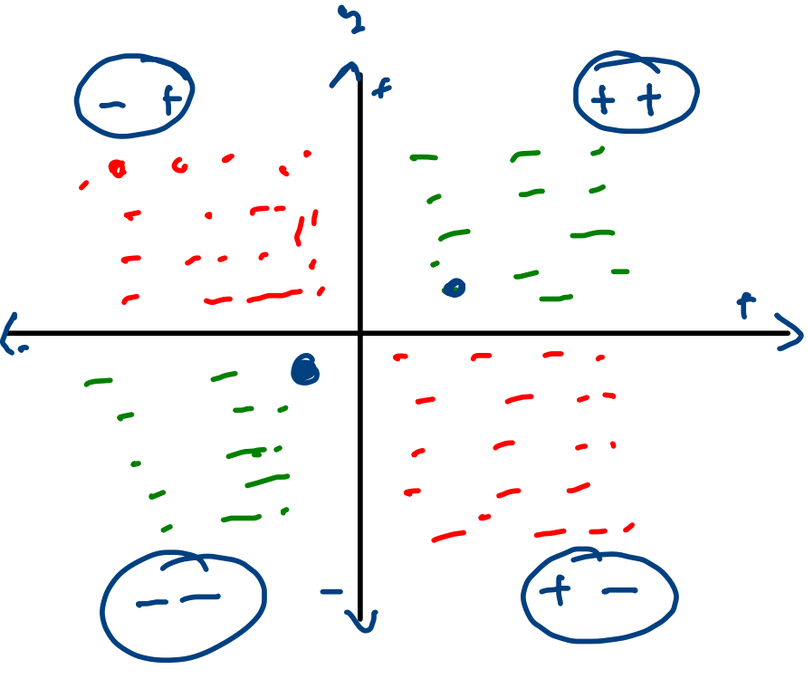
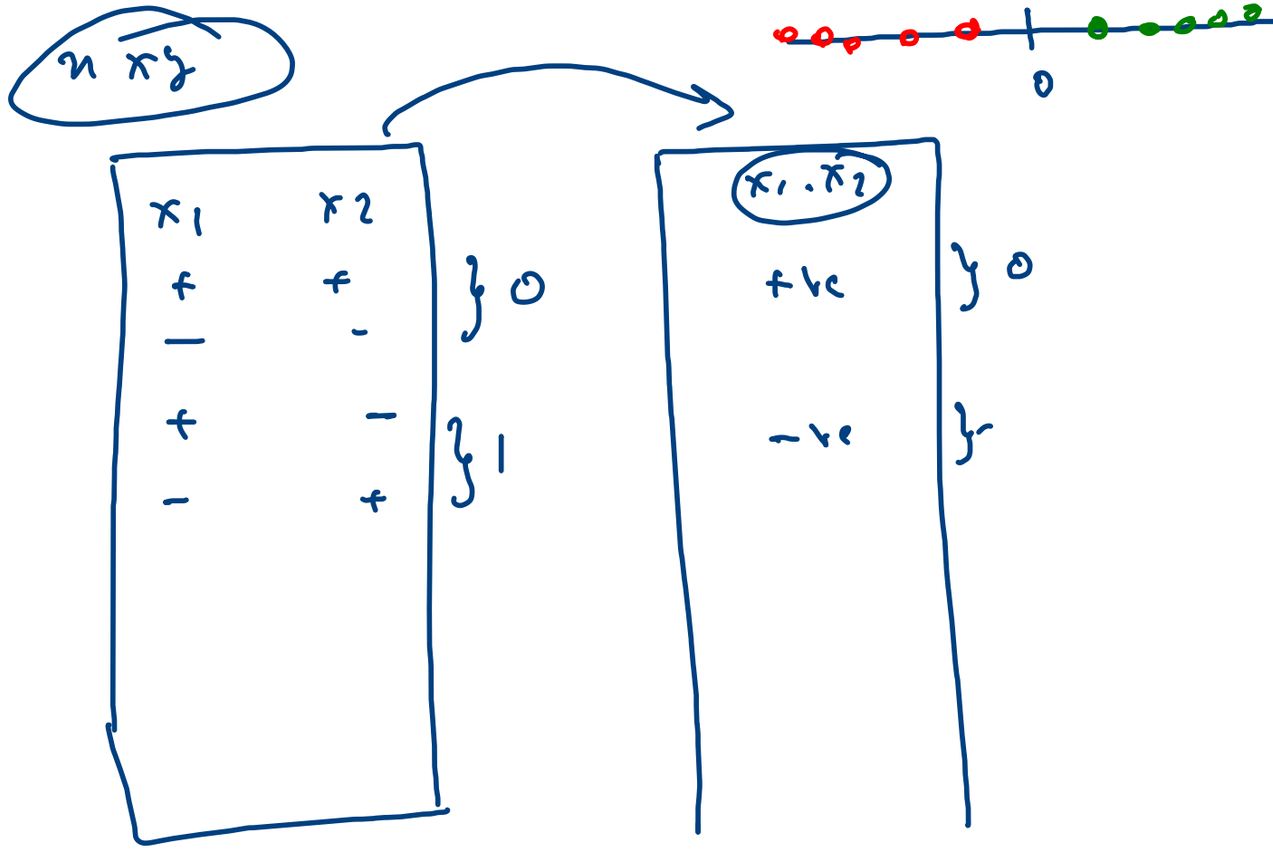
