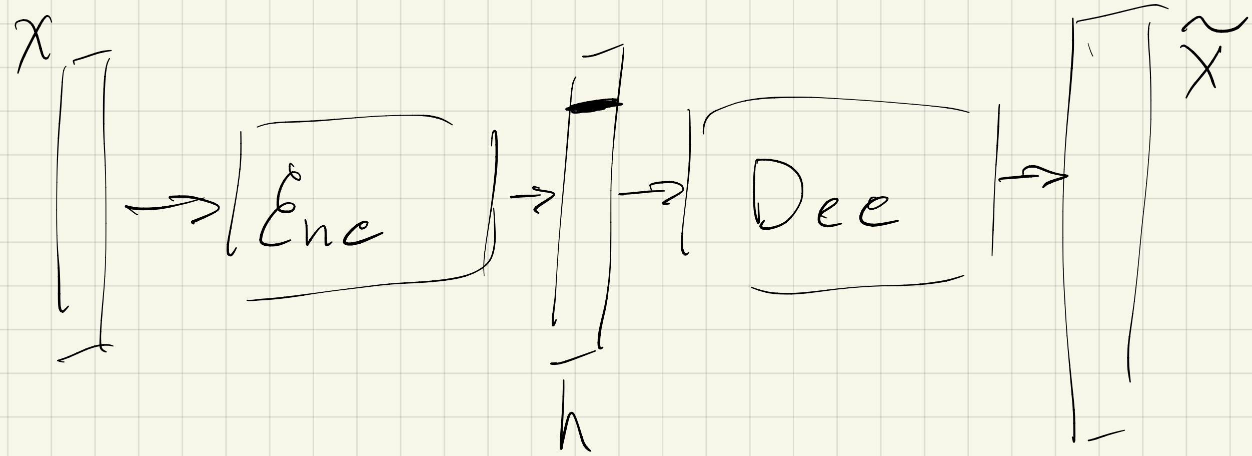
$$KL(p\|q) = -\sum p \log \frac{q}{p}$$

$$KL(B(p)\|h) = -\sum_{j=1}^{H} \left[p \log \frac{p}{h_j} + (1-p) \log \frac{(1-p)}{(1-h_j)} \right]$$

$$BCE(p,q) = H(p) + KL(p\|q)$$

$$H(p) = -\sum_{x \sim p(x)} p(x) \log p(x)$$



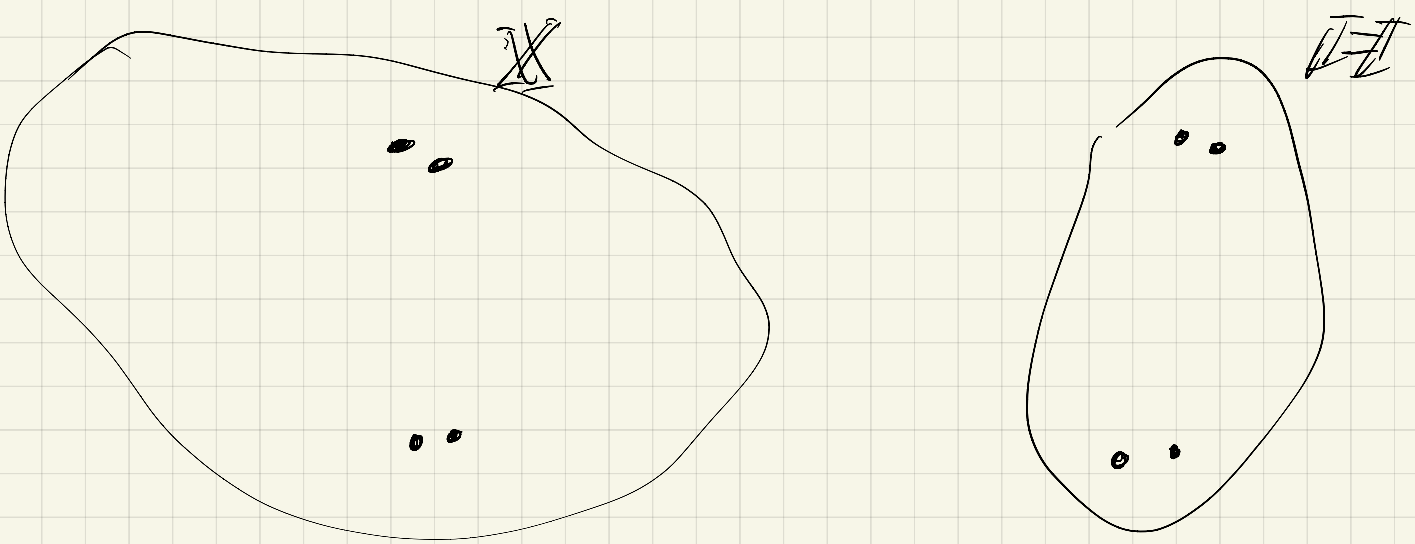
$$\mathcal{L} = MSE\left(D(\mathcal{E}(x)), \tilde{x}\right)$$

