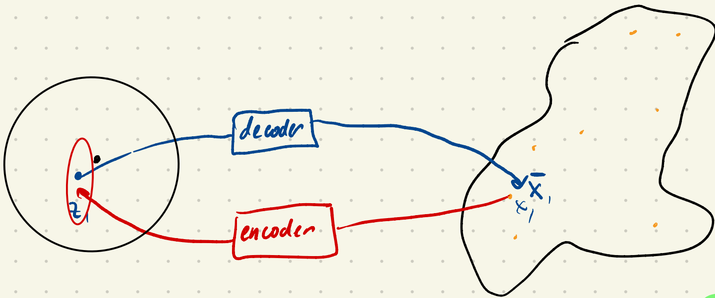
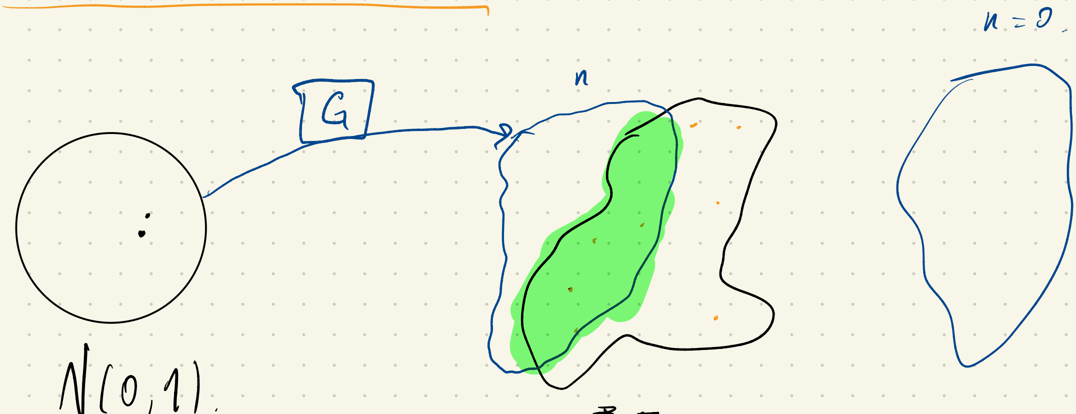


Z $\quad\quad\quad\quad$ X

VAE loss

$$L = \|x_i - \bar{x}_i\|_2 + KL(P(z), N(0,1))$$

$D(X) \to [0, 1]$ $\quad\quad$ $G: Z \to \mathcal{X}$



$N(0,1)$. $\quad\quad\quad\quad$ $\mathcal{X}$

$$L_D = -\mathbb{E}_{x \sim \mathcal{X}} \log_2 D(x) - \mathbb{E}_{z \sim N(0,1)} (1 - \log_2 D(G(z)))$$

$$L_G = \mathbb{E}_{z \sim N(0,1)} \left(1 - \log_2 D(G(z))\right)$$

$$L(G, D) = \min_{D} \max_{G} \; - \mathbb{E}_{x \sim X} \log_2 D(x) - \mathbb{E}_{z \sim N(0,1)} \left(1 - \log_2 D(G(z))\right)$$

1) $L \xrightarrow[D]{} \min$ $\quad \times 5 \qquad x + \xi$

2) $L \xrightarrow[G]{} \max$ $\quad \times 1 \qquad \bar{x} + \xi$

$$- \int_x P(x) \log_2 D(x) \, dx - \int_z P_z(z) \left(1 - \log_2 D(G(z))\right) dz$$

$$- \int_x P(x) \log_2 D(x) \, dx - \int_x q(x) \left(1 - \log_2 D(x)\right) dx =$$

$$= - \int_x \left[P(x) \log_2 D(x) + q(x) \left(1 - \log_2 D(x)\right) \right] dx$$

$$D^*(x) = \boxed{\frac{p(x)}{p(x)+q(x)}} = \frac{1}{2}$$

$$-\int_x \left(p(x)\log_2 \frac{p(x)}{p(x)+q(x)} + q(x)\left(1 - \log_2 \frac{p(x)}{p(x)+q(x)}\right)dx\right) =$$

$$= \boxed{KL\left(p(x)\,\|\,\underbrace{p(x)+q(x)}\right) + \\ + KL\left(q(x)\,\|\,\underbrace{p(x)+q(x)}\right).}$$

$$JS(p|q) = KL\left(p(x)\,\|\,\frac{p(x)+q(x)}{2}\right) +$$
$$+ KL\left(q(x)\,\|\,\frac{p(x)+q(x)}{2}\right).$$