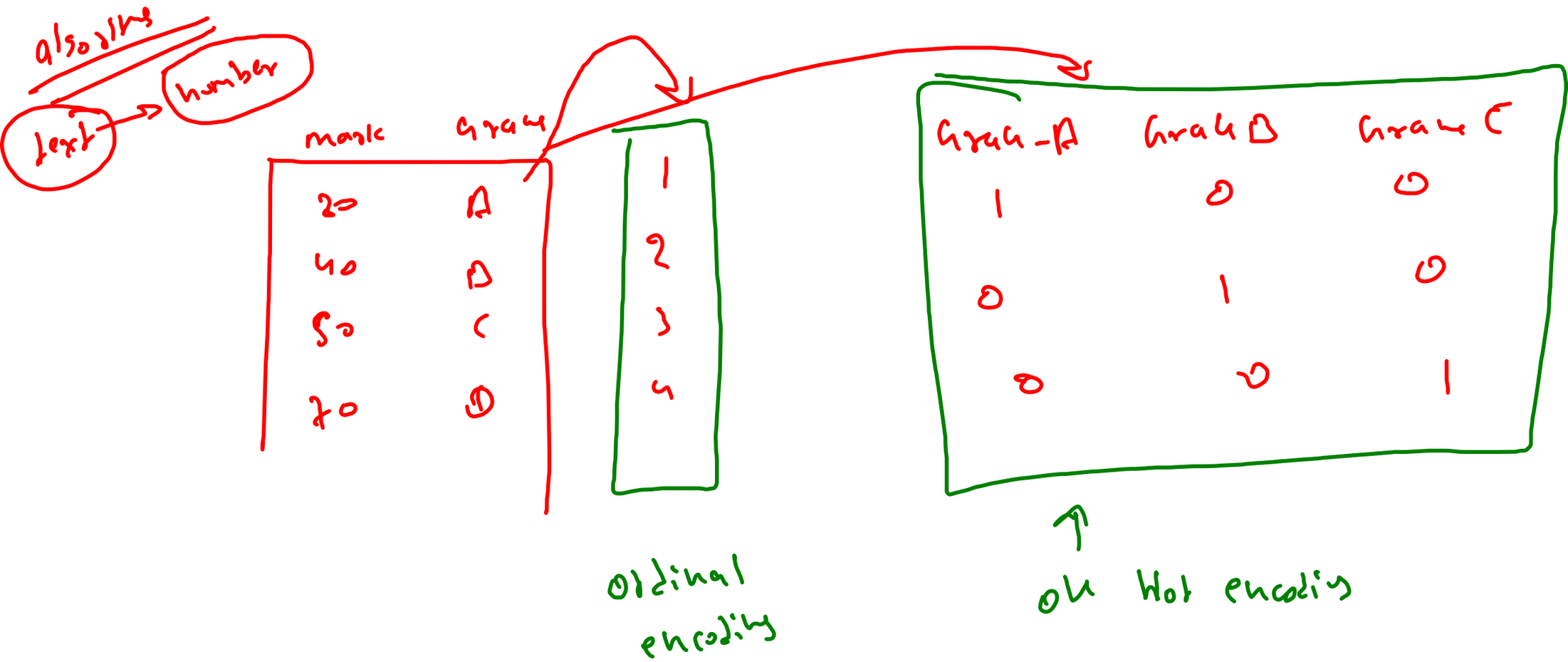
