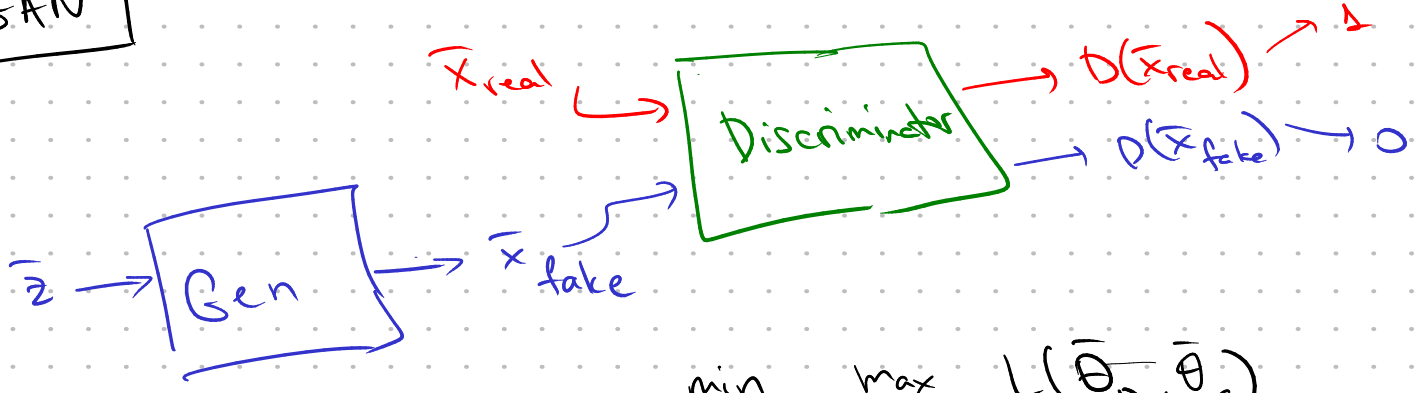
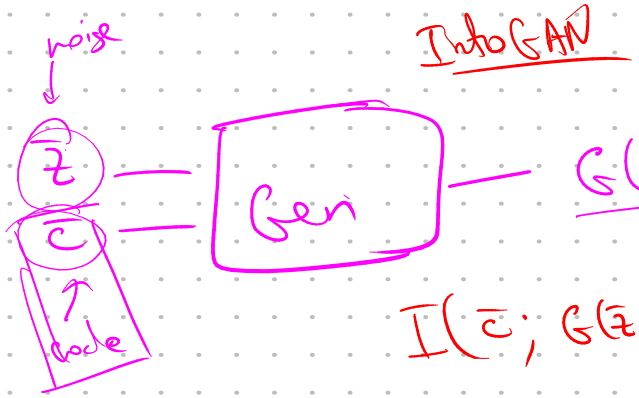
GAN



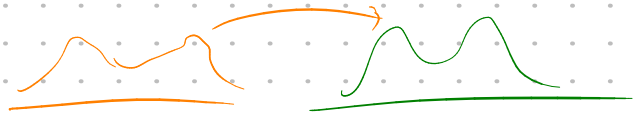
$$\min_{\bar{\theta}_G} \max_{\bar{\theta}_D} L(\bar{\theta}_D, \bar{\theta}_G)$$

$$L_{BCE} = \mathbb{E}_{\bar{x}_{real}}[\log D(\bar{x})] + \mathbb{E}_{\bar{z}\sim p_z}[\log(1 - D(G(\bar{z})))]$$