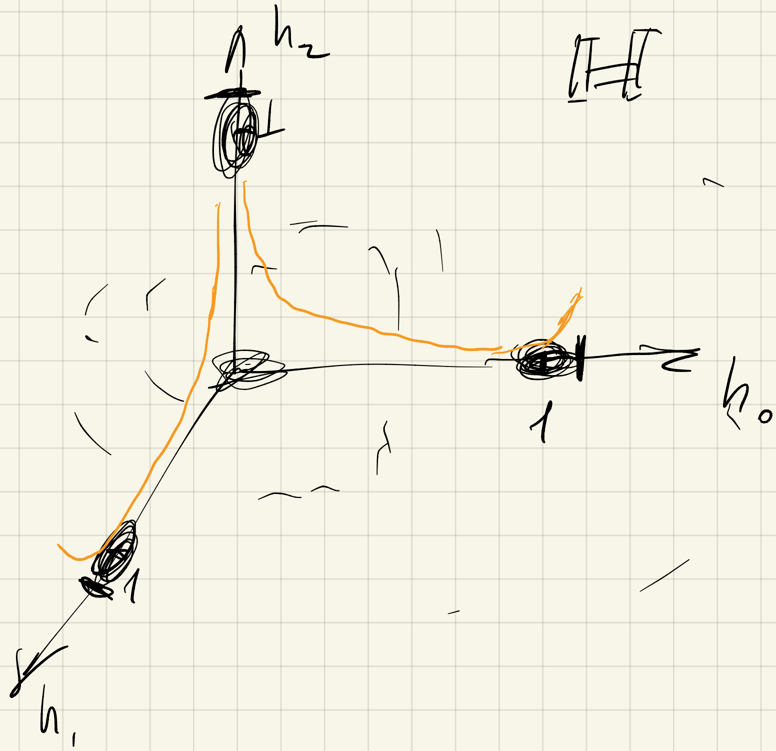
Denoising autoencoder

$\hat{x} = x + \varepsilon \qquad \varepsilon \sim \mathcal{N}(0, \sigma^2)$

$y = x$

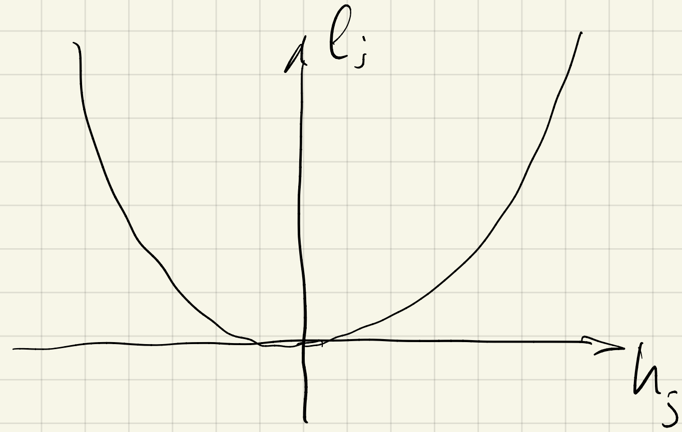
$h_i \in \mathbb{H} \qquad \mathbb{H} = \mathbb{R}^H$