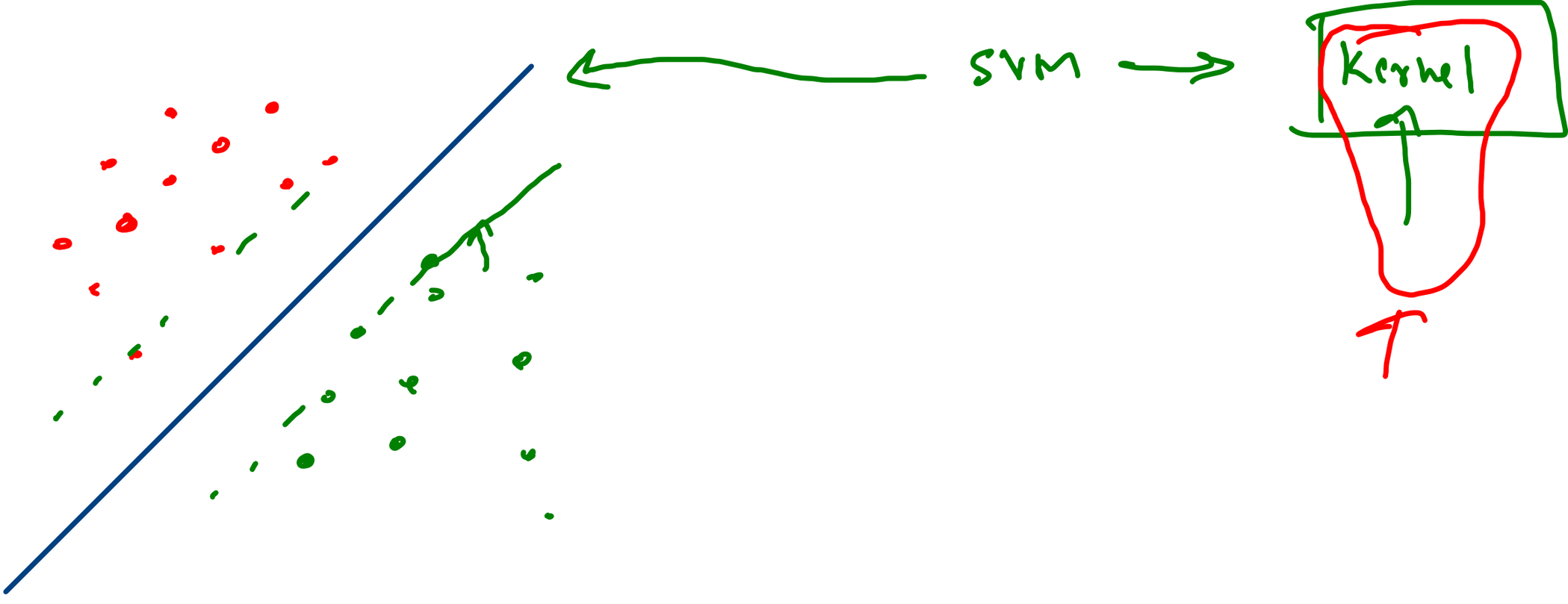
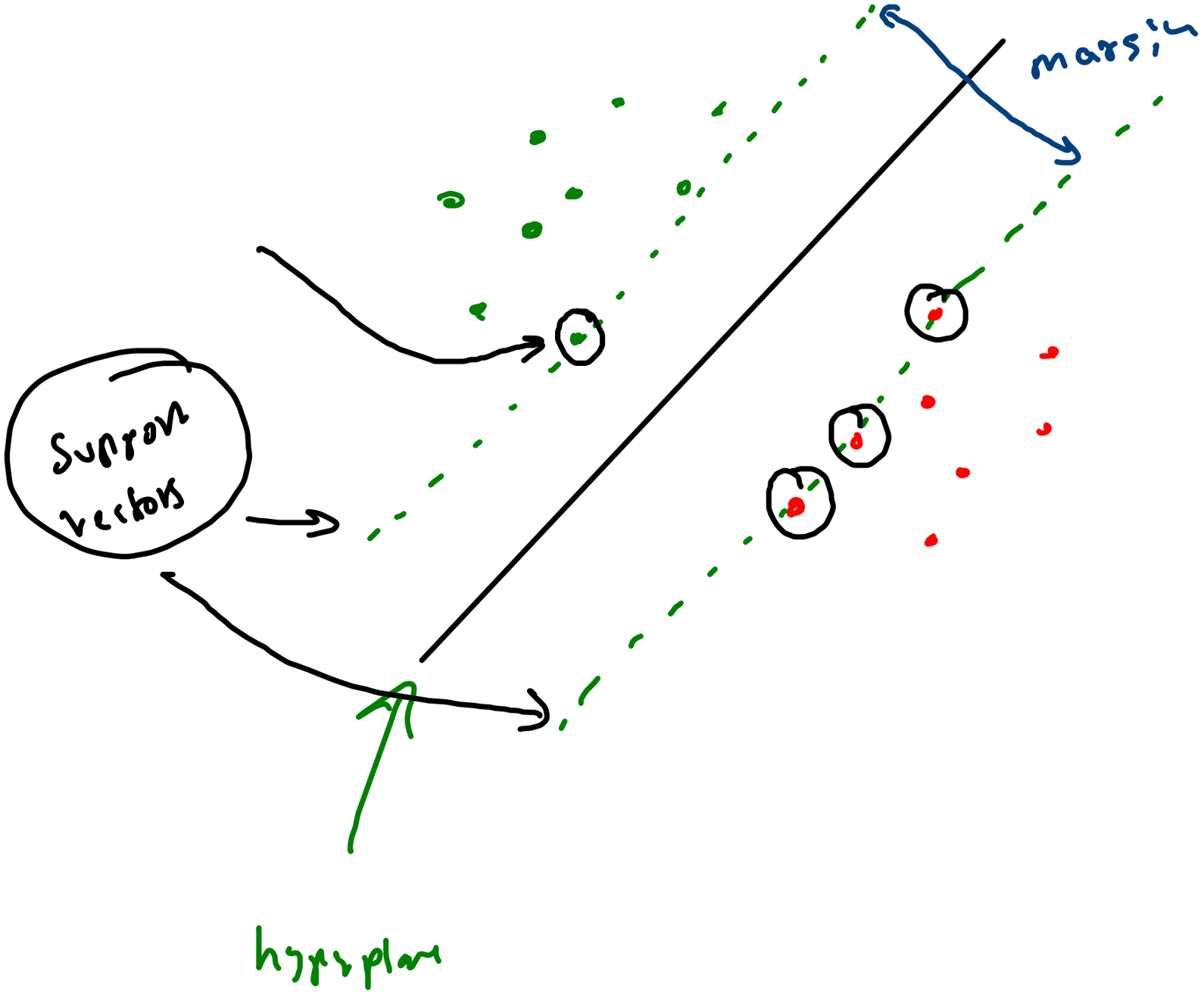

