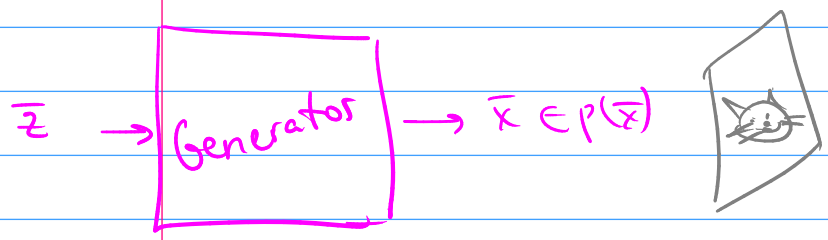
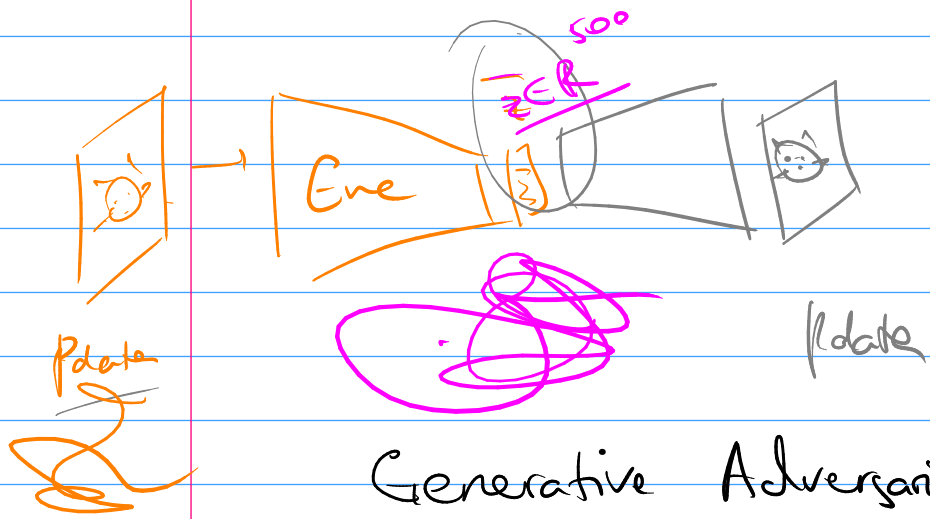
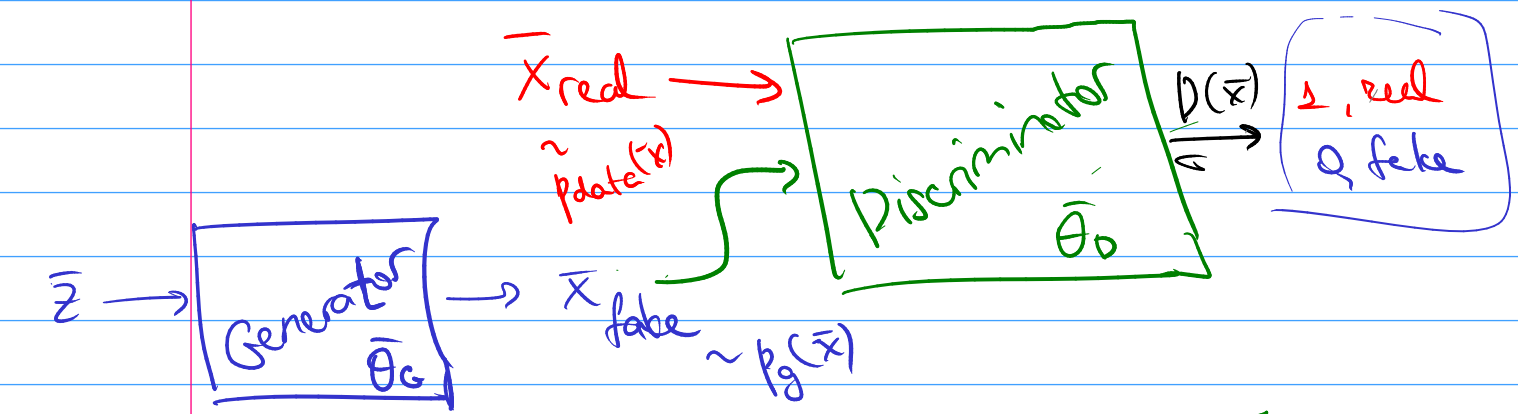


Autoencoder :



Generative Adversarial Networks



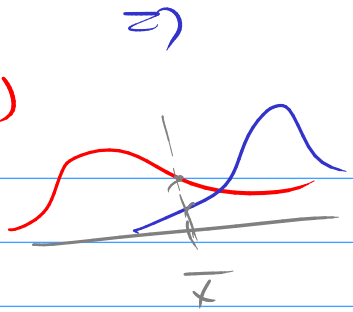
$$L_D(\bar{\theta}_D) = \mathbb{E}_{\bar{x}_{real}}\left[\log D(\bar{x})\right] + \mathbb{E}_{\bar{x}_{fake}}\left[\log(1 - D(\bar{x}))\right] \longrightarrow \max_{\bar{\theta}_D}$$

$\bar{x}_{fake} \sim p_G(\bar{x})$

$$L_G(\bar{\theta}_G) = \mathbb{E}_{\bar{z}}\left[\log(1 - D(G(\bar{z}))\right] \longrightarrow \min_{\bar{\theta}_G}$$

