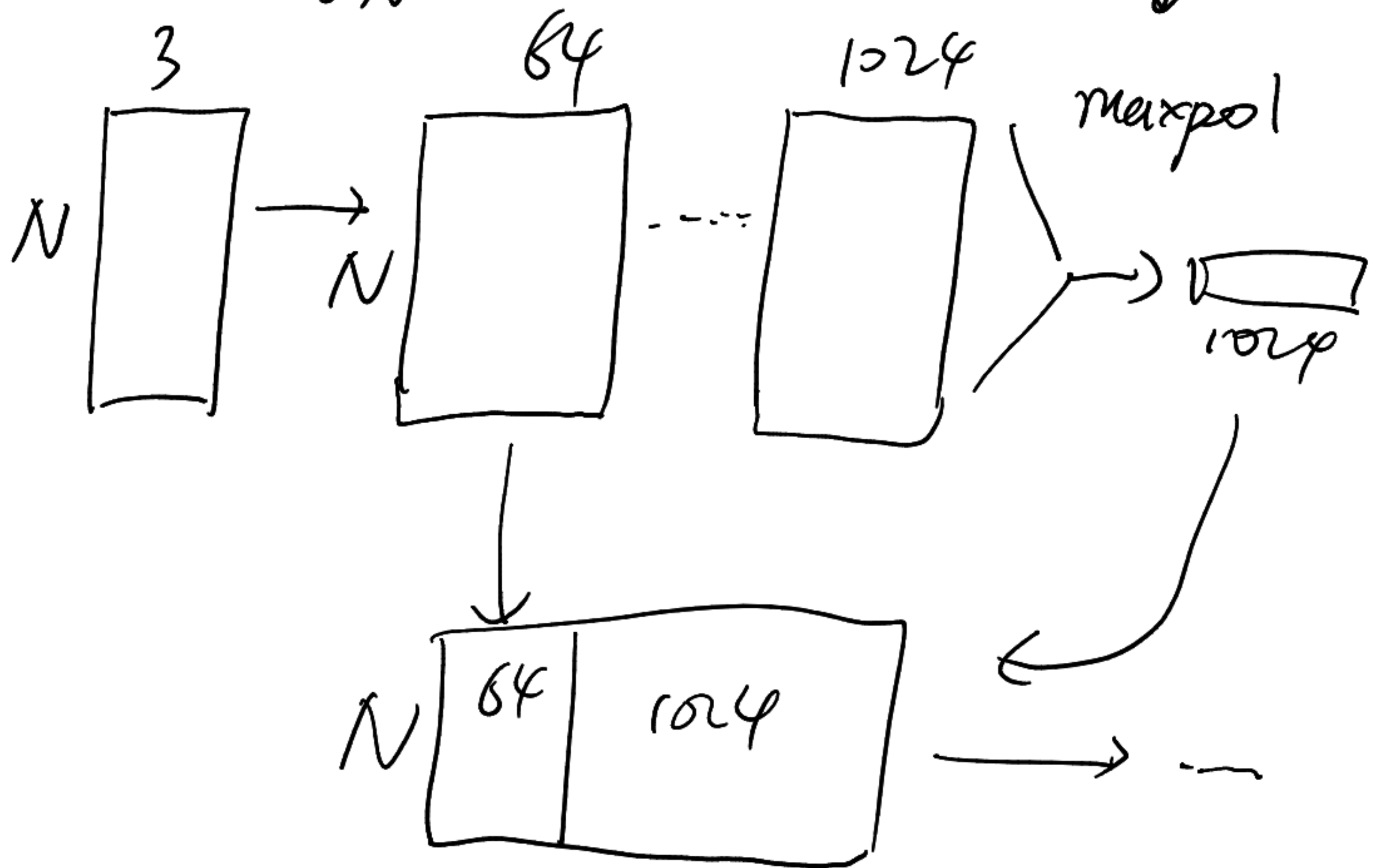


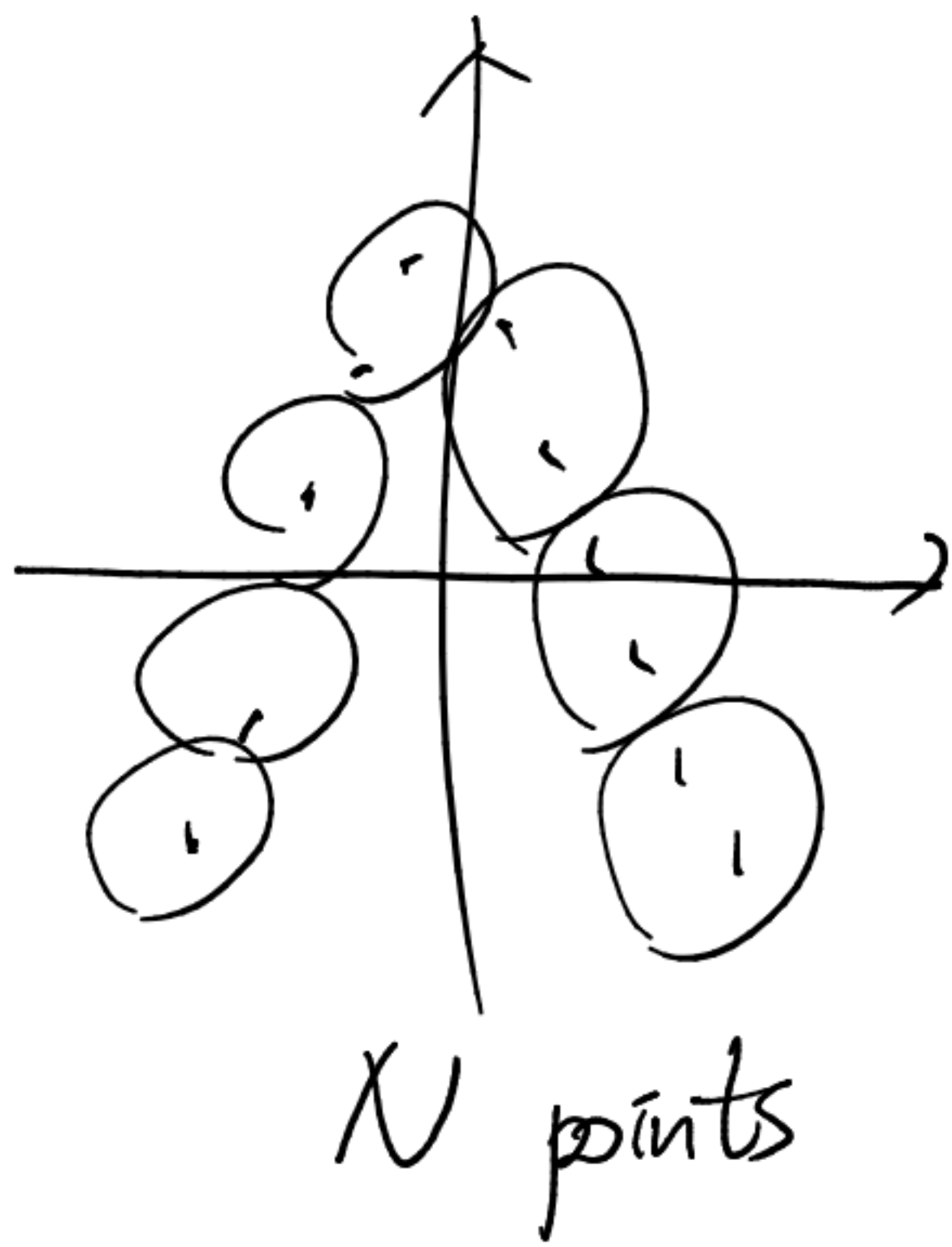
PointNet

$$f(x) = \max\{x_i\}$$

$$X = \{(x_i, y_i, z_i)\}_N$$

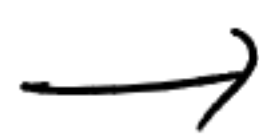


PointNet ++



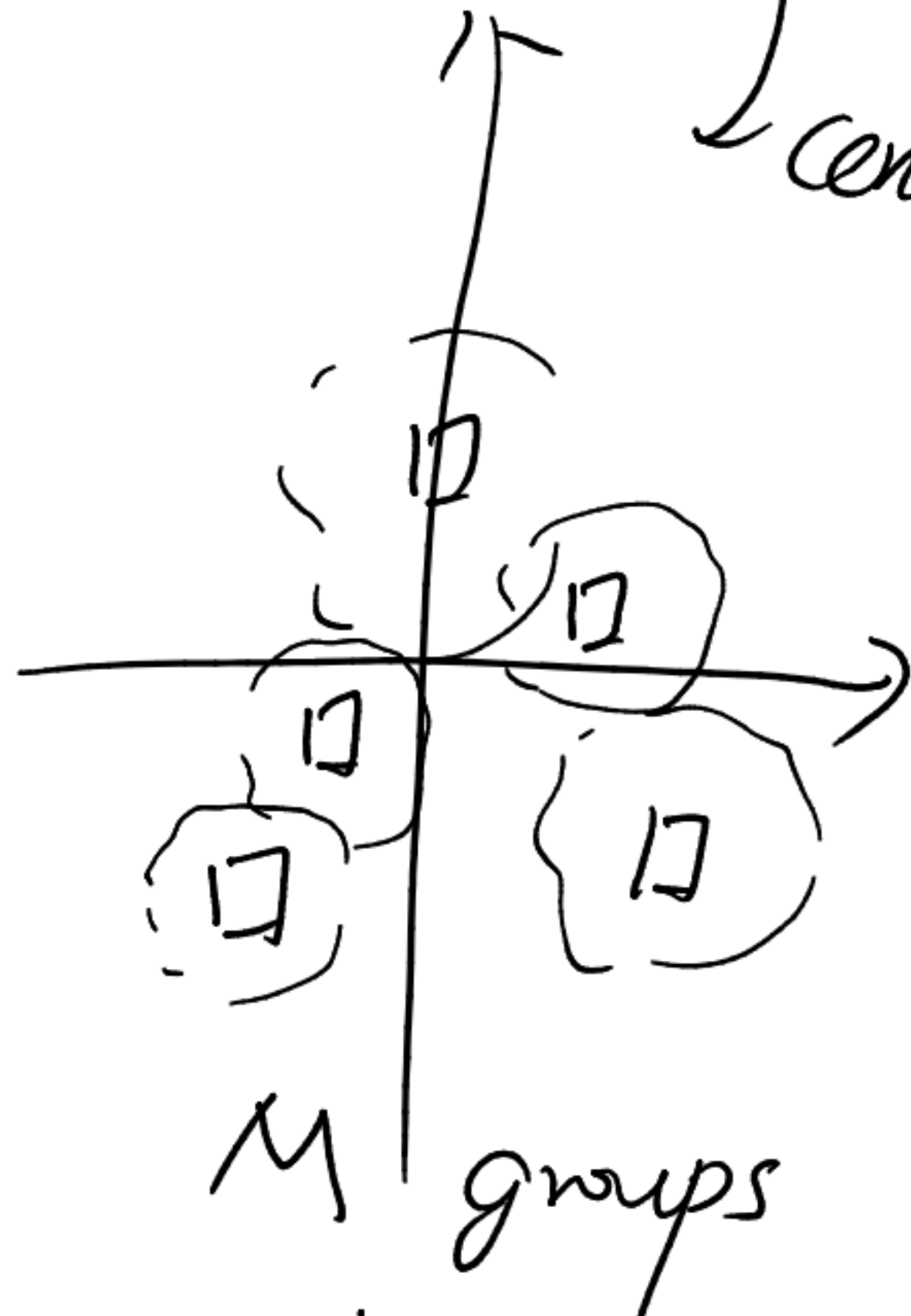
down sampling

group



farthest point sampling

centers



n points each
(n nearest points)