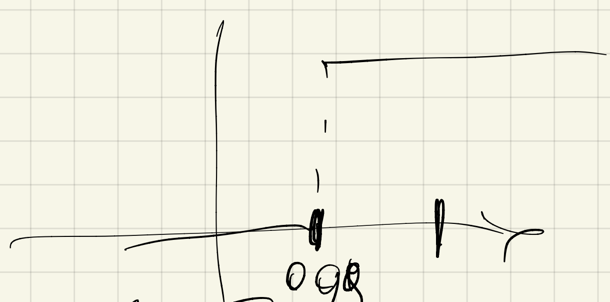
$$\mathcal{L} = MSE\big(\underbrace{D(\mathcal{E}(x))}_{=\,\tilde{x}},\ x\big) + \ell$$

① $\ell = \sum\limits_{j=1}^{M} h_j^2$



② $h_j \sim Ber(p)$

$p = 0{,}05$

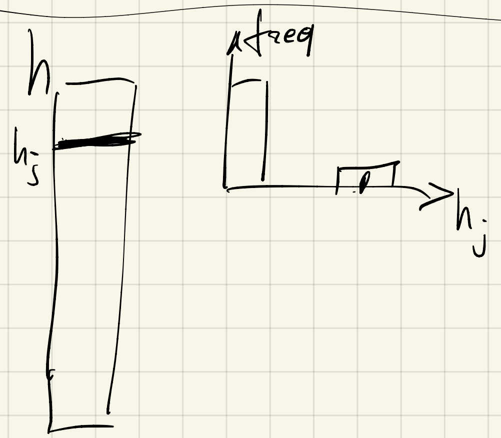


Дивергенция Кульбака-Лейблера

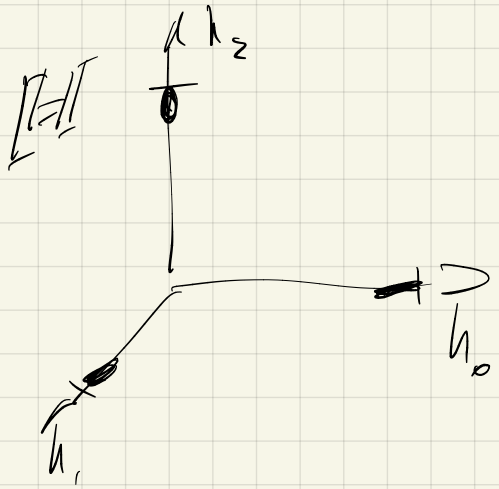
$$KL(p(x), q(x)) = \int\limits_{x \sim X} p(x) \log \frac{p(x)}{q(x)}\, dx$$

$$KL(Ber(\rho), \rho(h)) = -\sum_{j=1}^{H}\left[\rho \log \frac{\rho}{h_j} + (1-\rho)\log\frac{(1-\rho)}{(1-h_j)}\right]$$

$$BCE(\rho, h) = -\left(\sum_{i=1}^{N} h_{ij}\log \rho + (1-h_{ij})\log(1-\rho)\right)$$



