第二次報告

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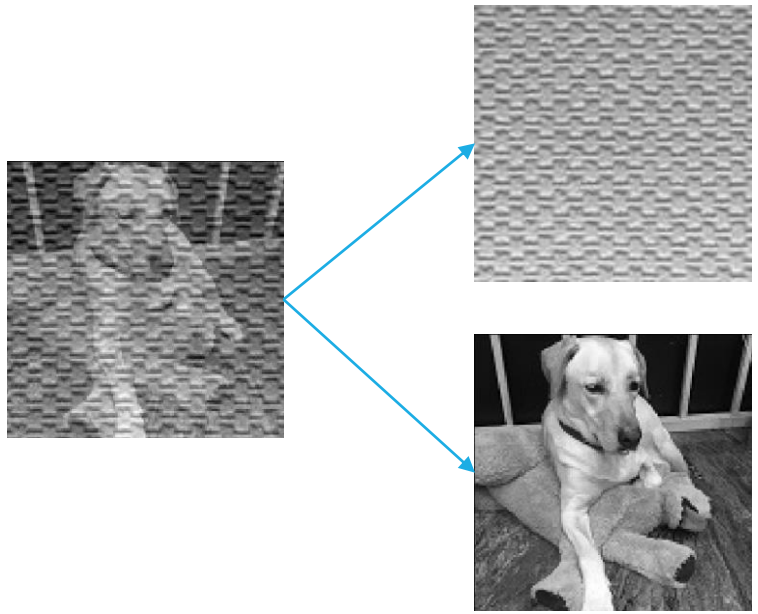
Problem

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



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

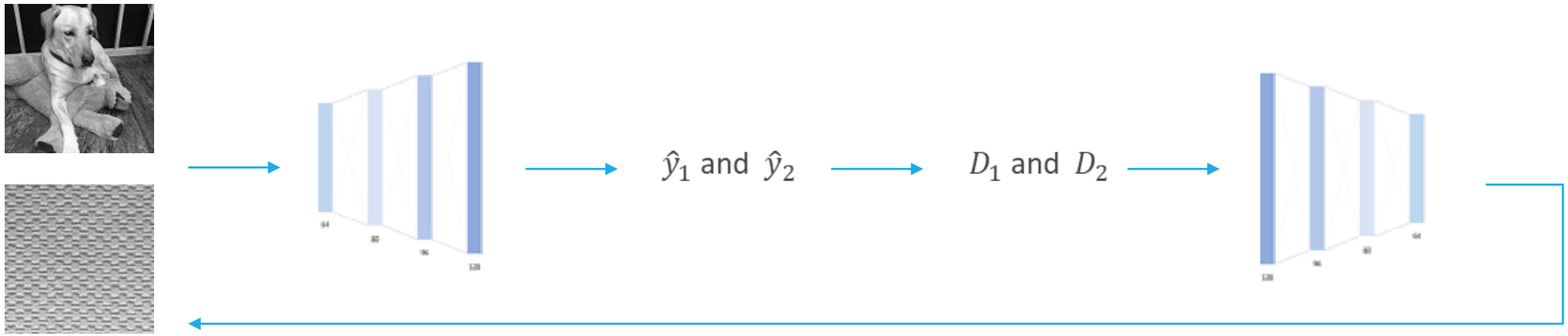
λ : regularization parameters

Γ_x : constraint for x (make it sparse)

Γ_D : constraint for D (normalize)