$$M \times n \geq N.$$

e.g. fix n . $\rightarrow M$

cover: $\{B_r(x) | x \in X, r \in \mathbb{R}\}$

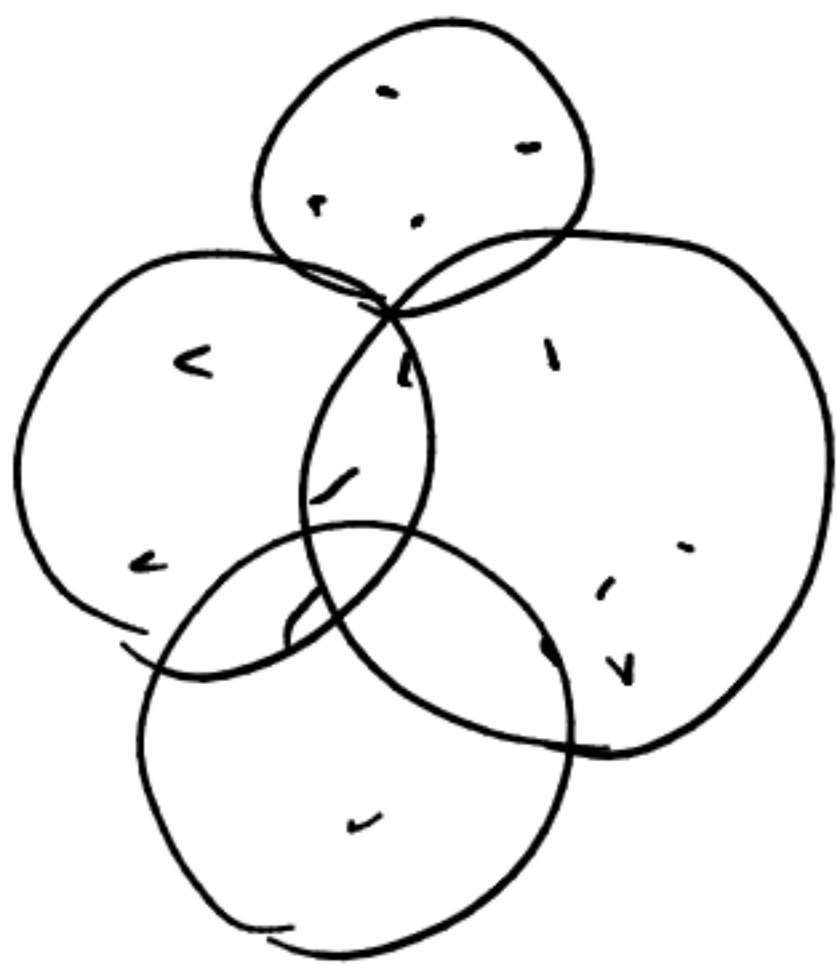
$X: [B, N, n, F]$

Batch

Number points

number points in group

Feature



f_{nn}

down, group



g_{nn}

up, interpolate

classification

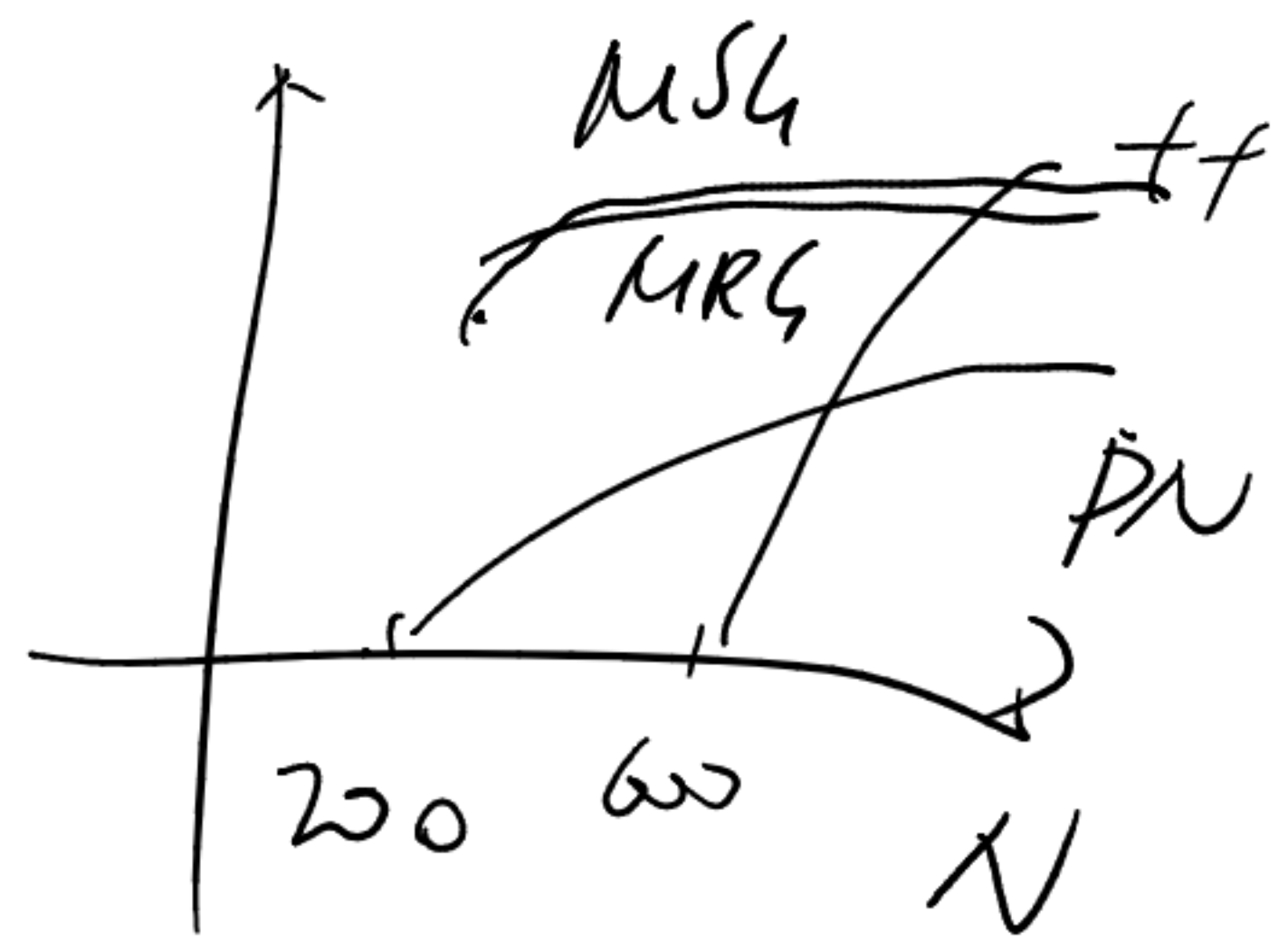
e.g. cat, dog.