where $G(\bar{z}) = \bar{x}_{fake}$

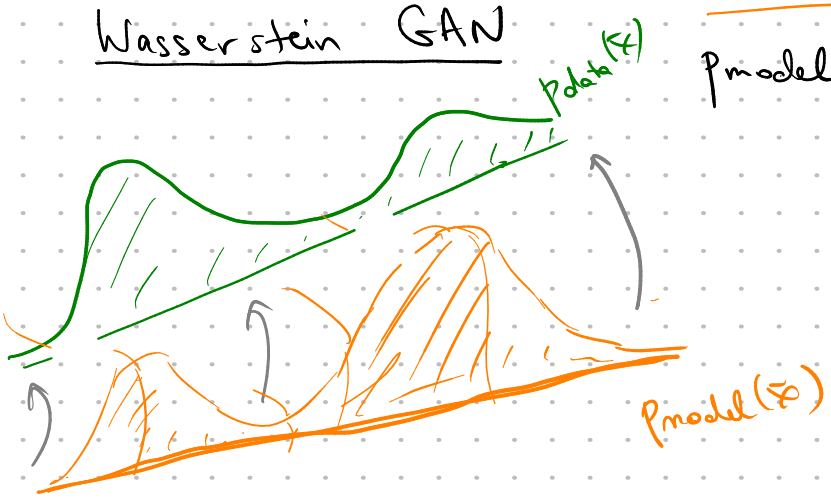


$$I(\bar{c}; G(\bar{z}, \bar{c})) = H(c) - H(c \mid G(\bar{z}, \bar{c}))$$



$$p_{model}(\bar{x}) \approx p_{data}(\bar{x})$$

Wasserstein GAN

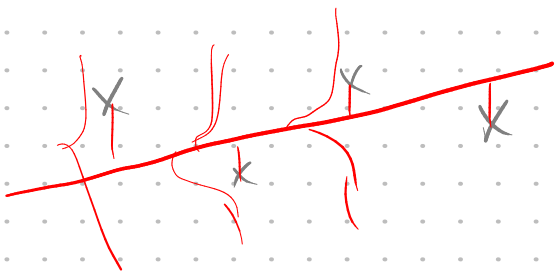


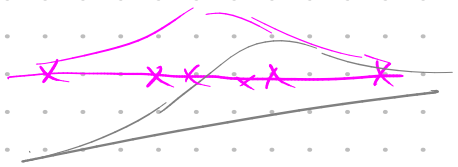
$$KL(p \| q) = \int p(\bar{x}) \log \frac{p(\bar{x})}{q(\bar{x})} d\bar{x}$$

$KL(p_{data} \| p_{model}) = \infty$

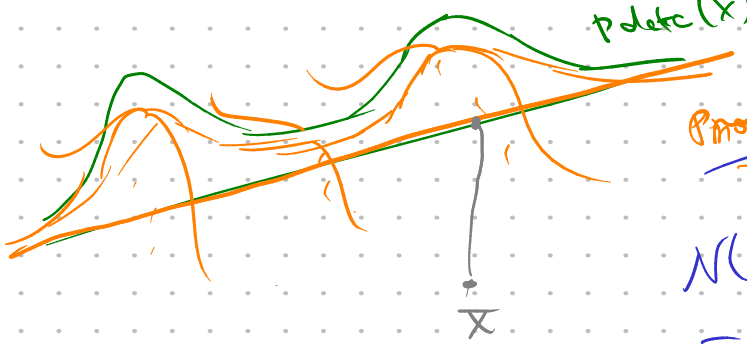
$KL(p_{model} \| p_{data}) = \infty$

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

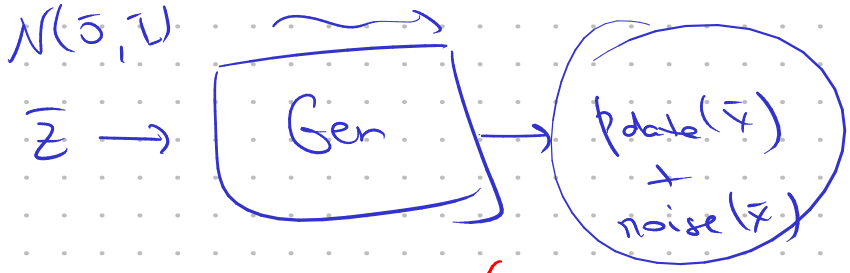




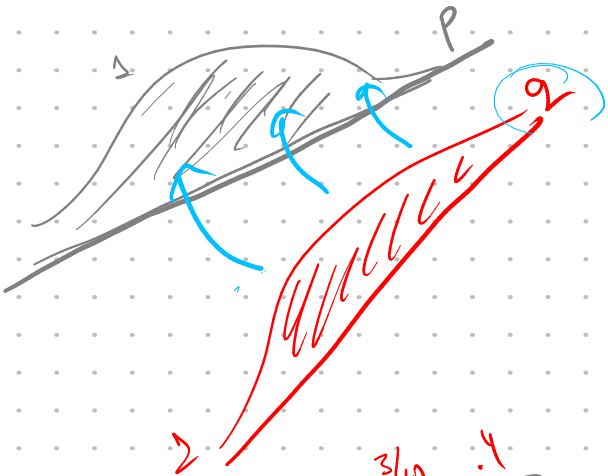
$$y \sim \mathcal{N}(y \mid \bar{w}^T \bar{x}, \sigma^2)$$

