

Lecture 9

Peephole convolutional LSTM

$$f_t = \sigma(W_{f-} h(t-1) + U_{f-} x(t) + \underline{V_{f-} \odot C(t-1)} + b_f)$$

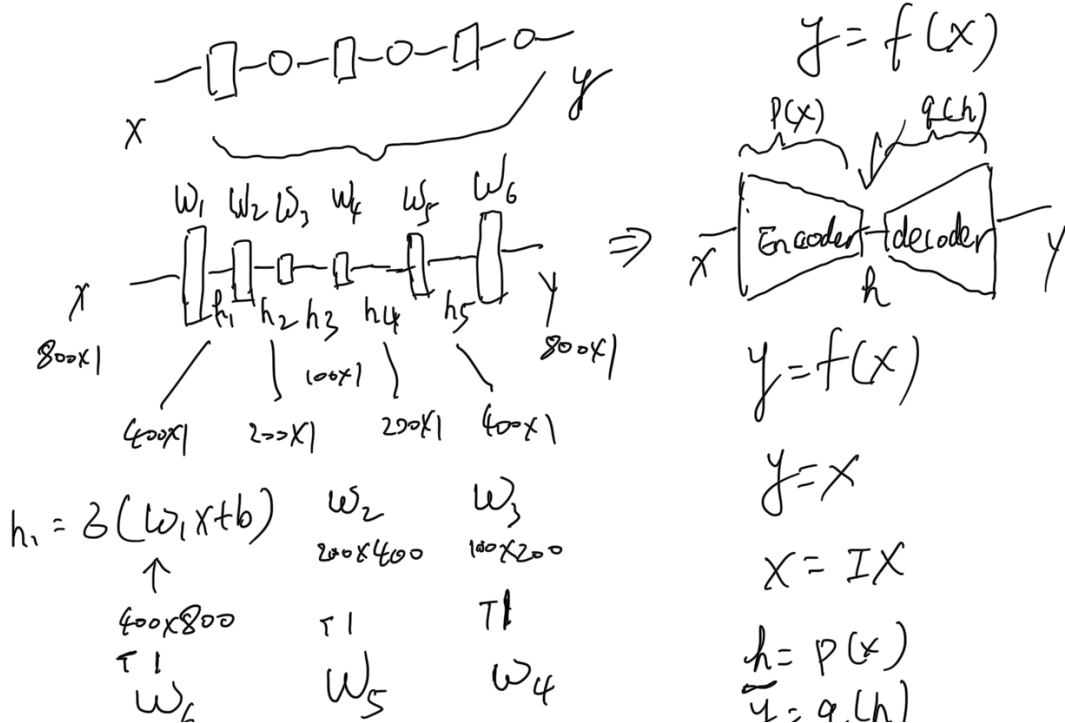
$$\tilde{i}_t = \sigma(W_{i-} h(t-1) + U_{i-} x(t) + \underline{V_{i-} \odot C(t-1)} + b_i)$$

$$C_t = f_t \odot C_{t-1} + \tilde{i}_t \odot \sigma(U_c x(t) + W_c h(t-1) + b_c)$$

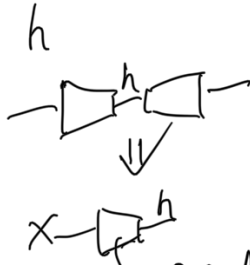
$$O_t = \sigma(W_o h(t-1) + U_o x(t) + \underline{V_o \odot C(t)} + b_o)$$