segmentation



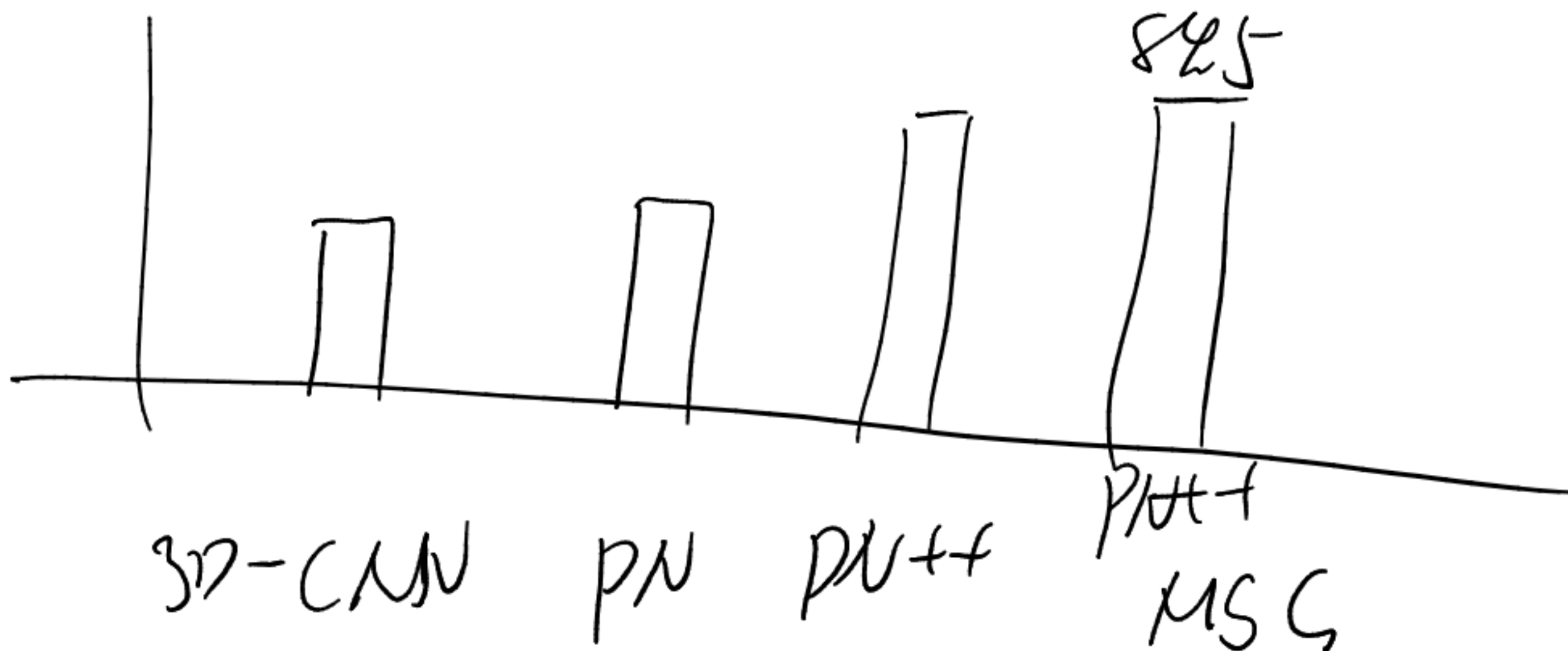
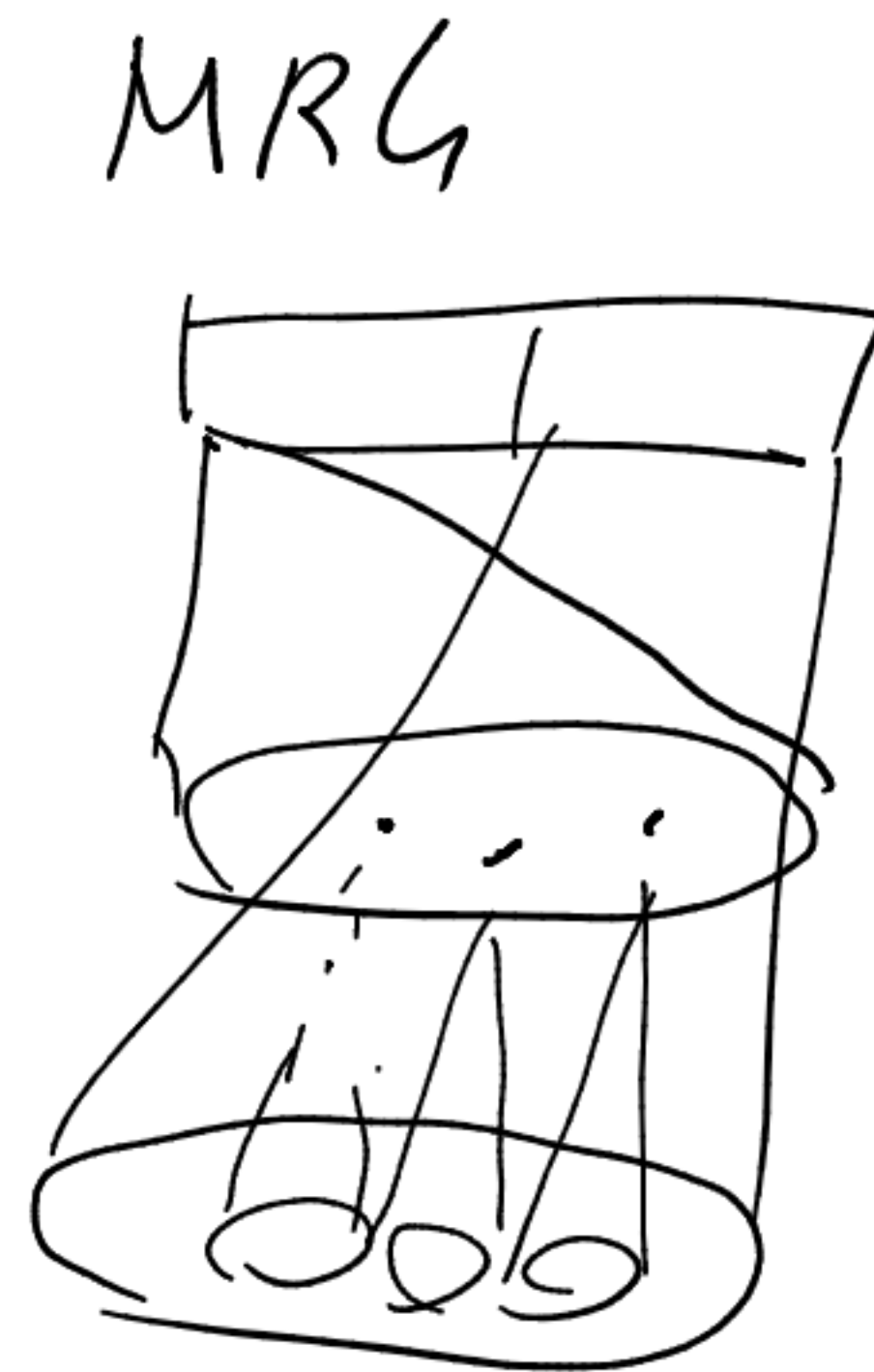
problem

