrix} a^T \\ \frac{1}{2} \\ a \end{bmatrix}^T \begin{bmatrix} b^2 \\ \frac{1}{2} \\ b \end{bmatrix} =$$

$$\left[a, a^2, \frac{1}{2} \right] \cdot \left[b, b^2, \frac{1}{2} \right]$$

$$a^T b^2 + \frac{1}{a} + ab$$

$$k(a, b) = \exp\left(-\frac{(a-b)^2}{2\sigma^2}\right)$$

$$= \exp\left(-\frac{1}{\lambda} (a-b)^2\right) \quad \lambda = -2$$

$$= e^{-\lambda} e^{-\frac{1}{\lambda} (a^2 + b^2 + 2ab)} = e^{-\frac{1}{\lambda} (a^2 + b^2)} e^{-\frac{2}{\lambda} ab}$$

$$= e^{-\frac{1}{2} (a^2 + b^2)} e^{ab} \xrightarrow{\text{infinite terms}}$$

Taylor series $\left[e^a = 1 + \frac{1}{1!} a^1 + \frac{1}{2!} a^2 + \frac{1}{3!} a^3 \dots + \frac{1}{n!} a^n \right]$

$$e^{ab} = 1 + \frac{1}{1!} (ab) + \frac{1}{2!} (ab)^2 + \frac{1}{3!} (ab)^3 \dots + \frac{1}{n!} (ab)^n$$

$$e^{-\frac{1}{2} (a-b)^2} = e^{-\frac{1}{2} (a^2 + b^2)} \left[1 + \frac{1}{1!} ab + \frac{1}{2!} (ab)^2 + \frac{1}{3!} (ab)^3 \dots + \frac{1}{n!} (ab)^n \right]$$

$$= 1 + \frac{1}{1!} ab + \frac{1}{2!} (ab)^2 + \frac{1}{3!} (ab)^3 \dots + \frac{1}{n!} (ab)^n$$

$$= \left[\int s, \int s \sqrt{\frac{1}{1!} ab} \quad \int \sqrt{\frac{1}{2!} (ab)^2} \dots \right] \cdot \left[\int s, \int s \frac{1}{1!} ab \quad \int \frac{1}{2!} (ab)^2 \dots \right]$$