$$\mathcal{L} = MSE(D(\mathcal{E}(x)), x) + \lambda KL(Ber(\rho), \rho(h))$$



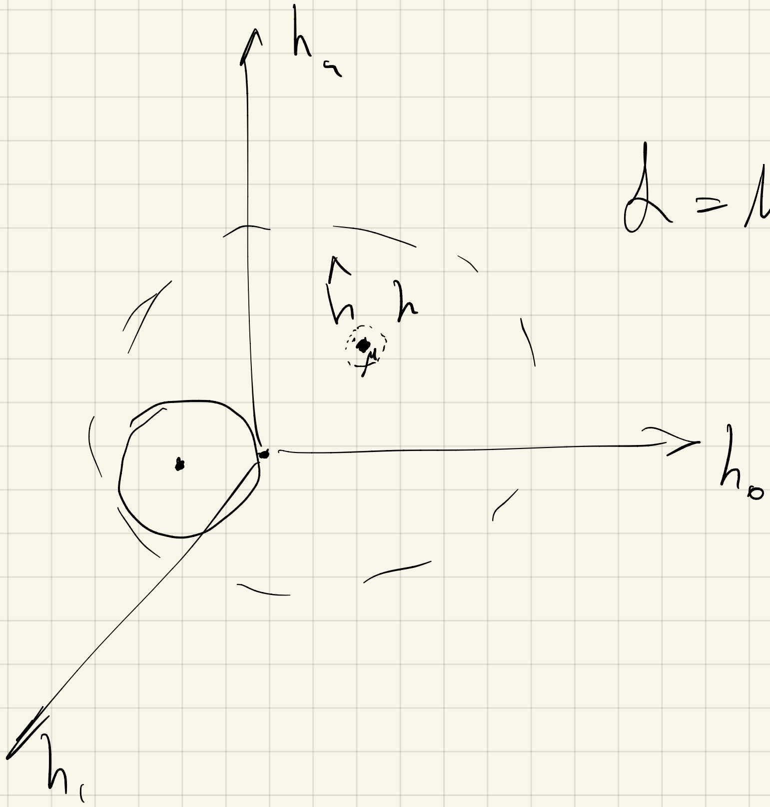
Разреженный автокодировщик

Sparse autoencoder

$$h \to \hat{h}$$

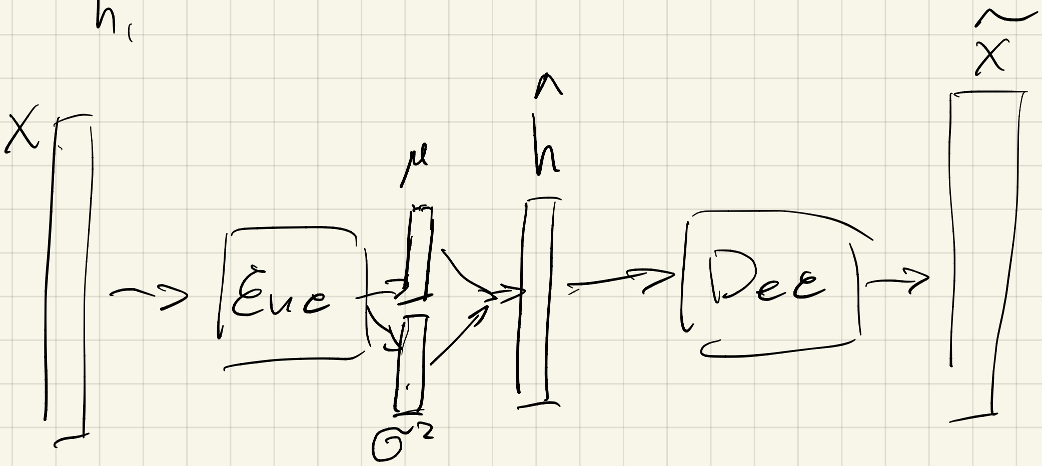
$$\begin{bmatrix} 0{,}78 \\ 0{,}01 \\ 0{,}2 \\ 0{,}02 \\ 0{,}985 \end{bmatrix} \to \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$$

$$D(\hat{h}) = \hat{x}$$



$$\mathcal{L} = MSE(D(\hat{h}), x)$$

$$\hat{x} = D(\hat{h})$$

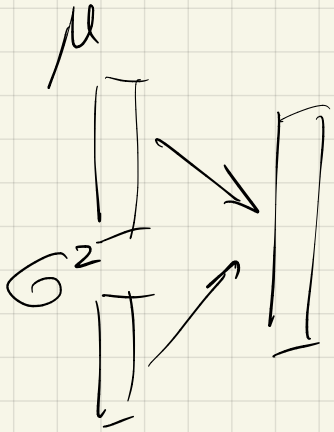


$$\mathcal{L}(\tilde{x}, \tilde{x}) = MSE(x, \tilde{x}) + C$$

$$\hat{h} \sim \mathcal{N}(\mu_h, \Sigma_h)$$

$$\mu_h, \ln(\sigma^2) = \mathcal{E}(x) \qquad \sigma^2 = e^{\ln(\sigma^2)}$$

$$KL(\hat{h}, \mathcal{N}(\mu, \sigma^2)) = \frac{1}{2}\left[\sum_{i=1}^{M} \mu_i^2 + \sum_{i=1}^{M} \sigma_i^2\right] - \sum_{i=1}^{M} (\log \sigma_i^2 + 1)$$