$$I = -\log p(x),$$

$$H(p) = E\,I = -\int_x p(x)\log p(x).$$

$$KL(p\|q) = \mathbb{E}\left(I_p(x) - I_q(x)\right) =$$

$$= \int_x p(x)\left[-\log p(x) + \log q(x)\right) =$$

$$= -\int_x p(x) \log \frac{p(x)}{q(x)}.$$

$$KL(p\|q) = \mathbb{E}_{x\sim p} \log_2 \frac{q(x)}{p(x)}$$

$\theta = \hat{\theta} = 0$ $KL(p\|q) = 0$

$\hat{\theta} = 100 \sim \infty$

$$KL(q\|p) = \mathbb{E}_{x\sim q} \log_2 \frac{p(x)}{q(x)}$$

$\theta = \hat{\theta}$ $KL(q\|p) = 0$

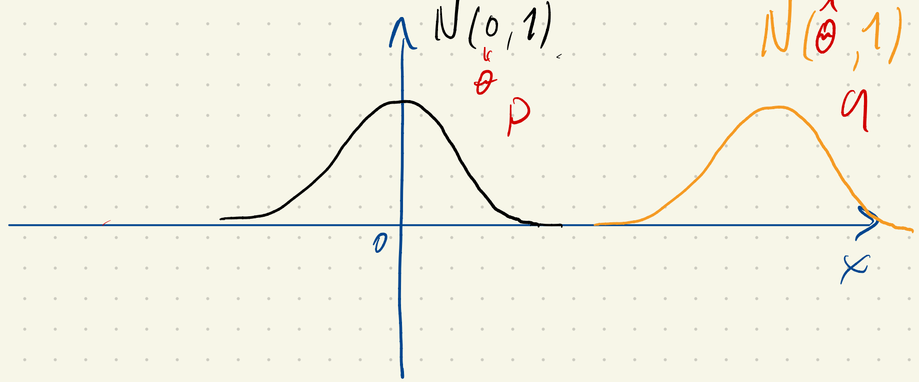
∞

$$JS(p, q) = KL\left(p \,\Big\|\, \frac{p+q}{2}\right) + KL\left(q \,\Big\|\, \frac{p+q}{2}\right)$$

$\theta = \hat{\theta}$ 0

$\theta = 100$

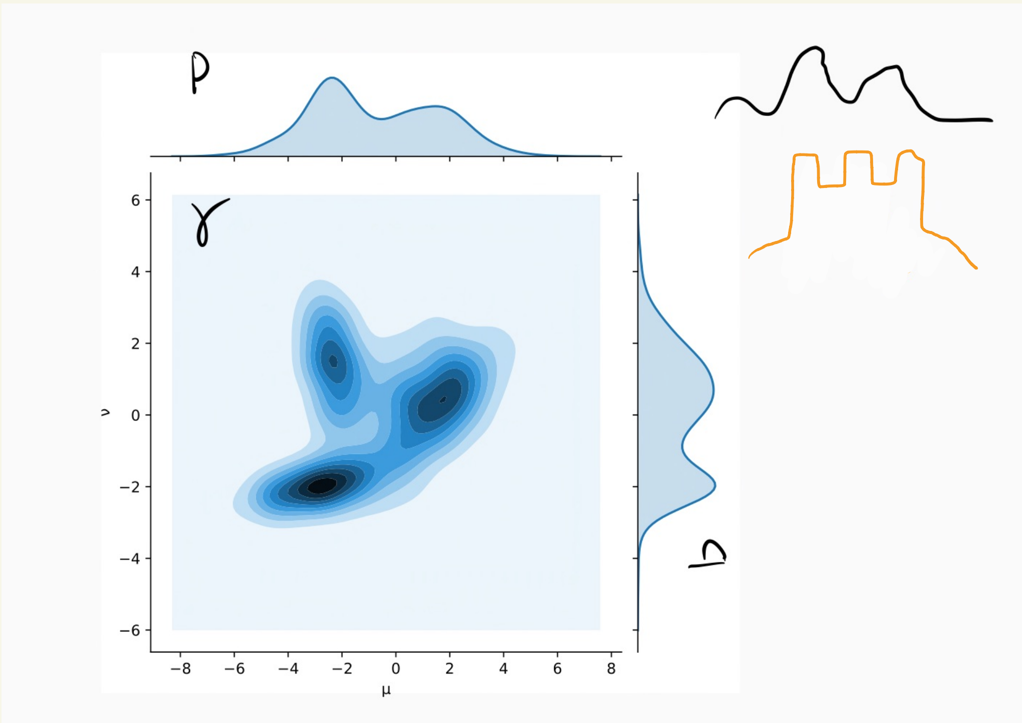
$\underbrace{2}_{\text{const}}$



$$W(p, q) = \|\theta - \hat{\theta}\|$$

$$W(p,q) = \inf_{x,y \sim \gamma} \mathbb{E} \|x-y\|_2$$

wasserstein



$$W(p,q) = \sup_f \left(\mathbb{E}_{x\sim p} f(x) - \mathbb{E}_{x\sim q} f(x) \right),$$

где f липшецова ф-я с
$K=1$.

$$\forall x,y \quad |f(x) - f(y)| \le K |x-y| \quad K=1$$

x ; $\sin(x)$.

$\sigma(x)$. $th(x)$. 

ReLU(x) $\rightarrow$ $\max(0, x)$.

f - dnn. $f_\theta(x)$ $\|\nabla_x f_\theta(x)\|$.

$$\boxed{\| \|\nabla_x f_\theta(x)\| - 1 \|_2}$$

$$L_D = -\mathbb{E}_{x\sim p} f_{\theta_f}(x) + \mathbb{E}_{x\sim q} f_{\theta_f}(x) + \quad (1)$$

$$L_G = -\mathbb{E}_{x\sim q} f_{\theta_f}(x) = -\mathbb{E}_{z\sim N} f_{\theta_f}(G_{\theta_G}(z)) \quad (2)$$

f - critic.

optim = Adam (G.parameters())

optim.step().