$$N: N \quad \frac{N}{2} \quad \frac{N}{4}$$

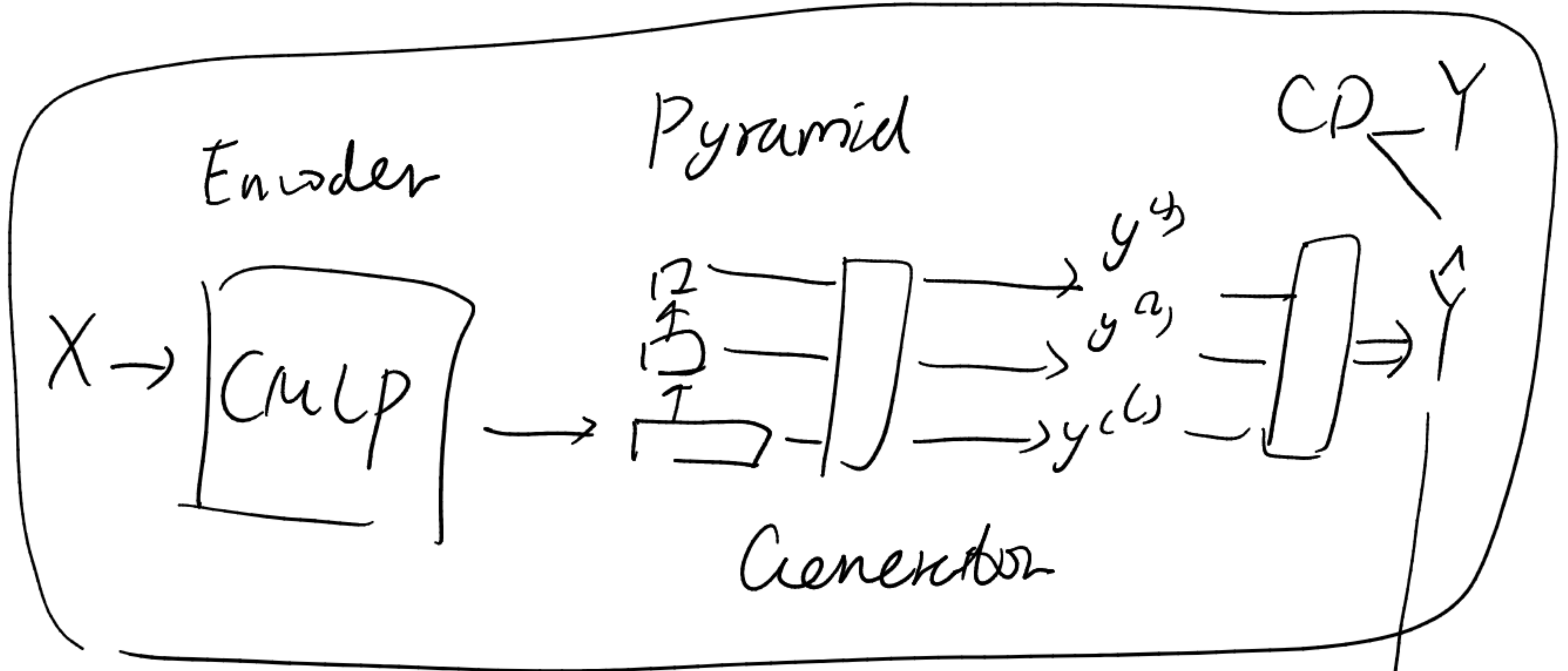
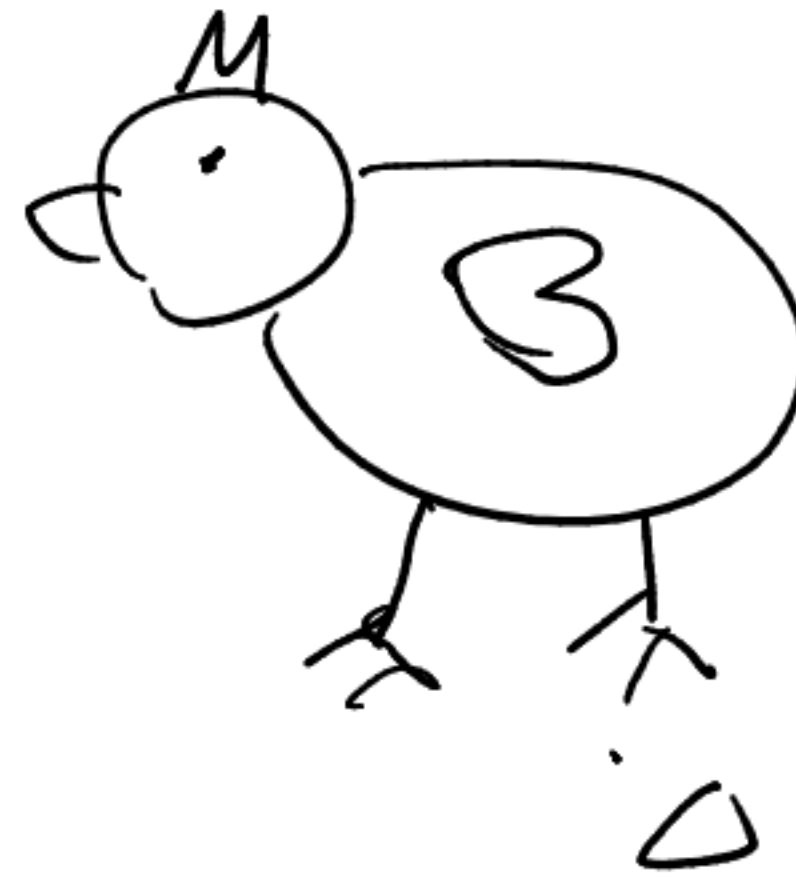


↓?

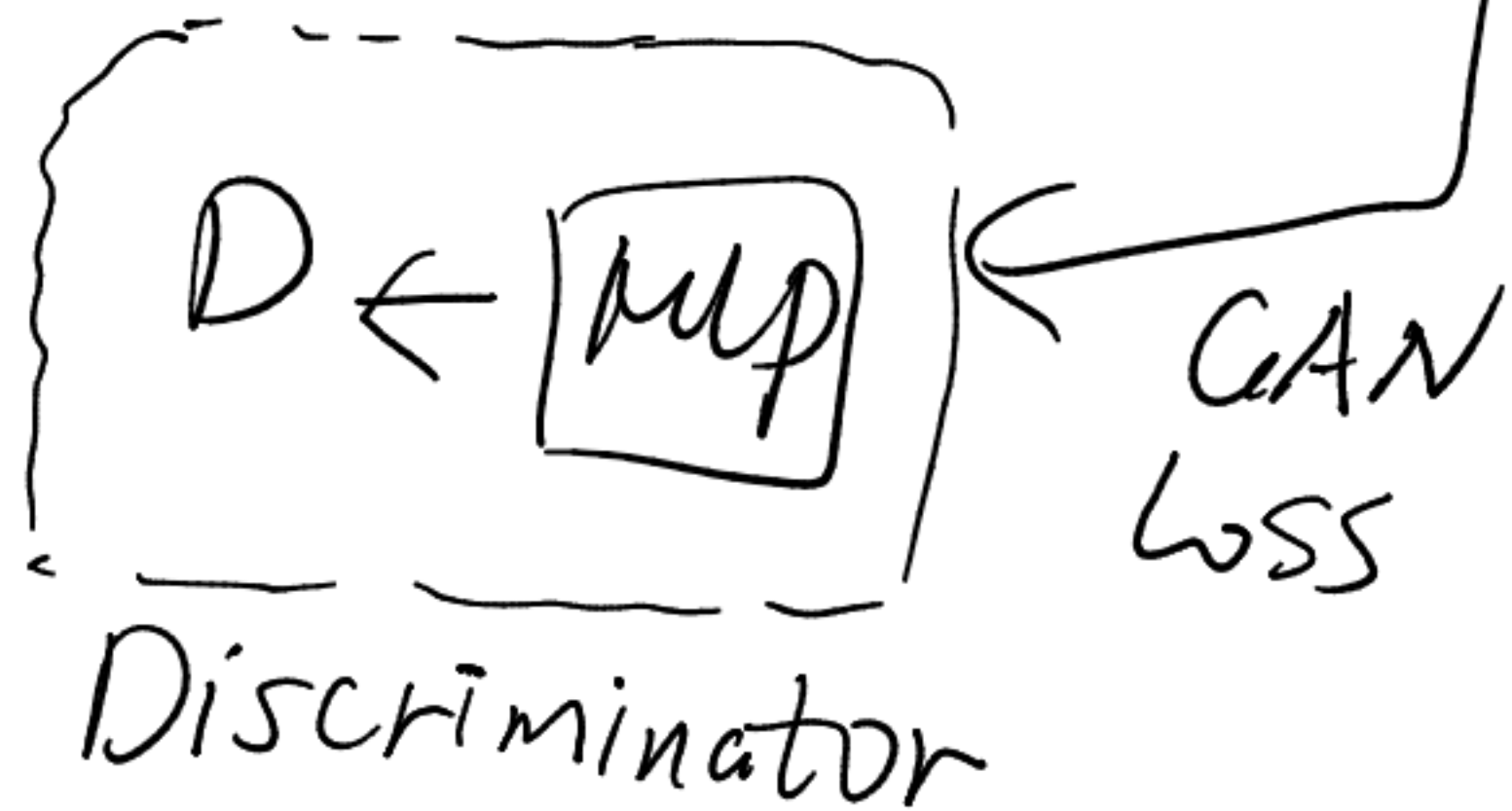
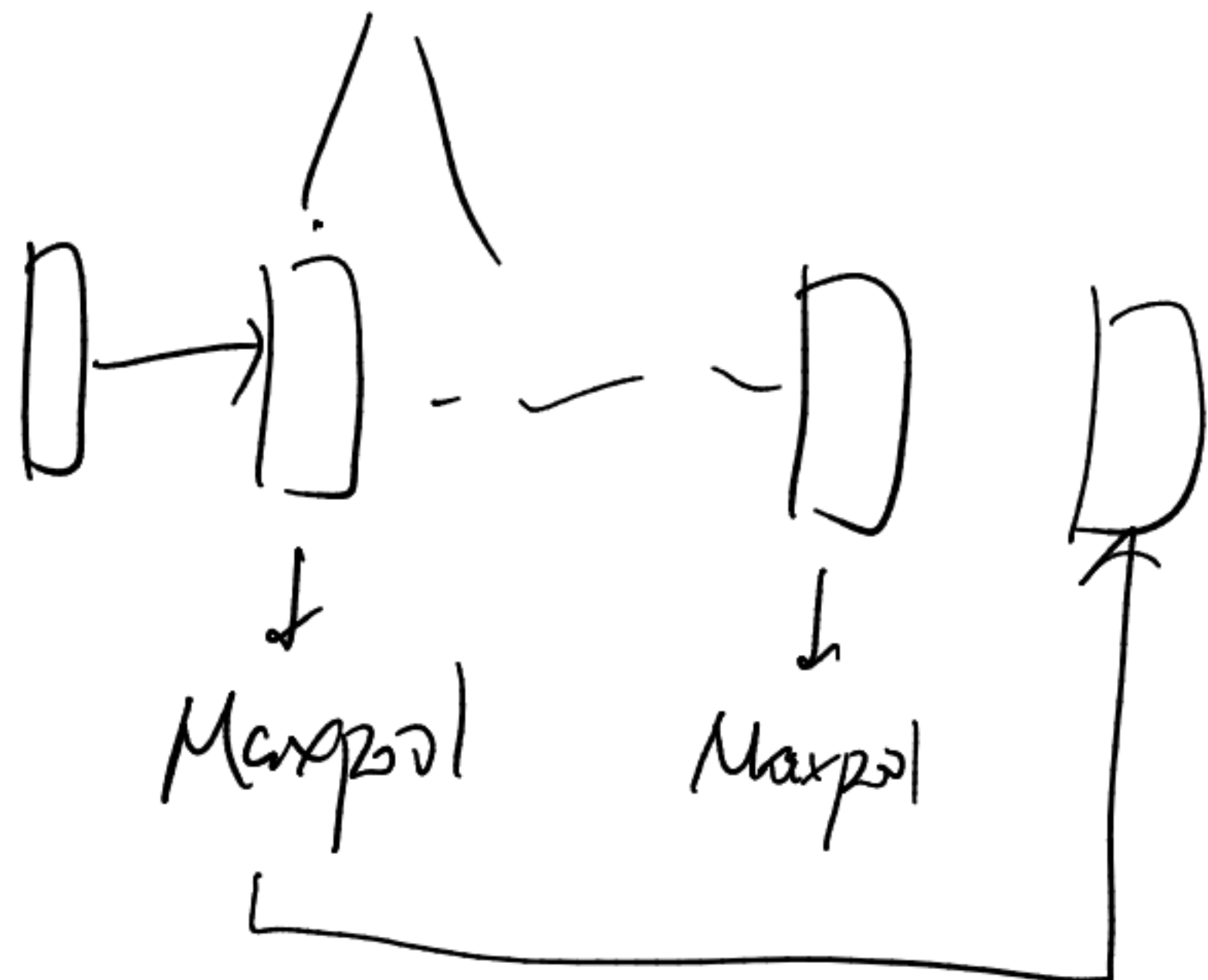
- ① Multi-scalar grouping (MSG)
- ② Multi-res grouping (MRG)