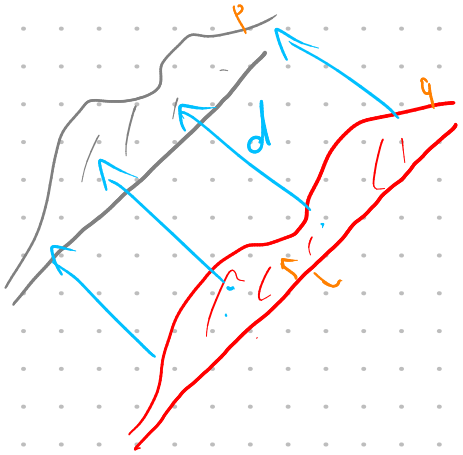


$$p_{model}(\bar{x}) = p_{data}(\bar{x}) + \mathcal{N}(\bar{x} \mid \ldots)$$

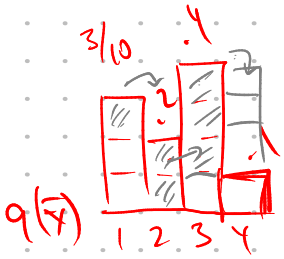


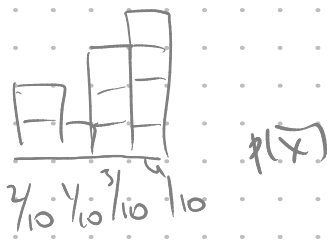
Wasserstein distance / Earth Mover Distance (EMD)





EMD(p,q) = d





$$\frac{3}{10} + \frac{2}{10} + \frac{1}{10} = \frac{6}{10}$$

$$\inf_{\gamma \in Prob(p,q)} \left(\mathbb{E}_{\gamma(\bar{x},\bar{y})} \left[\|\bar{x} - \bar{y}\| \right] \right) = W(p,q)$$

Kbovich Monge-Kantorovich / Kantorovich-Rubinstein duality

$$W(p,q) = \sup_{f:\ \|f\|_L \le 1} \left(\mathbb{E}_{\bar{x}\sim p(\bar{x})}[f(\bar{x})] - \mathbb{E}_{\bar{x}\sim q(\bar{x})}[f(\bar{x})] \right)$$

p: p_{data} — q: $p_{model}(\bar{x})$

$\bar{x} - f_{\bar{w}} - f(\bar{x})$

$\bar{z} - G_{\bar{\theta}} - g(\bar{z})$

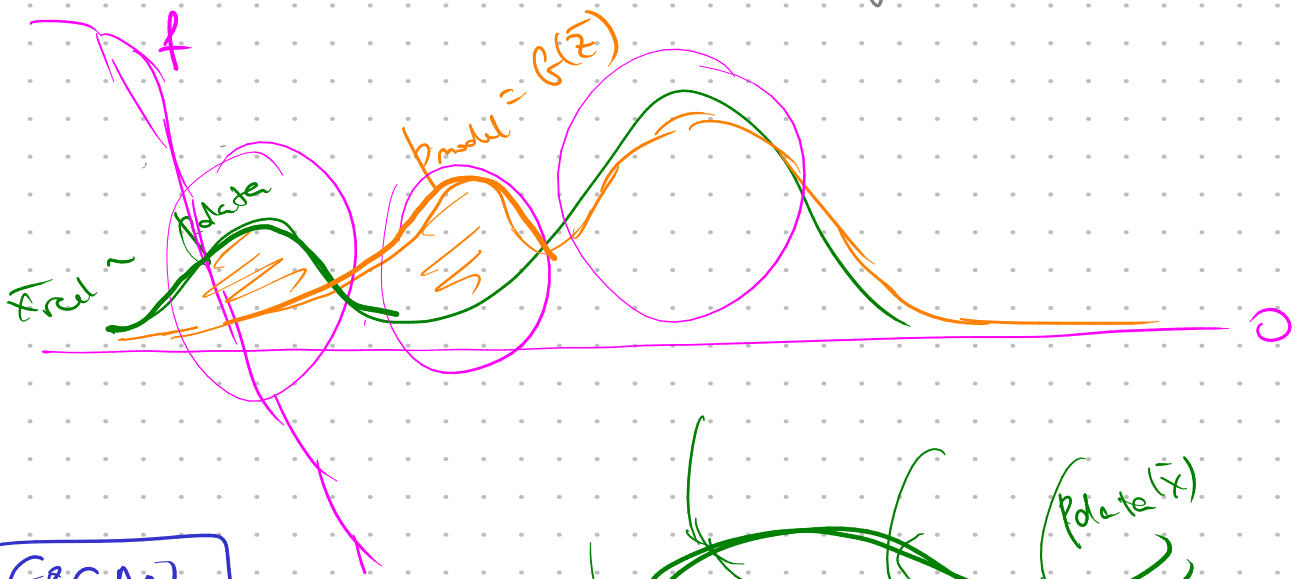
- fix $G, \bar{\theta}$: learn $\bar{w}$:

