# 第四次報告

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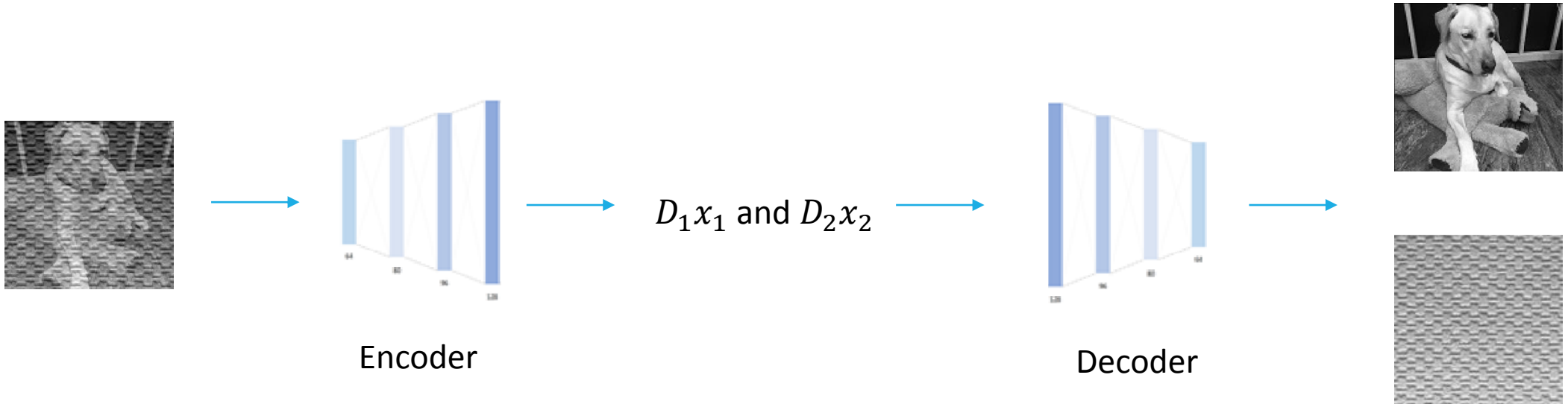
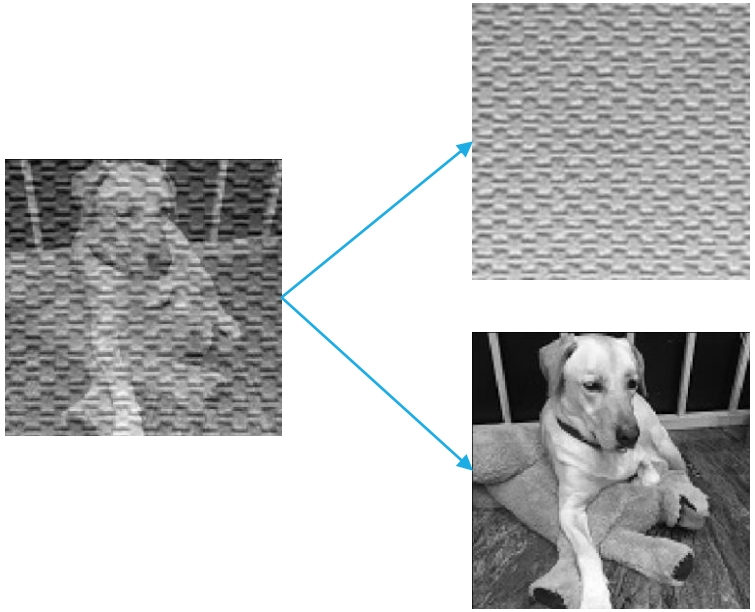
# Separate Signal

1. When separating a signal, we need to map that signal into high dimension.
2. Use pre trained $\mathrm{D}_1$ and $\mathrm{D}_2$ to find its sparse representation $x_1$ and $x_2$.
3. Use decoder to recover image $\mathrm{D}_1 x_1$ and $\mathrm{D}_2 x_2$.