PF-Net

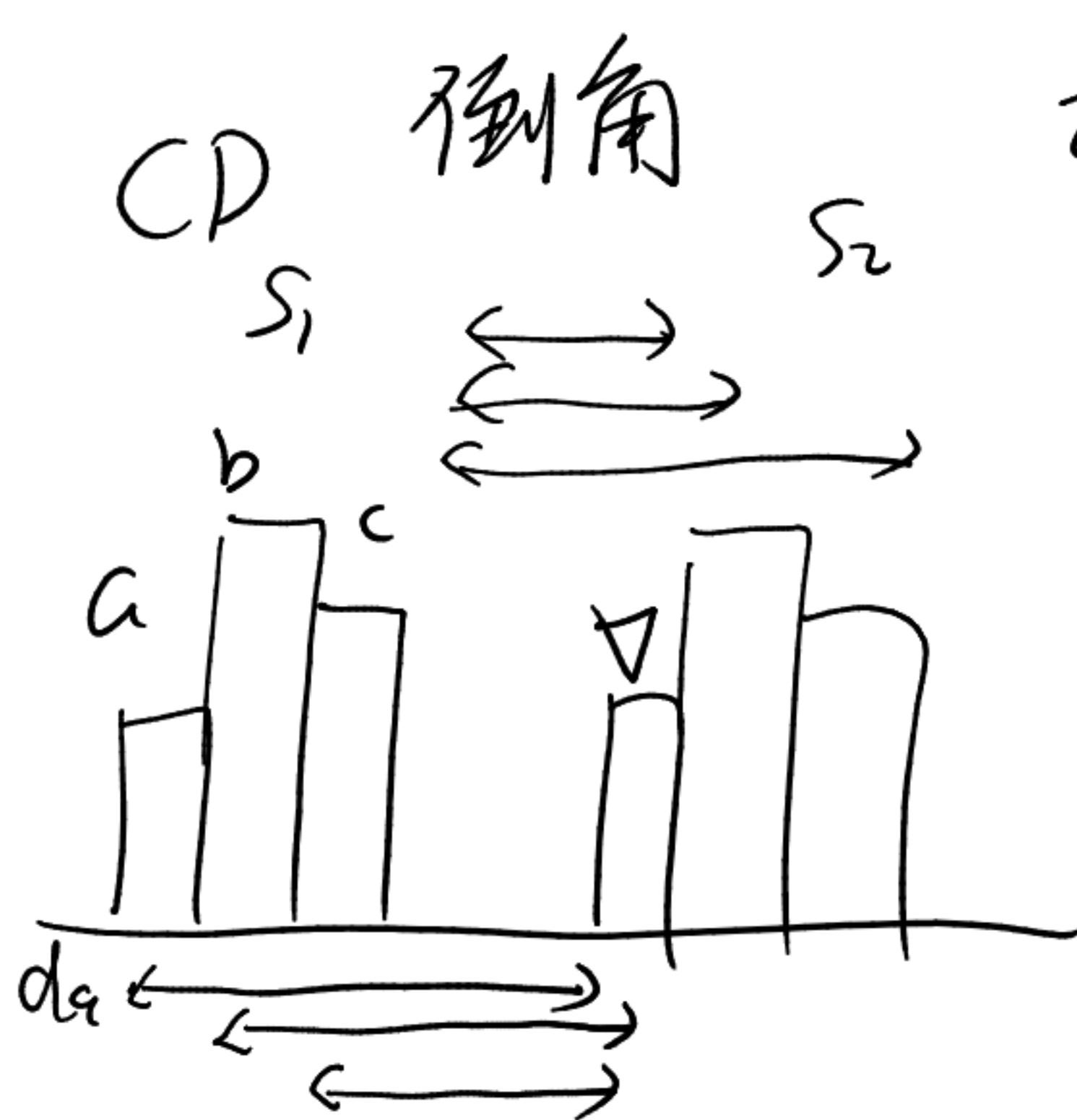


CMLP



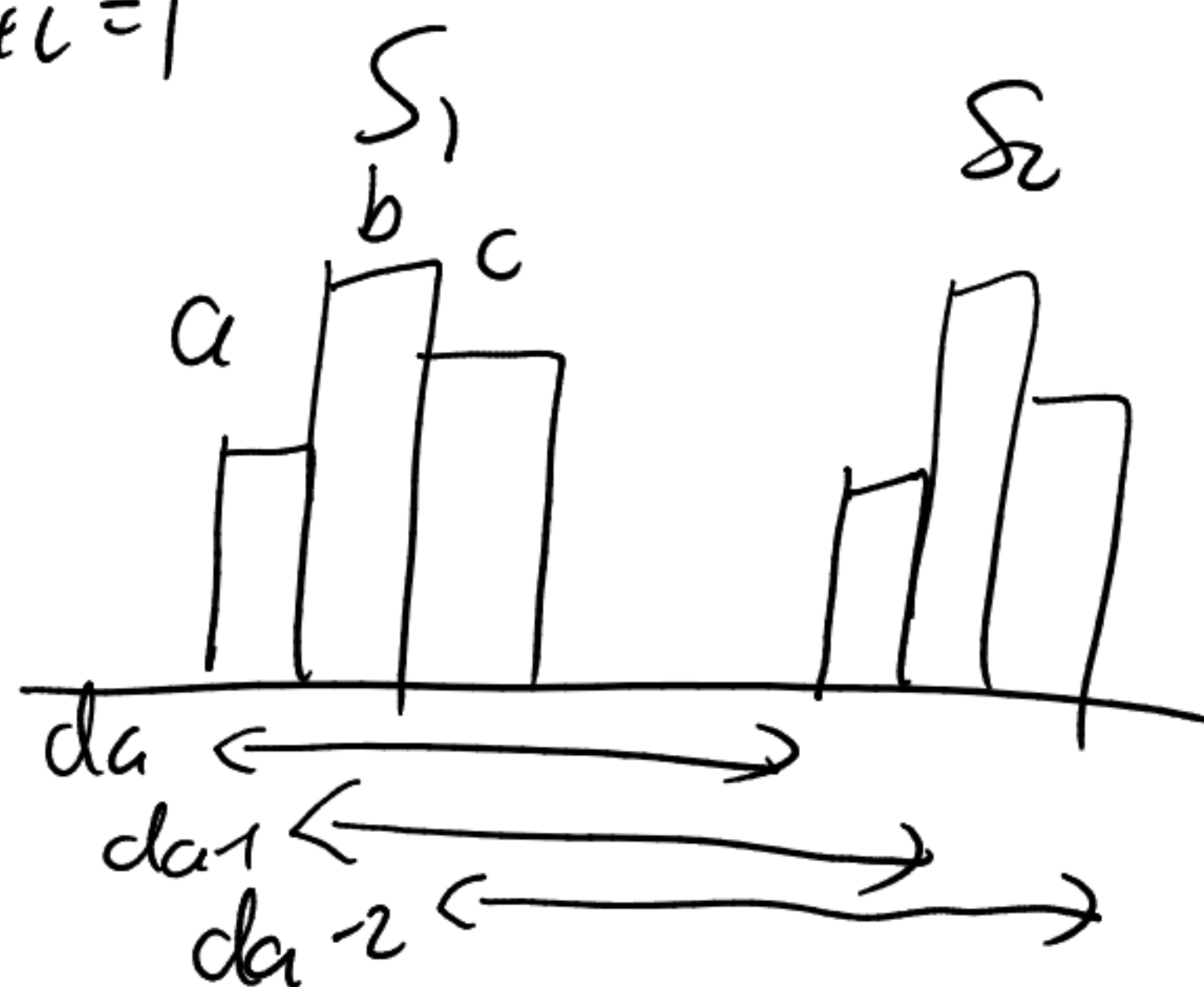
CD: Chamfer Distance

$$d_{CD}(S_1, S_2) = \frac{1}{|S_1|} \sum_{x \in S_1} \min_{y \in S_2} \|x - y\|_2^2 + \frac{1}{|S_2|} \sum_{y \in S_2} \min_{x \in S_1} \|y - x\|_2^2$$