$$\mathbb{E}_{\bar{x}_{real}}[f(\bar{x})] - \mathbb{E}_{\bar{z}}[f(G(\bar{z}))] \xrightarrow[\bar{w}]{} \max$$

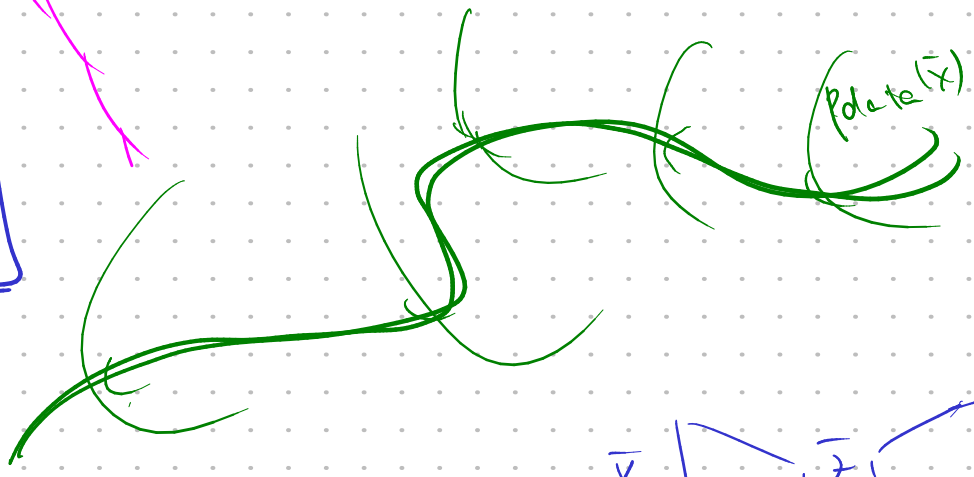
- fix $\bar{w}$, i.e. f:

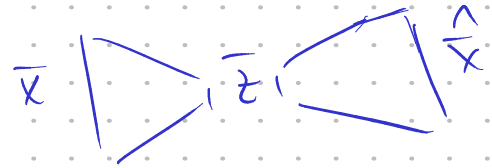
$$\mathbb{E}_{\bar{x}_{real}}[f(\bar{x})] + \mathbb{E}_{\bar{z}}[f(G(\bar{z}))] \xrightarrow[\bar{\theta}]{} \min$$

