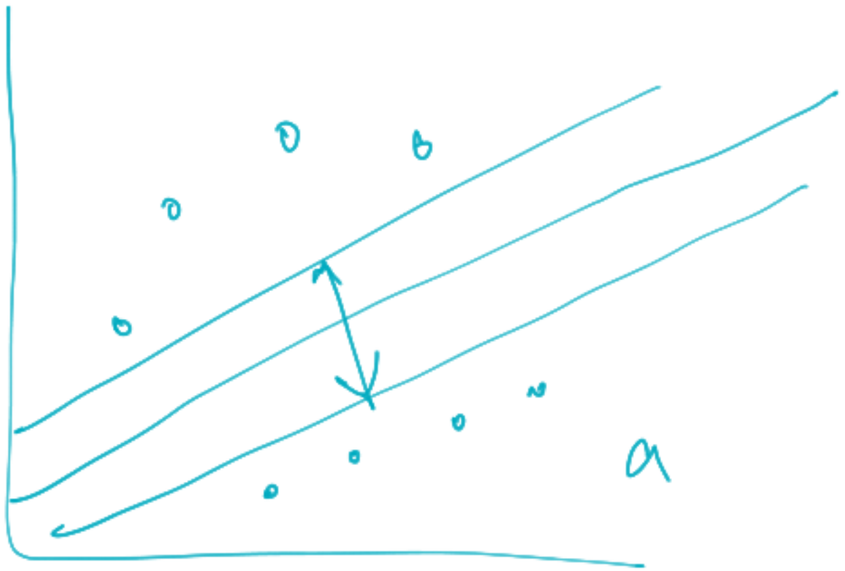
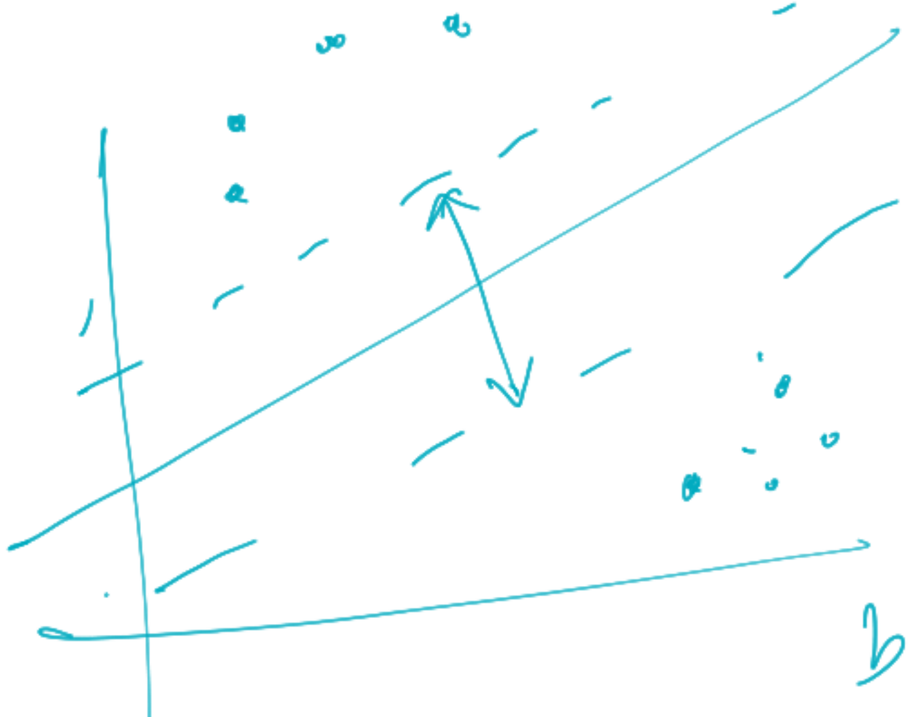