推土机 WD EMD

$a+b+c=1$



$$\frac{1}{S_1} \sum_{x \in S_1} \min_{y \in S_2} \|x - y\|_2^2 +$$

$$\frac{1}{S_2} \sum_{y \in S_2} \min_{x \in S_1} \|y - x\|_2^2$$

$$= [a \cdot d_a + b(d_a - 1) + c(d_a - 2)]$$

$$[a \cdot (d_a - 2) + b(d_a - 1) + c \cdot d_a]$$

$$= 2(d_a - 1)(a + b + c)$$

$$= 2(d_a - 1)$$

$$\propto d_a$$

$$\min \int d(x, y) d\gamma$$

$$= \min_{x, y} \sum_{x, y} \|x - y\|_2^2 \gamma$$



$$= a \cdot d_a + b \cdot (d_a - 1)$$

$$+ c \cdot (d_a - 2)$$

$$= d_a - b - 2c$$

$$\propto d_a$$

$$\mathcal{L} = \lambda_1 CD + \lambda_2 WD + \lambda_3 KL$$

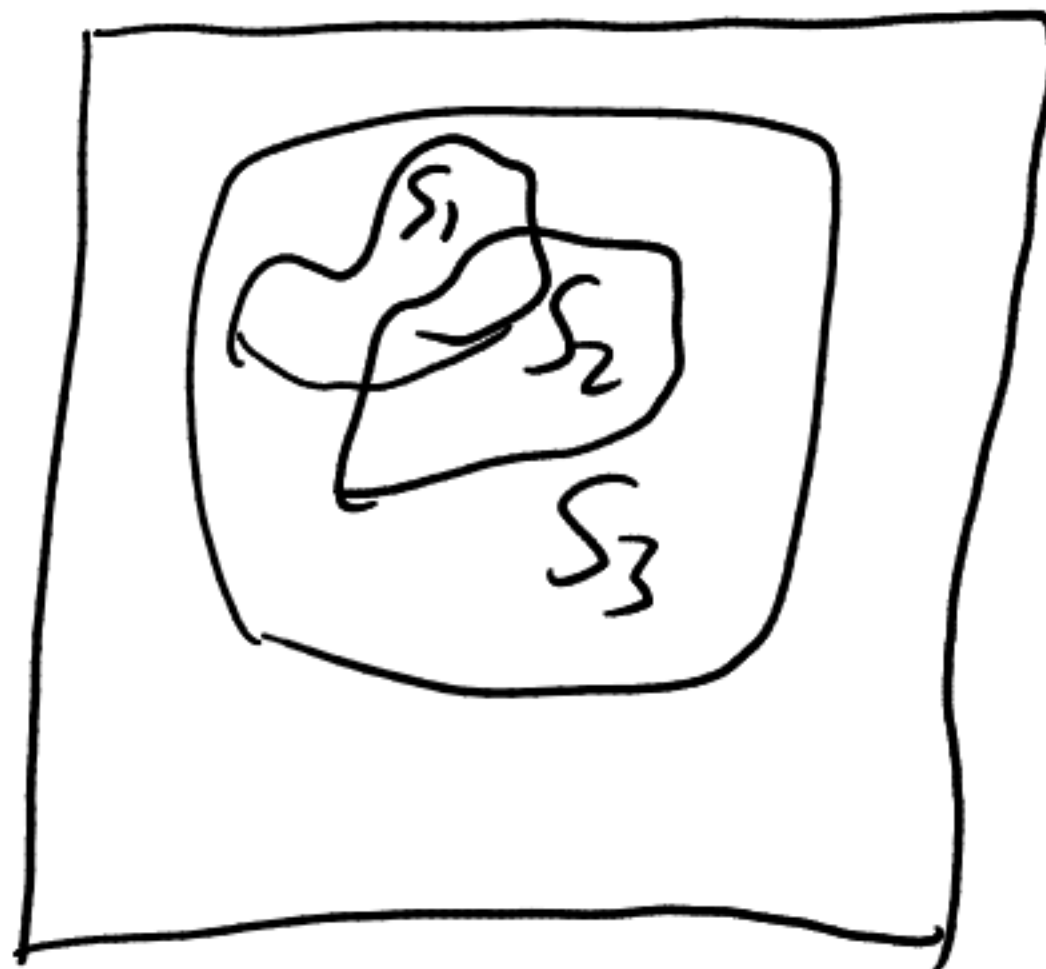
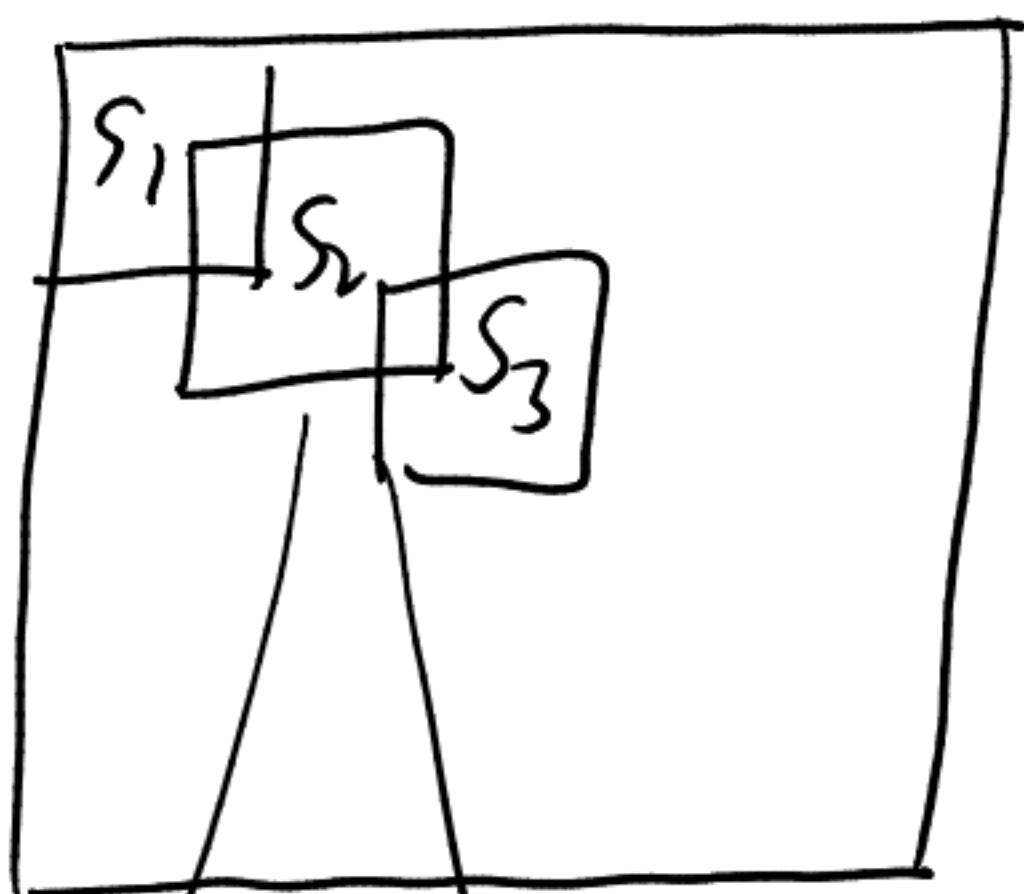