y
x
- +
+ +
- -
+ -

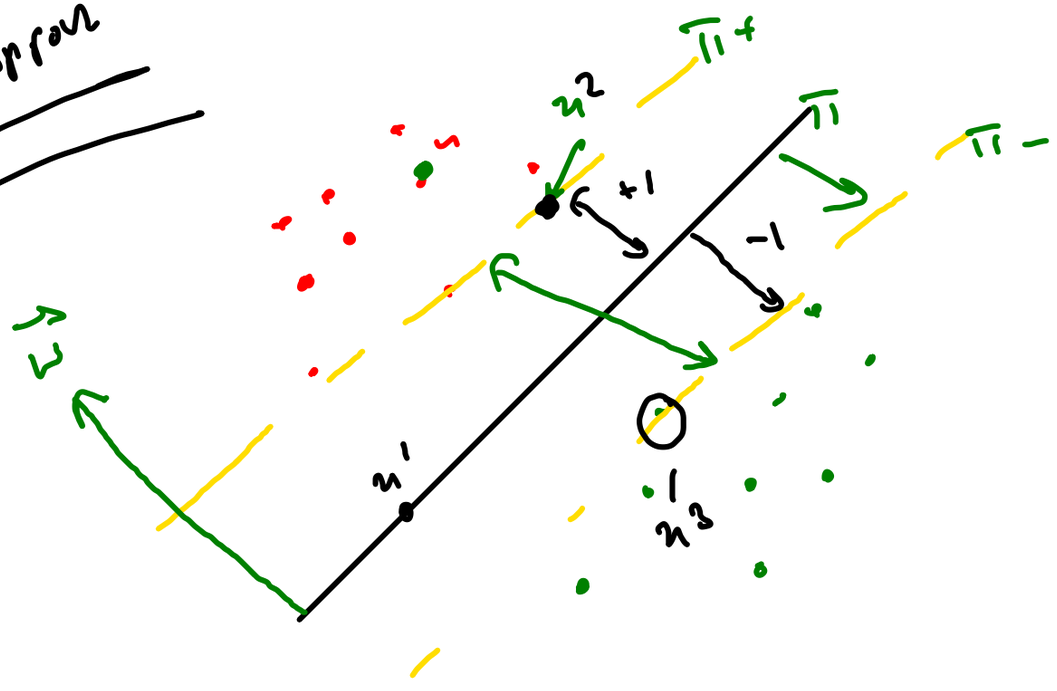

n x y
x1 x2
+ +
- -
+ -
- +
0
1
x1 . x2
+ve
-ve
0
0


also like
text
number
marks
grade
20
40
50
70
A
B
C
D
1
2
3
4
grade-A
grade B
grade C
1
0
0
0
1
0
0
0
1
Ordinal encoding
One Hot encoding