$$h_t = O_t \odot C_t$$

Autoencoder: encoder + decoder

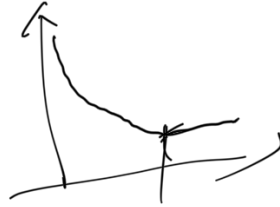


800x400 400x200 200x100



encoder as a dimension reduction

PCA \rightarrow size of D
eigenvalues



$$L = \sum_{i=1}^m (x_i - y_i)^2$$

m - number of samples

$$y = g(p(x))$$

$$x \xrightarrow{p(x)} h \xrightarrow{g(h)} y$$

800×1 100×1 800×1

$$y = x \quad L((x - y)^2) = \sum (x_i - y_i)^2$$



1D space $[0, 10]$ 10 samples

2D space $[0, 10]^2$, 100

3D $[0, 10]^3$, 1,000

1,000,000 $[0, 10]^6$

Convolutional Auto encoder



vector



image
 800×800

pooling
 $800 \times 800 \times N$

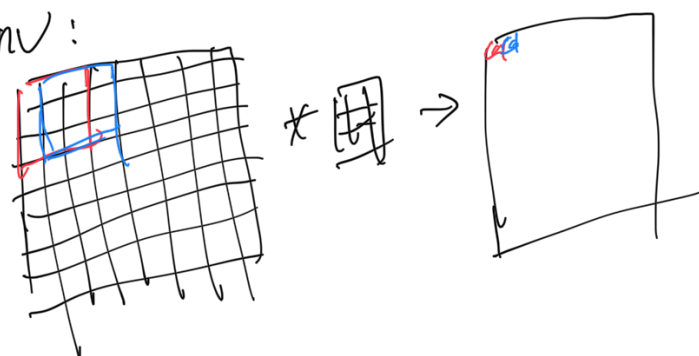
100×100
 $400 \times 400 \times N$

super-sampling

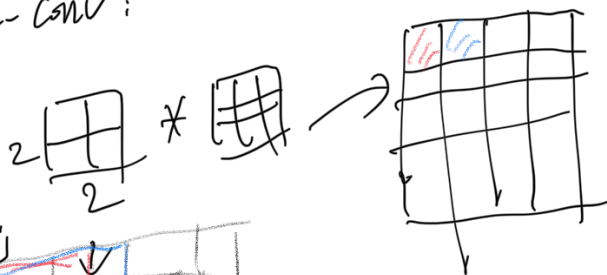
y
 800×800

deconvolution / transposed convolution

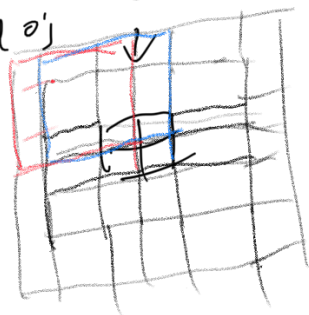
conv:



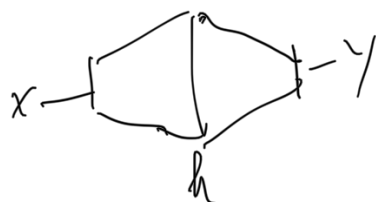
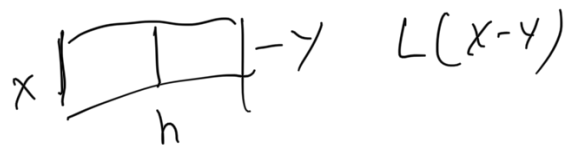
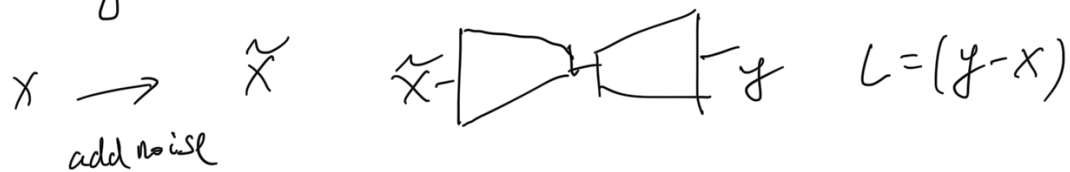
de-conv:



pad 0's



Denoising Auto encoder



$$h = [x, 0, 0, 0] \rightarrow y = [x]$$

sparse Autoencoder

$$L = \sum_{i=1}^m (y_i - x_i)^2 + \lambda \sum_{i=1}^m |h_i|$$

KL divergence

$$p_j = \frac{1}{m} \sum_{i=1}^m h_j(x_i)$$

$$h = \begin{bmatrix} h_1 \\ \vdots \\ h_j \\ \vdots \\ h_n \end{bmatrix}$$

x_i — i sample input

define sparsity parameter $\hat{p}_j = 0$

KL divergence

$$\sum_{j=1}^n KL(\hat{p} || p_j) = \sum_{j=1}^n \left[\hat{p} \log \frac{\hat{p}}{p_j} + (1 - \hat{p}) \log \frac{1 - \hat{p}}{1 - p_j} \right]$$

$$L = \sum_{i=1}^m (y_i - x_i)^2 + \lambda \sum_{j=1}^n KL(\hat{p} || p_j)$$

L2 norm

$$+ \lambda \sum |h|^2$$