$\bar{\theta} \to \max$

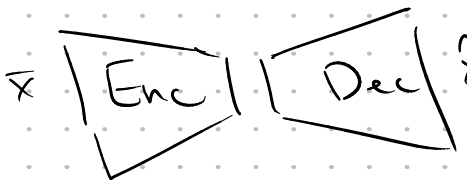


EBGAN
energy-based

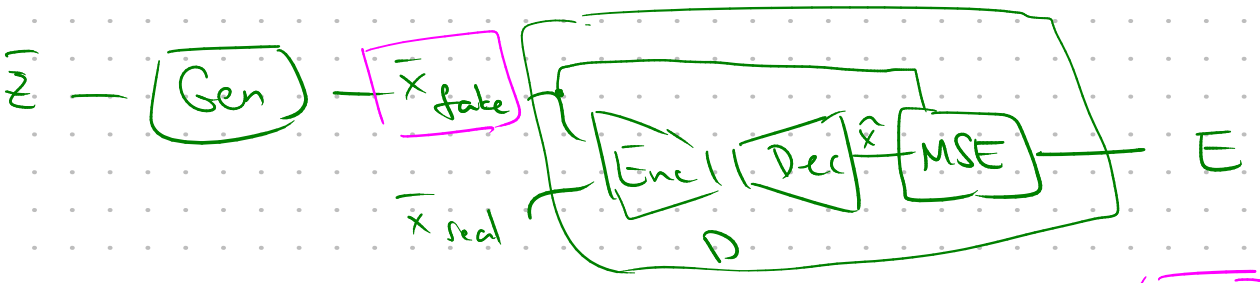




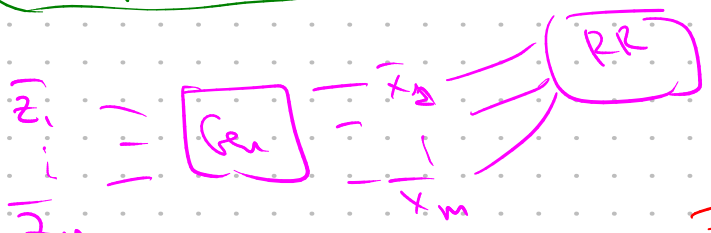
D:



$$\| Dec(Enc(\bar{x})) - \bar{x} \| \to \min$$



Repelling regularizer:

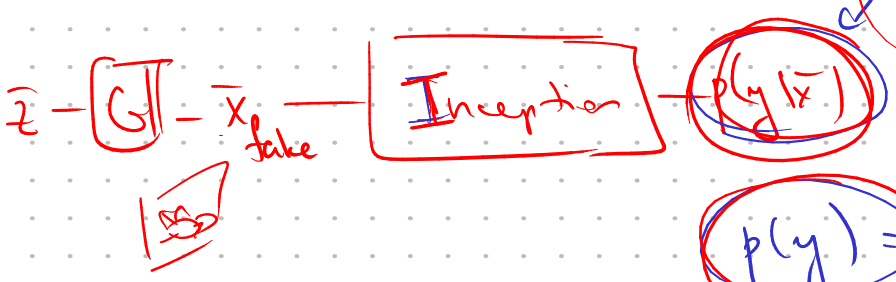


$$\sum_{i,j} \cos(\bar{x}_i, \bar{x}_j) \to \min$$

$$E_x\left[KL(p(y) \| p(y|\bar{x}))\right]$$

маленькая дисперсия

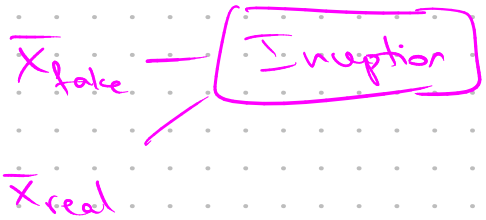
Inception Score



$$p(y) = \int p(y|G(\bar{z}))\, p(\bar{z})\, d\bar{z}$$

большая дисперсия

FID - Frechet Inception distance

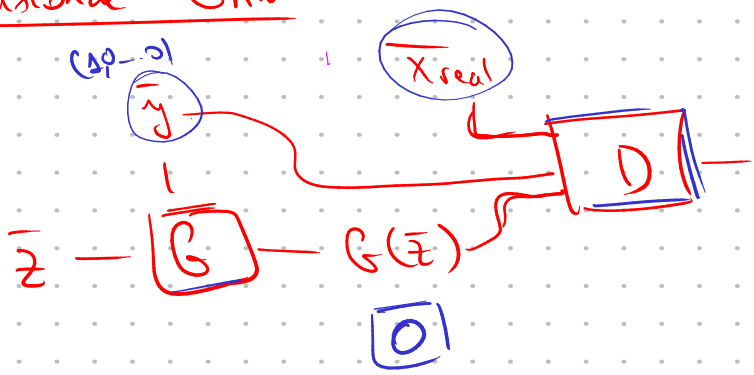


$$\sqrt{\inf_{\gamma} \int_{\mathbb{R}^n \times \mathbb{R}^n} \| \bar{x} - \bar{y} \|^2 \, d\gamma(\bar{x}, \bar{y})}$$

Conditional GAN

$p(\bar{x} \mid \bar{y})$

$D = \{(\bar{x}, \bar{y})\}$



Adversarial autoencoders (AAE)