5000 epoch: 4000 CD, 1000 KL

X

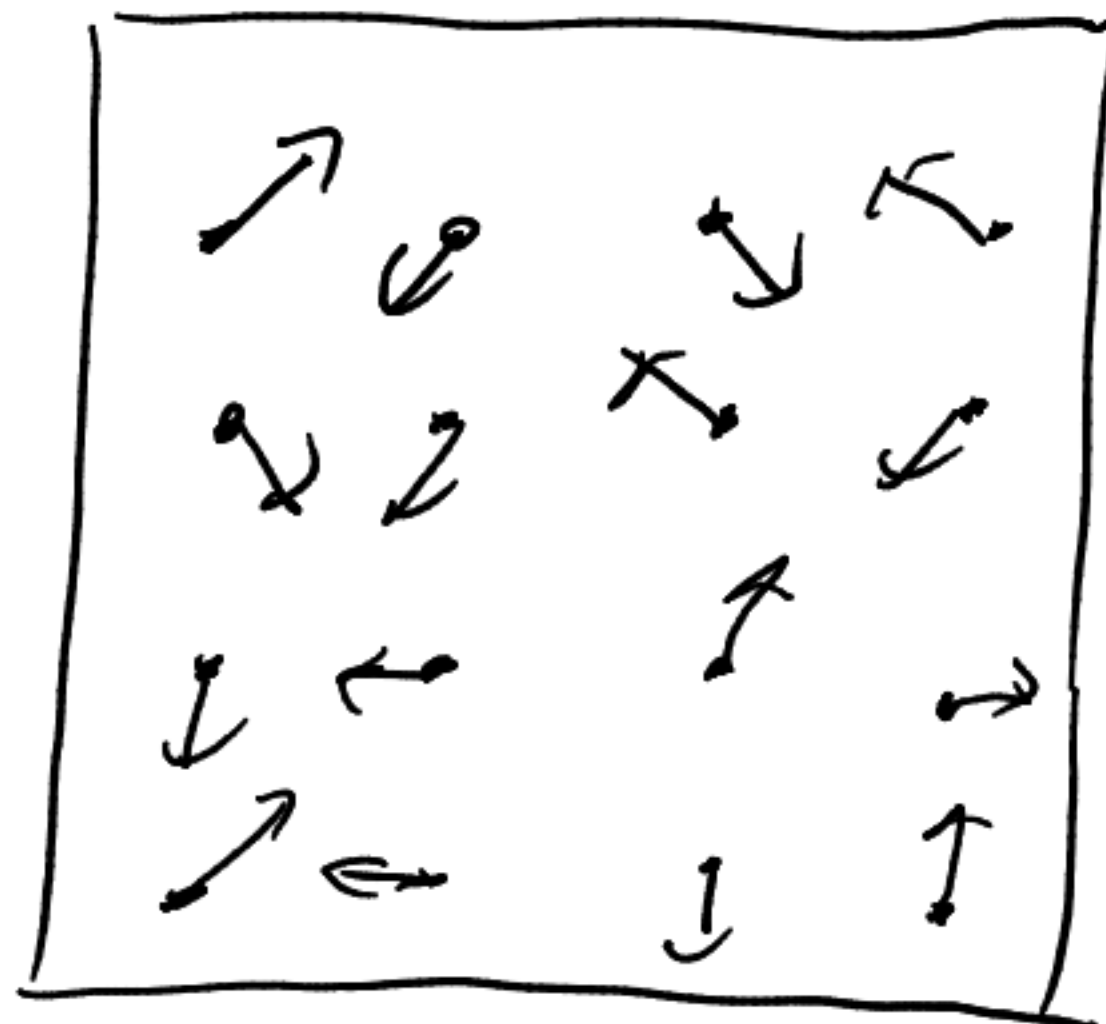
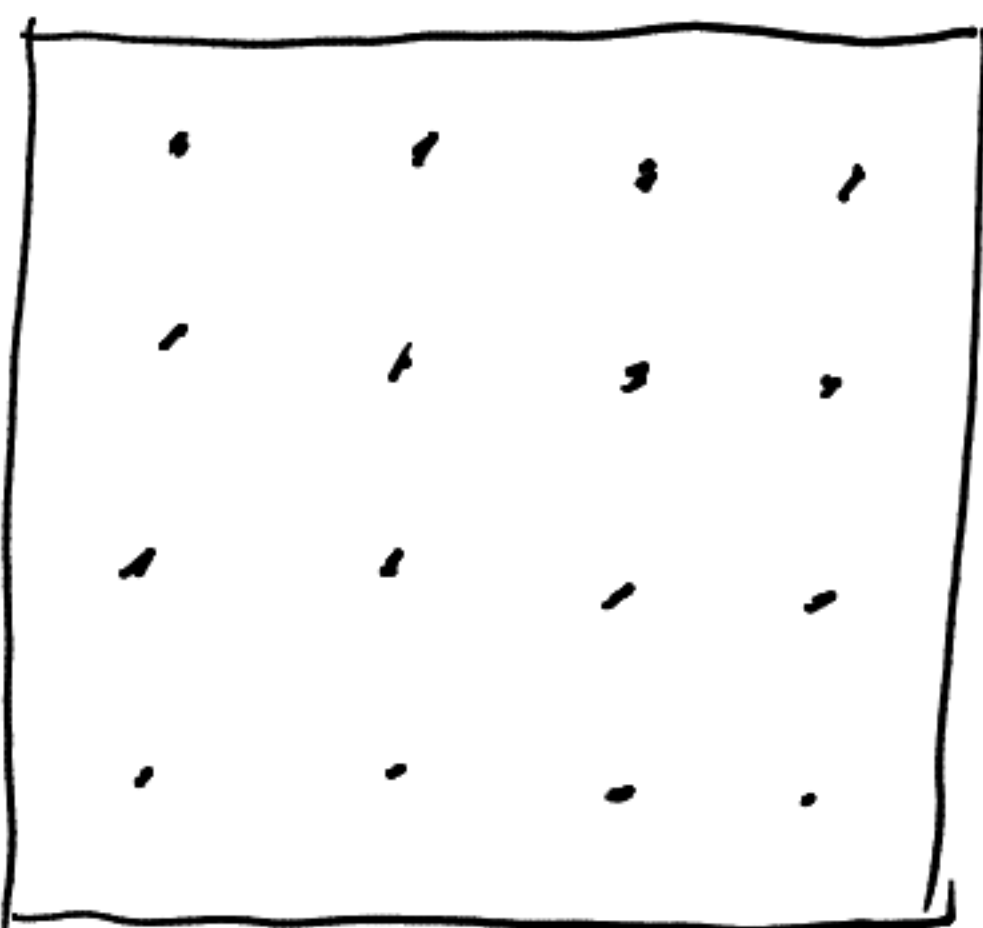
$$Y = f(X; \eta)$$

Y



base

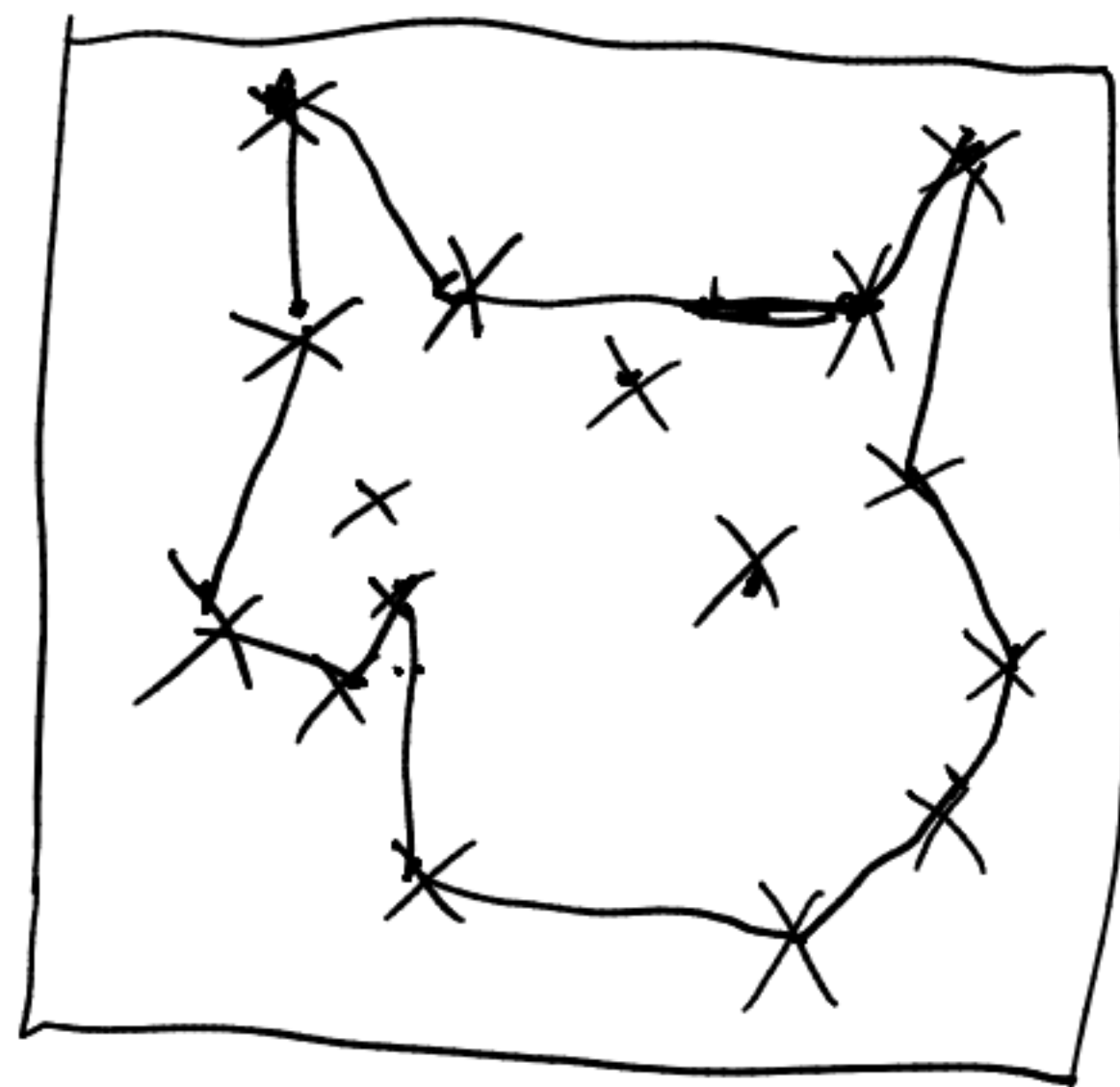
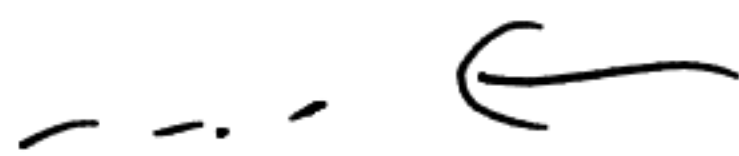
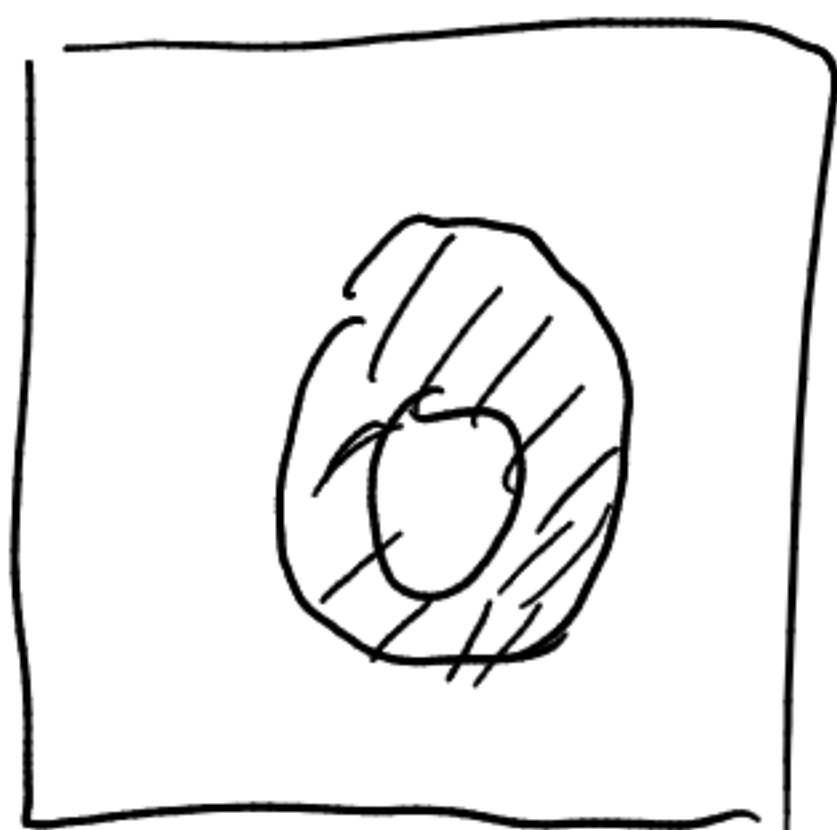
noise: $Z(i, \eta)$