a



b

class 1

≥ 1

> 0

< 0

< -1

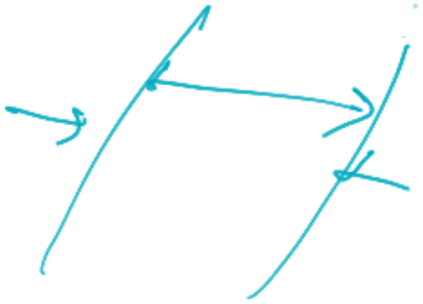
class 0

$w^T x + c = 1$

bf

$w^T x + c = -1$

$y = mx + c$



$$y = m x + c$$

$$= m_1 x_1 + m_2 x_2 + m_3 x_2 \ldots + m_n x_n + c$$

$$= [m]_{1 \times n} [x]_{1 \times n} + 0$$

$$= \boxed{m^T} x + c = w^T x + c$$

$n \times 1 \quad 1 \times n$

$w^T x_1 + b = 1$

$w^T x_2 + b = -1$

vector → mag, dirn

$$w^T (x_1 - x_2) = 2$$

$$\frac{w^T (x_1 - x_2)}{\|w^T\|} = \frac{2}{\|w^T\|}$$

wts: (w, x)

max: $\frac{2}{\|w^T\|}$

max = num / den

min = den / num

2 / 10 ↓ = 0.2

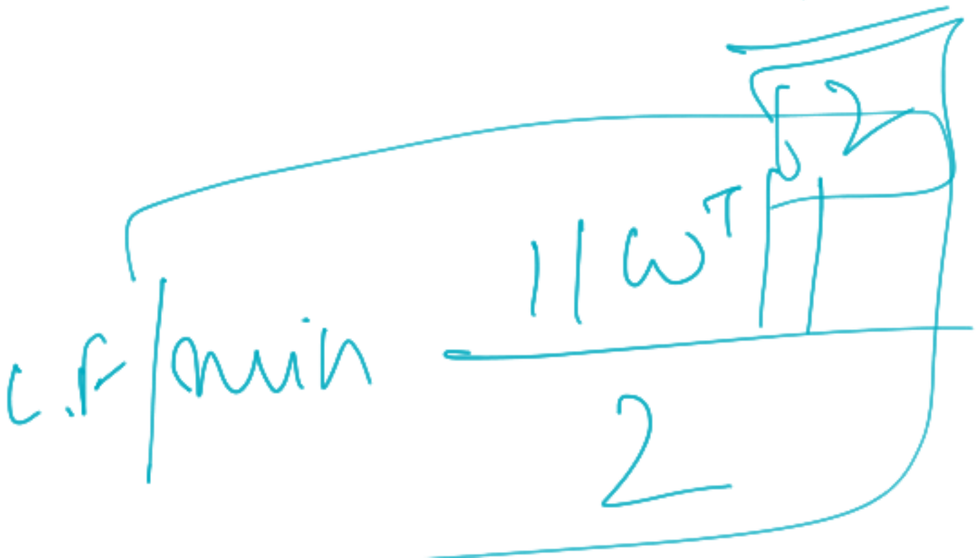
2 / 20 = 0.1 ↓

den ↑ ↓

10 = 5

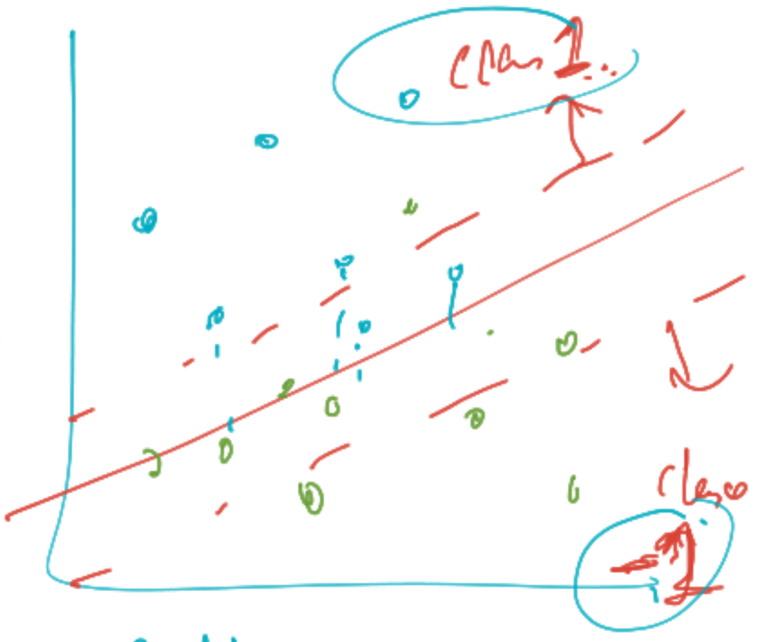
20 / 2 = 10

num ↑ sum ↑



$y_i = +1 \quad w^T x + b \geq 1$

$= -1 \quad w^T x + b \leq -1$



Soft margin

$y_* (w^T x + b) \geq 1$

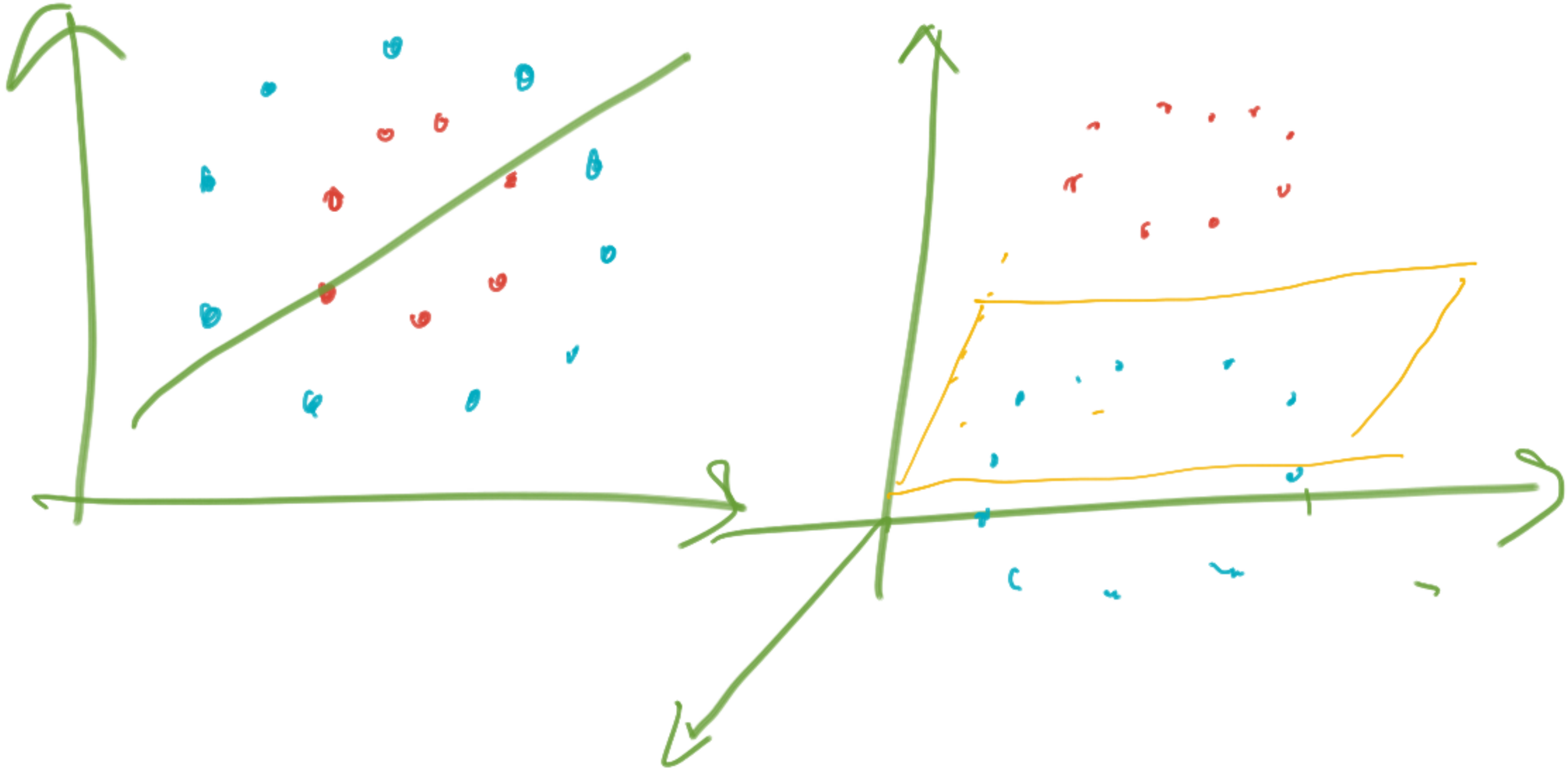
$$\text{s.t} : \min_{(w,b)} \frac{\|w^T\|}{2} + C \sum_{i=1}^{\omega} \xi_i$$