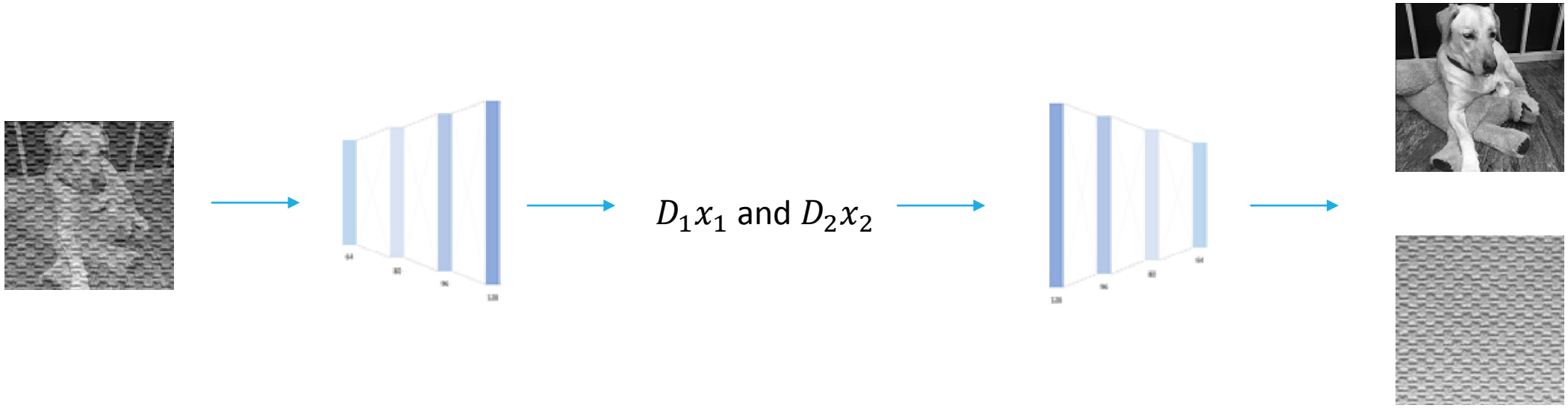
Mapping into high dimension

1. Use the Autoencoder architecture, but separate it into Encoder and Decoder.
2. Map data into high dimension via Encoder($\hat{y}_1$ and $\hat{y}_2$).
3. Train a dictionary for $\hat{y}_1$ and $\hat{y}_2$, respectively.
4. Use Decoder to map $\hat{y}_1$ and $\hat{y}_2$ back to original dimension.
5. Retrain Encoder and Decoder until they converge, i.e. repeat step2, 3, 4



Separate signal

1. When separate a signal, we need to map that signal into high dimension.
2. Use pre trained D_1 and D_2 to find its sparse representation x_1 and x_2.
3. Use decoder to reconstruct image via $\mathrm{D}_1 x_1$ and $\mathrm{D}_2 x_2$.

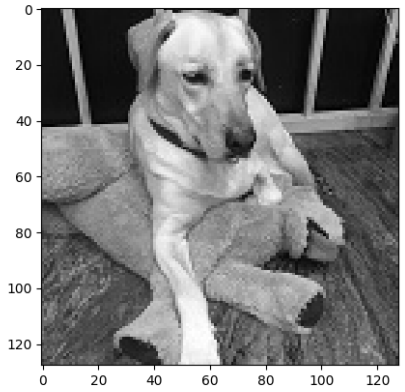


Experiment 1

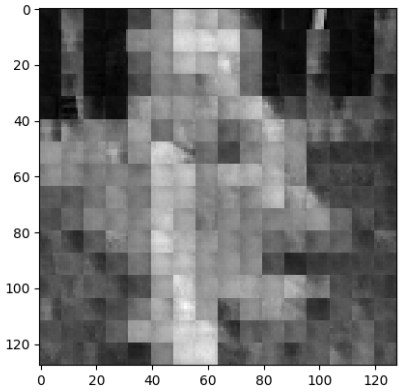
Encoder, epoch=20000, learning=0.001

Decoder, epoch=20000, learning=0.001

Dictionary Learning, epoch=3000



y1



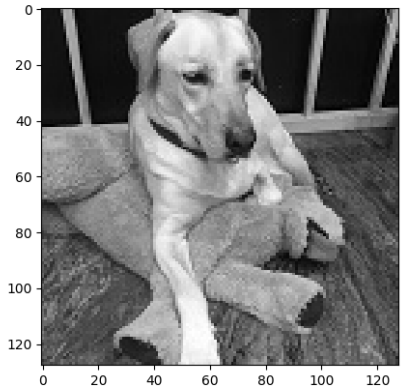
Reconstructed y1

Experiment 2

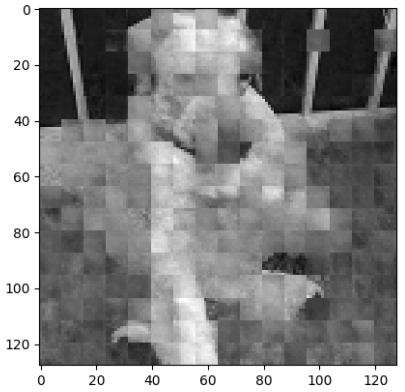
Encoder, epoch=30000, learning=0.001

Decoder, epoch=100000, learning=0.001

Dictionary Learning, epoch=5000



y1



Reconstructed y1

How to improve?

1. Using different decoder for y_1 and y_2.
2. Bigger learning.
3. More Epochs.
4. Try using CNN to replace MLP in Encoder and Decoder. (not sure)
5. Try to use GAN architecture. (still thinking about it)