SVM
Kernel


margin
Support vectors
hyperplane

distance between support vectors



distance $= \vec{w}\cos\theta + b$

$= w^T x + b$

π	$w^T x_1 + b = 0$
$\pi+$	$w^T x_2 + b = +1$
$\pi-$	$w^T x_3 + b = -1$

$\pi_+ - \pi_-$ $=$ $w^T x_2 + b = 1$

$- \quad w^T x_3 - b = +1$

$w^T(x_2 - x_3) + 0 = 2$

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

distance

why focus

+1, -1 distance

w^T is not unit vector

π_+

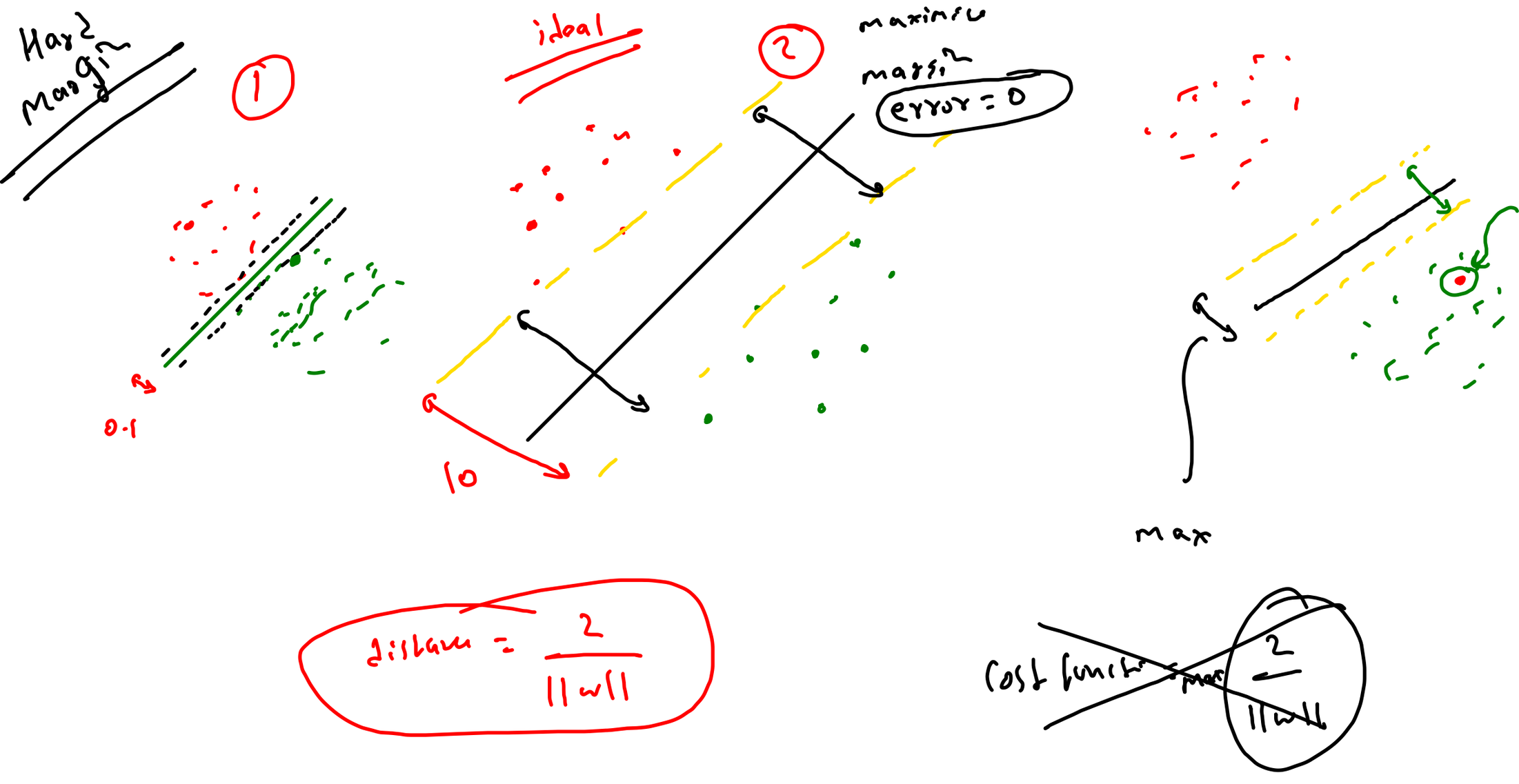
$$w^T x_2 + b = k$$