$\hat{h} \sim \mathcal{N}(\mu, \sigma^2)$

$$\varepsilon \sim \mathcal{N}(0, 1)$$

$$\hat{h} = \varepsilon \cdot \sigma + \mu$$

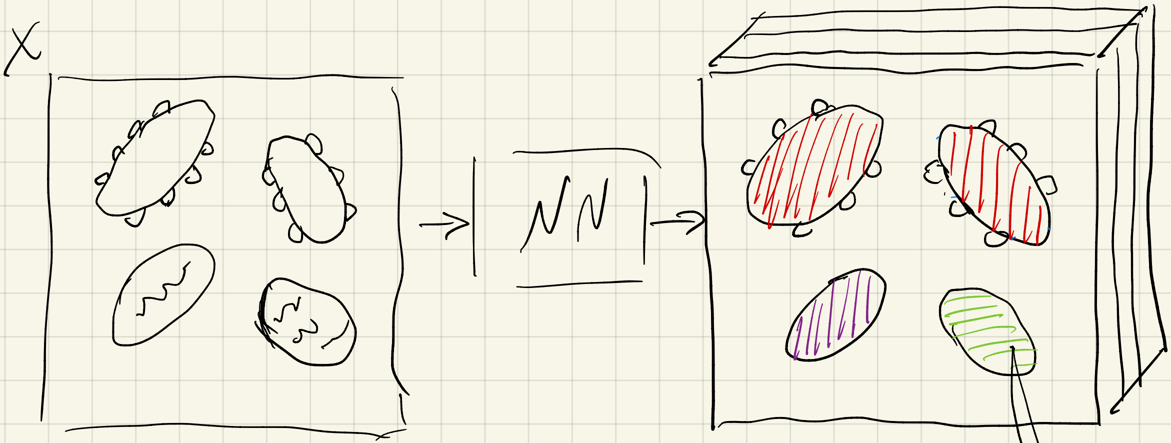
$$x \sim \mathcal{N}(\mu - \mu_0) \iff x \sim \mathcal{N}(\mu) + \mu_0$$

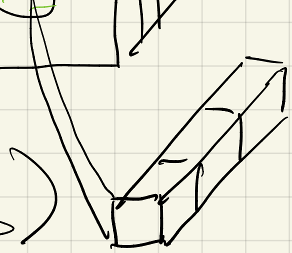
$$x \sim \mathcal{N}((k\sigma)^2) \iff x \sim k\mathcal{N}(\sigma^2)$$

$$\mu, \sigma^2 = \mathcal{E}(x)$$

$$\hat{x} = D(\hat{h})$$

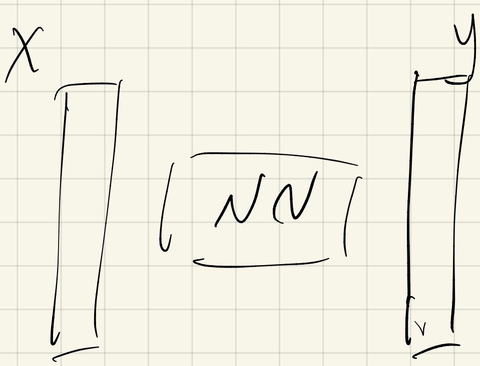
Семантическая сегментация U-net





$$\mathcal{L} - ?\quad CE(\underbrace{NN(x)}_{\hat{y}}, \underbrace{Segmap}_{y})$$

$$\sum_{i=1}^{D}\sum_{j=1}^{C} y \log \hat{y}$$



$$W_x = W_y$$
$$H_x = H_y$$