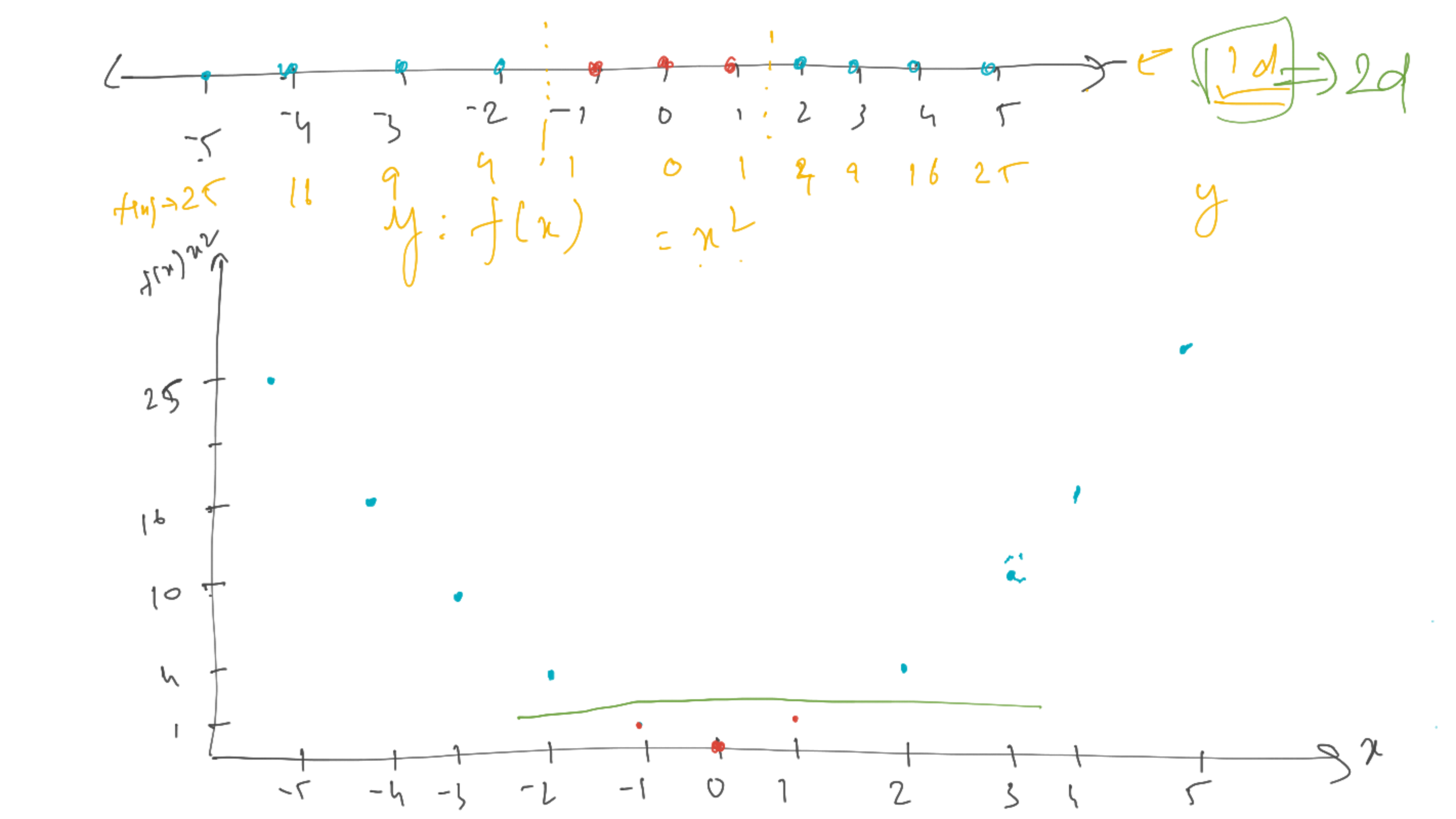
Kernels

- linear
- polynomial
- rbf
- sigmoid

low ⇒ high

$x \Rightarrow f(x)$




1d → 2d
-5 -4 -3 -2 -1 0 1 2 3 4 5
f(x) → 25 16 9 4 1 0 1 4 9 16 25
y : f(x) = x²
y
f(x) = x²
25
16
10
4
1
x
-5 -4 -3 -2 -1 0 1 2 3 4 5