$$\frac{w^T x_2 + b}{k} - \frac{}{k} = 1$$

$$\frac{k w^T x_2}{k} + b' = 1$$

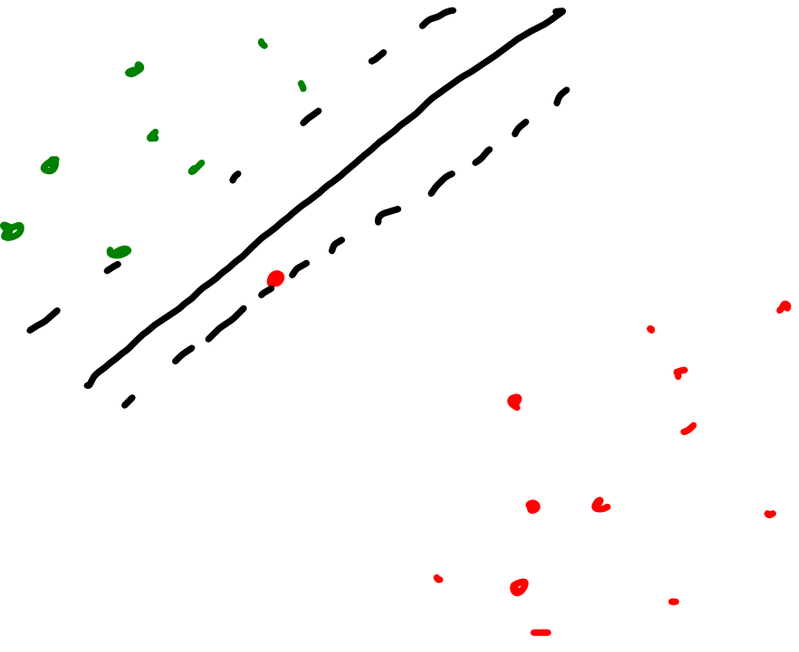
$$\downarrow$$

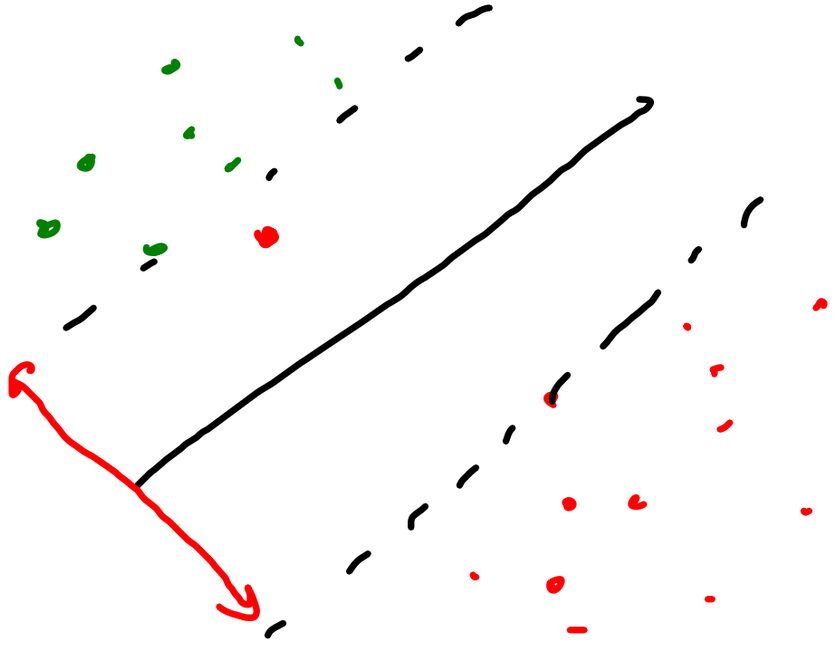
$$w^T x_2 + b' = 1$$



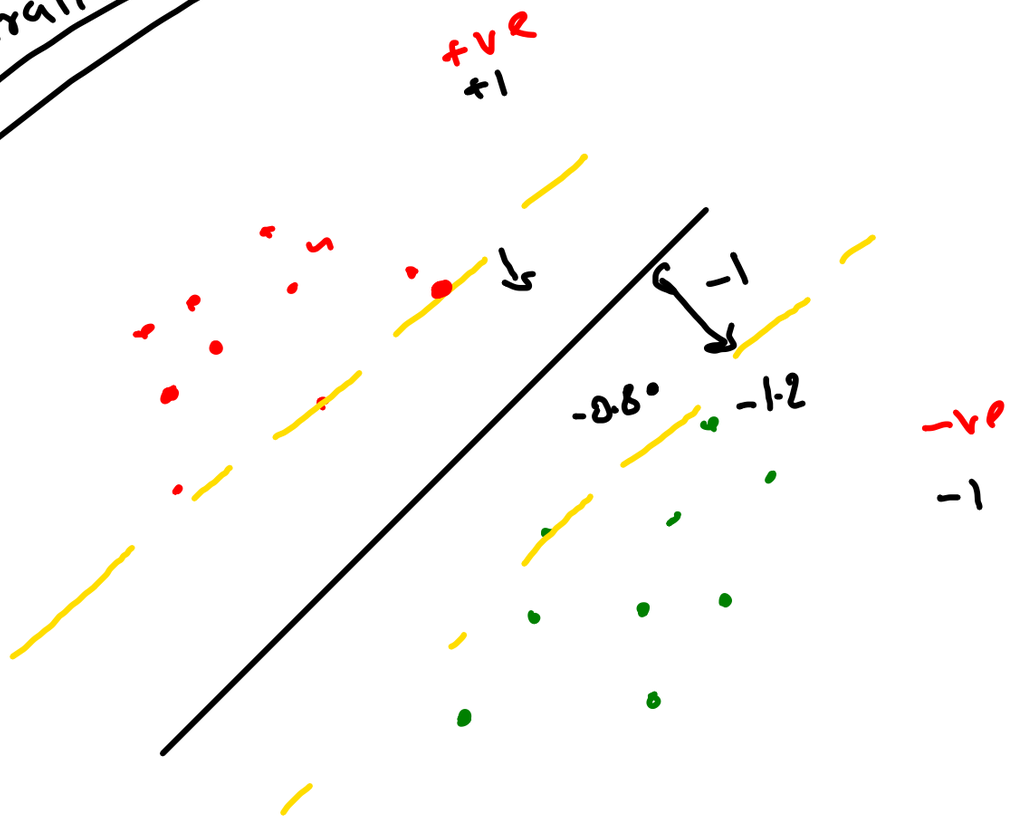
$$\text{distance} = \frac{2}{\|w\|}$$

cost function = max $\frac{2}{\|w\|}$





Generalize



if x is +ve

Actual

$y = +1$

$w^T x + b \geq 1$ ✓✓

$w^T x + b < 1$ ✗

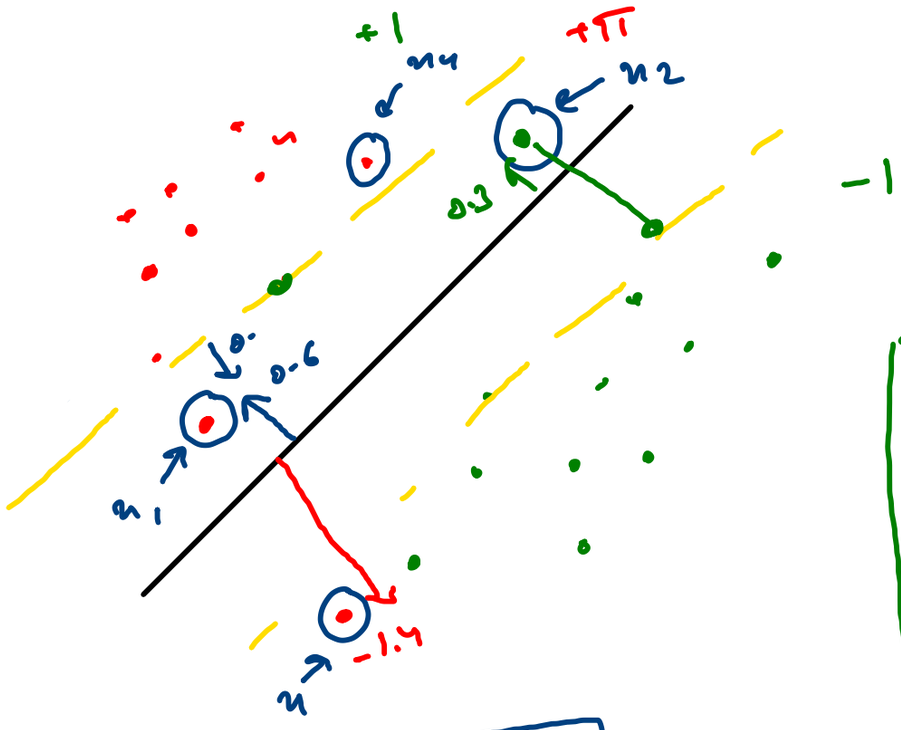
$y_i (w^T x + b) \geq 1$ ✓✓

$y_i (w^T x + b) < 1$ wrong

$y_i = -1$

$-(w^T x + b) \leq -1$ ✓✓

$w^T x + b > -1$ ✗



$y = +1$

$y = -1$

$y_i(w^T x_3 + b) = -1.4$

$= 1 - (2.4)$

error

$y_i(w^T x_1 + b) < 1$

1×0.6

$0.6 <$

$1 - (0.4)$

error

$y_i(w^T x + b) = 1.2$

$1 \times 1.2 = 1 - (-0.2)$

-2

correctly $z < 0$

wrong $z > 0$

$y_i(w^T x_2 + b) = -0.3$

$= 1 - (1.3)$

error

$-1.4 = 1 - x$ (error)

$x = 1 + 1.4$

$= 2.4$

2nd z

Cost function = $\begin{cases} 0 & y_i(w^T x + b) \geq 1 \\ z & y_i(w^T x + b) < 1 = 1 - (z) \end{cases}$