# Dictionary Learning

$$\underset{D1,D2,x1,x2}{argmin} \|y_1 - D_1 x_1\|_F^2 + \|y_2 - D_2 x_2\|_F^2 + \lambda \left\| {D_1}^T D_2 \right\|_F^2 + \Gamma_x(x_1) + \Gamma_x(x_2) + \Gamma_D(D_1) + \Gamma_D(D_2)$$



- $y_1$ : picture 1
- $y_2$ : picture 2
- $D_1$ : dictionary for picture 1
- $D_2$ : dictionary for picture 2
- $x_1$ : sparse representation of picture 1 for $D_1$
- $x_2$ : sparse representation of picture 2 for $D_2$
- $\lambda$ : regularization parameters
- $\Gamma_x$ : constraint for x (make it sparse)
- $\Gamma_D$ : constraint for D (normalize)

# Training Dictionary

1. Random D and x
2. Train both D and x, until they converge
3. L0 proximal mapping of x replace by L1 proximal mapping. Fix D, and find x
4. Use those pre trained D and x, and back to step 2
5. Repeat step 3 and 4 until D and x converge

# Reconstructing by Dictionary

1. Random x
2. Use l1 proximal mapping to find x
3. Make previous x as initial value, then use l0 proximal mapping to find final x

# Problem & Solution

Problem:

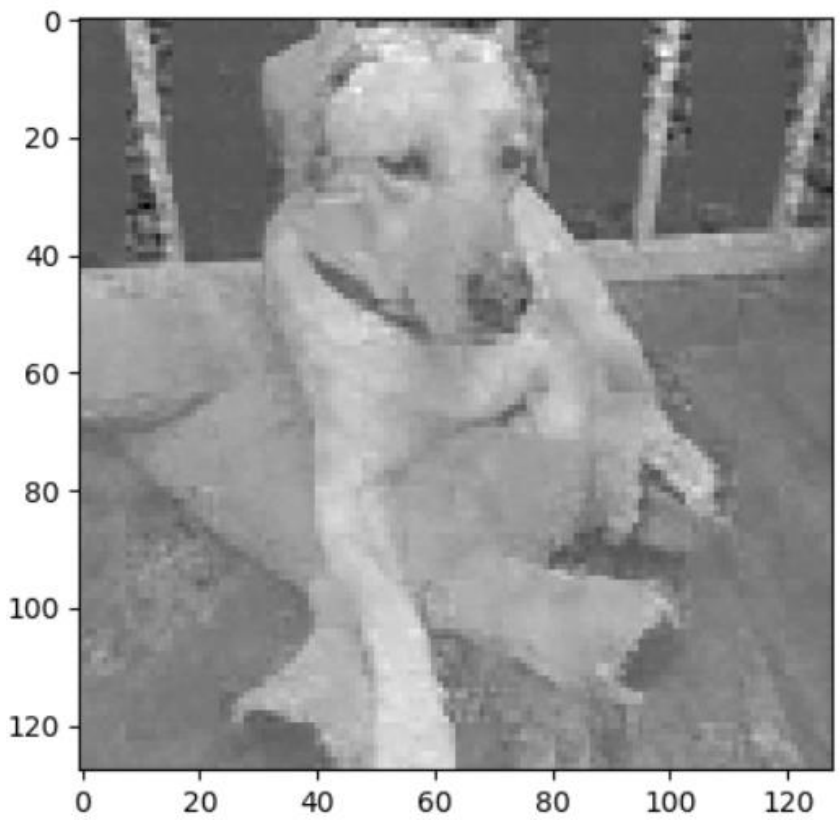
- It still cannot get correct x.
- The calculated nonzero value of x can have the same position as the correct x, but the value is slightly different.

Solution:

- So we decided to train decoder with some noise added on nonzero value’s position of x.

# Result of Denoise Decoder

- Training decoder with some noise added on nonzero value's position of x (5% of $||x||$ ).
- Reconstructed y1 by y1 and random initial value of x.
- In order to remove noise, decoded image will be blurred.



# Better Method?

- CNN Encoder and Decoder
- GAN