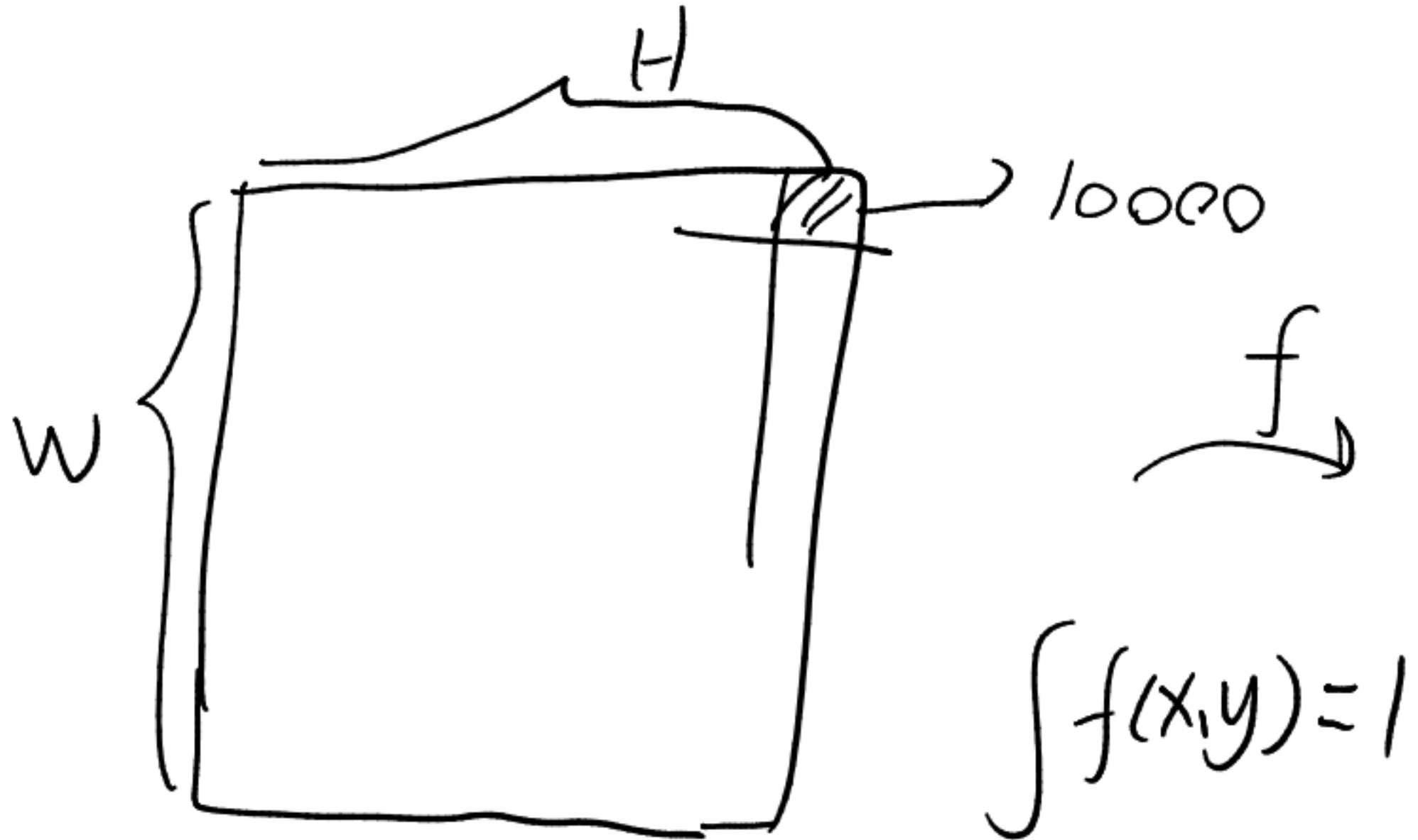
$$S_i = (H, W) = \{(x, y)\}$$

diffusion

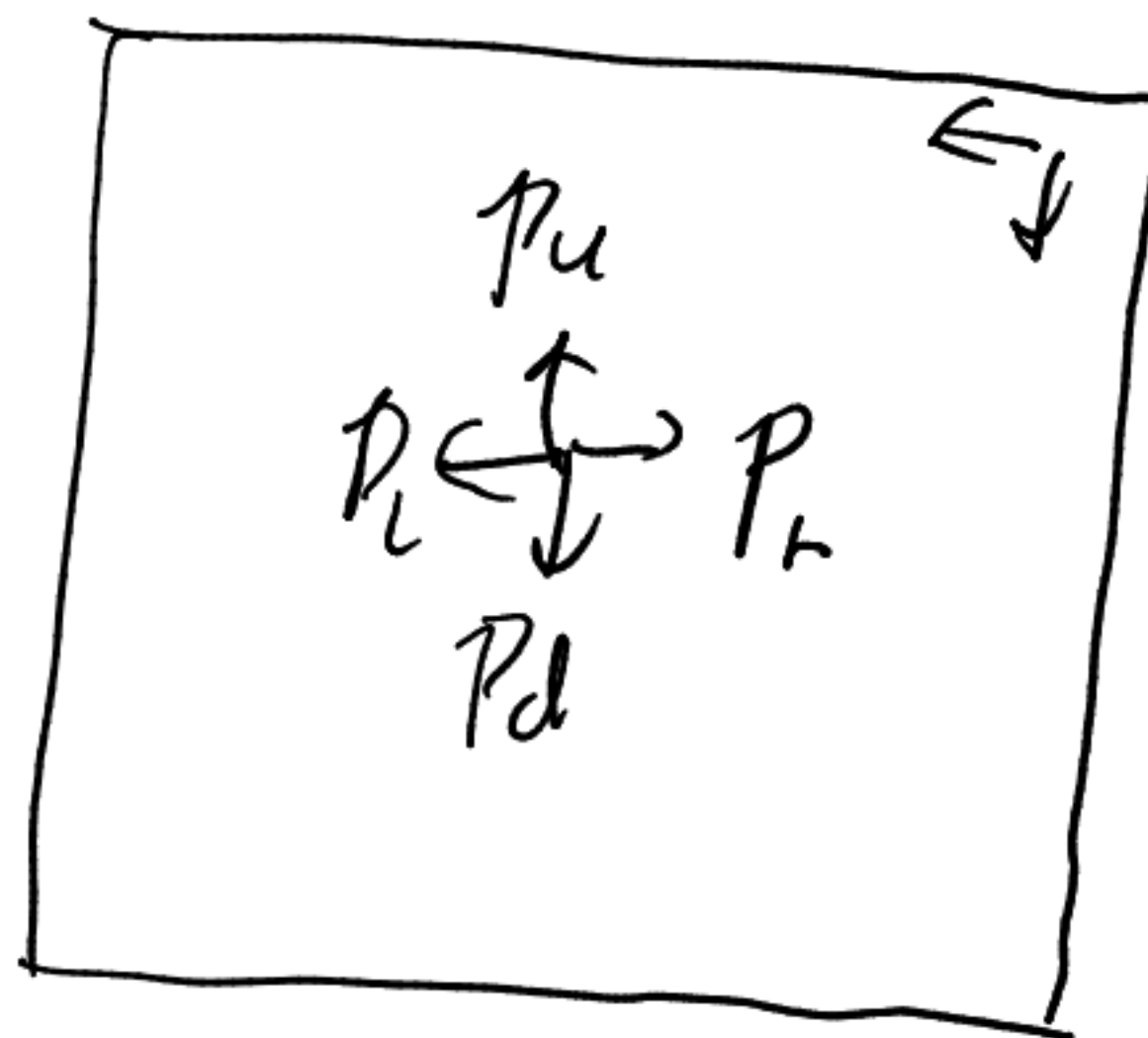
$$x' = \alpha x + (1 - \alpha) z$$



$$f(x) = X + Z^{(n)}$$



$$\int f(x,y) = 1$$



$$P = \begin{bmatrix} \end{bmatrix}$$

$$f(x;\eta)$$

$$Y = f^{(n)}(x;\eta) \text{ fixed point}$$

$$f(x)$$