Polynomial:

$$K(x, y) = (x^T y + c)^d$$

$x_1 \quad x_2$

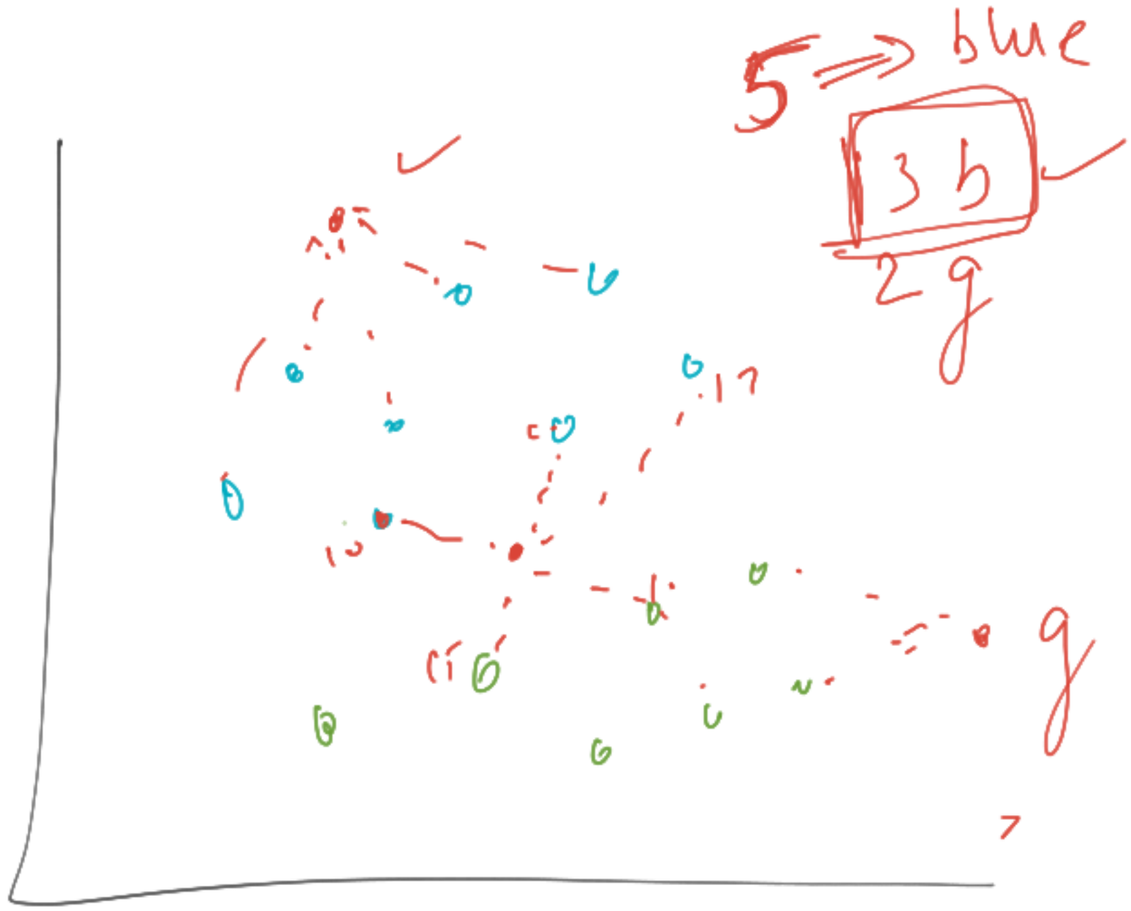
$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}_{2\times 1} \begin{bmatrix} x_1 & x_2 \end{bmatrix}_{1\times 2} = \begin{bmatrix} x_1^2 & x_1 x_2 \\ x_1 x_2 & x_2^2 \end{bmatrix}_{2\times 2}$$

$x_1, x_2 \Rightarrow x_1^2 \quad x_2^2 \quad x_1 x_2$ 5 d

RBf

$$K(x, x') = \exp\left(\frac{\|x - x'\|^2}{2\sigma^2}\right)$$

K - nearest neighbour. odd



avg (< point) ≥ neg.