z → error

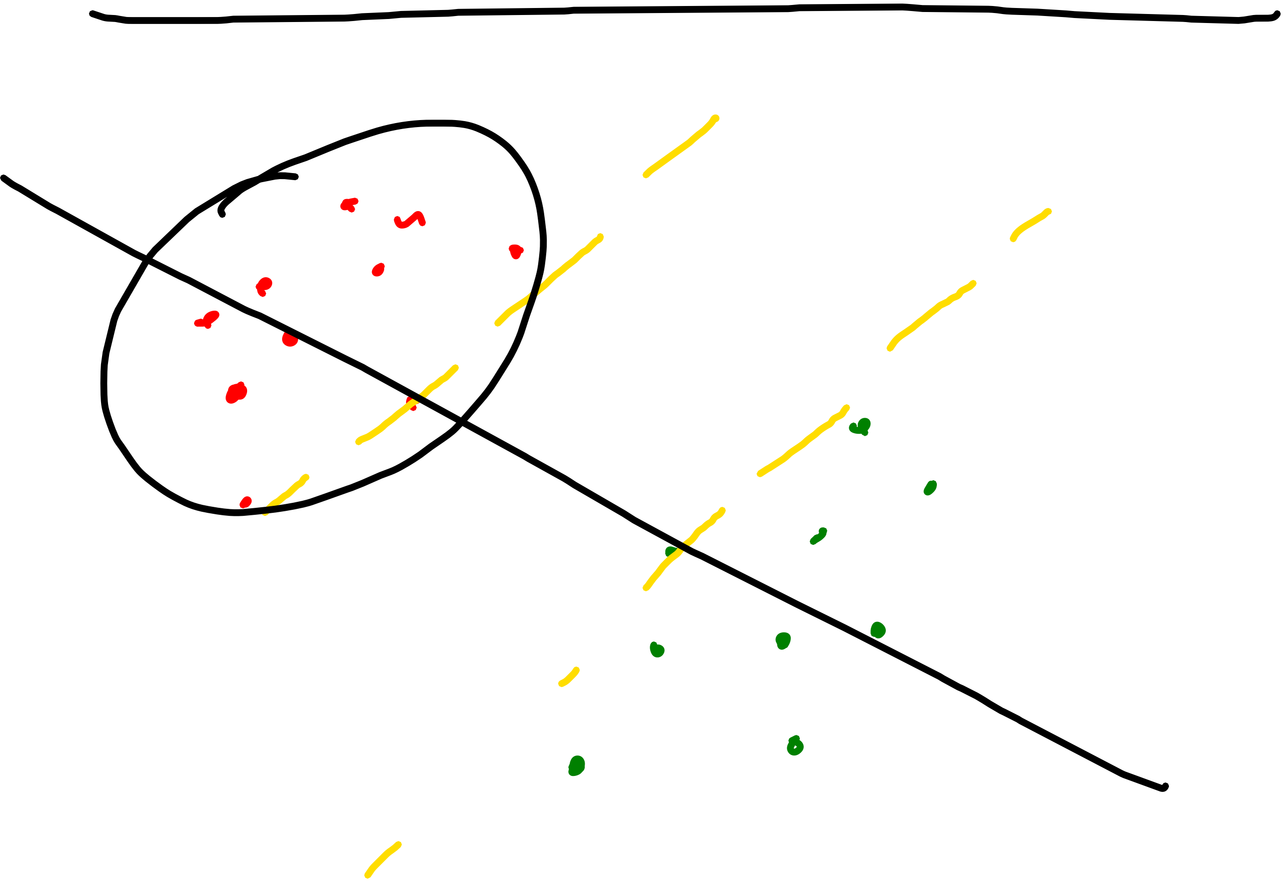
$$\text{Cost function} = \max\left(\frac{2}{\|w\|}\right) + C \min\left(\frac{1}{m}\sum_{i=1}^{m} z_i\right)$$

regularization

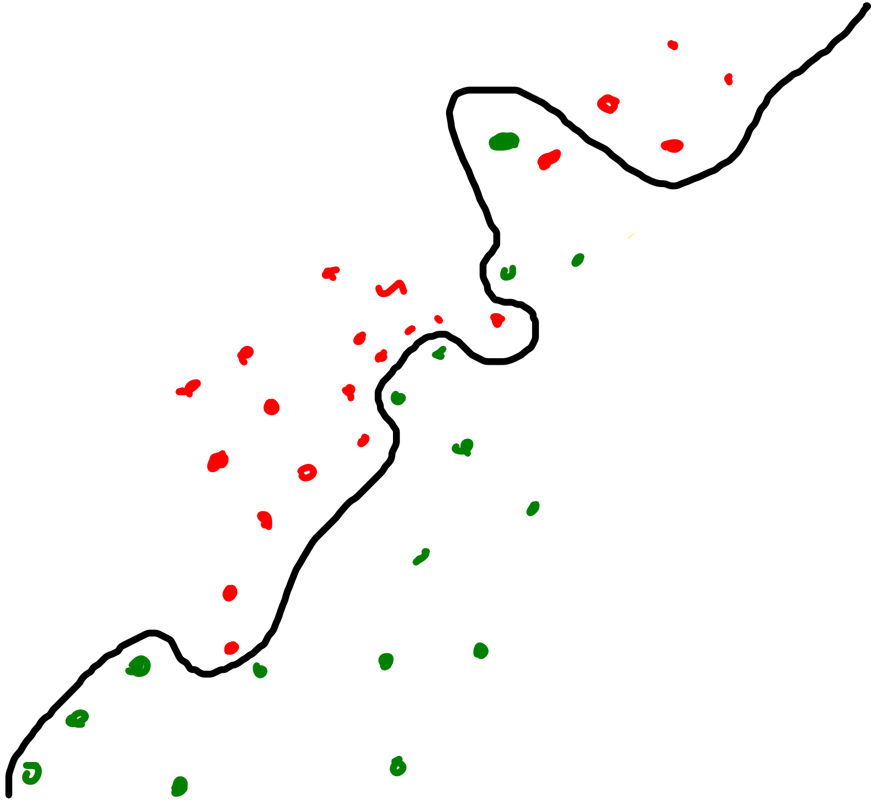
- $C = 0 \rightarrow$ underfit
- $C = \infty \rightarrow$ overfit

$C = 0$ → street width max

$C = \infty$ → min



underfit



overfit