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

fix G $\Rightarrow$ $D_G^*(\bar{x}) = \dfrac{p_{data}(\bar{x})}{p_{data}(\bar{x}) + p_g(\bar{x})}$ $\Rightarrow$

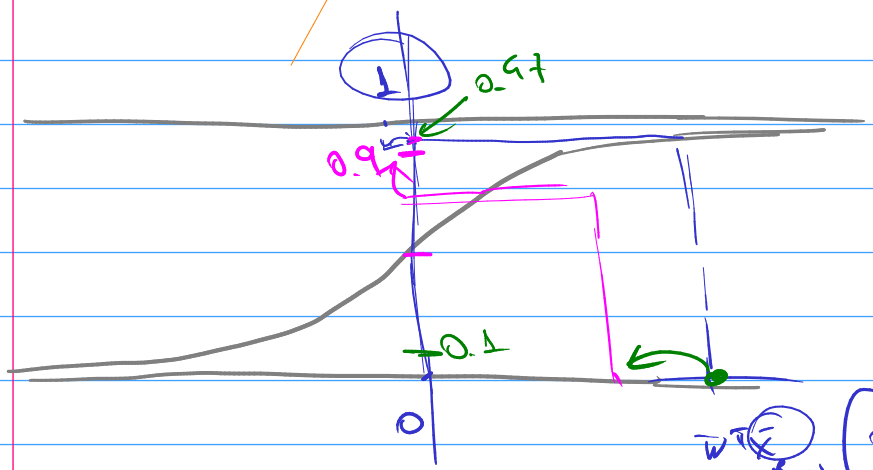


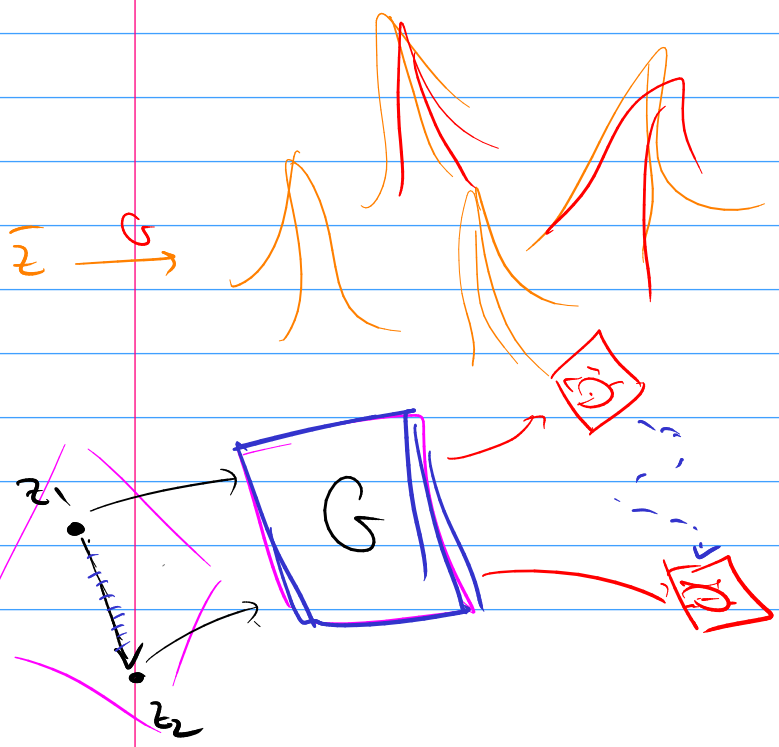
$\Rightarrow G^*$: $p_g^*(\bar{x}) = p_{data}(\bar{x})$

$$p(data|\bar{x}) = \frac{p(\bar{x}|data)p(data)}{p(\bar{x}|data)p(data) + p(\bar{x}|g)p(g)}$$

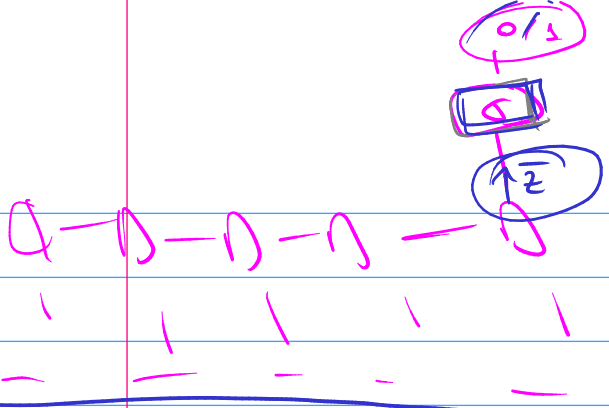
$$L_G = JSD(p_{data}\|p_g) = KL\left(p_{data}\,\|\,\frac{p_{data}+p_g}{2}\right) + KL\left(p_g\,\|\,\frac{p_{data}+p_g}{2}\right)$$

$$L_G = -\mathbb{E}_{\bar{z}}[\log D(G(\bar{z}))]$$

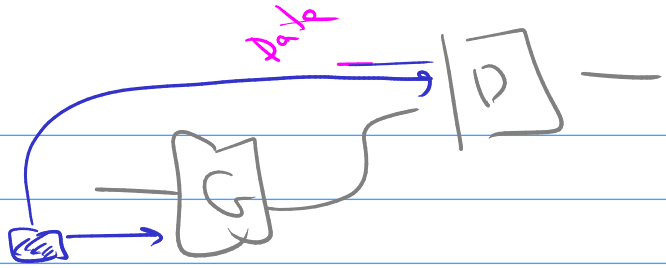




mode collapse



Conditional GAN



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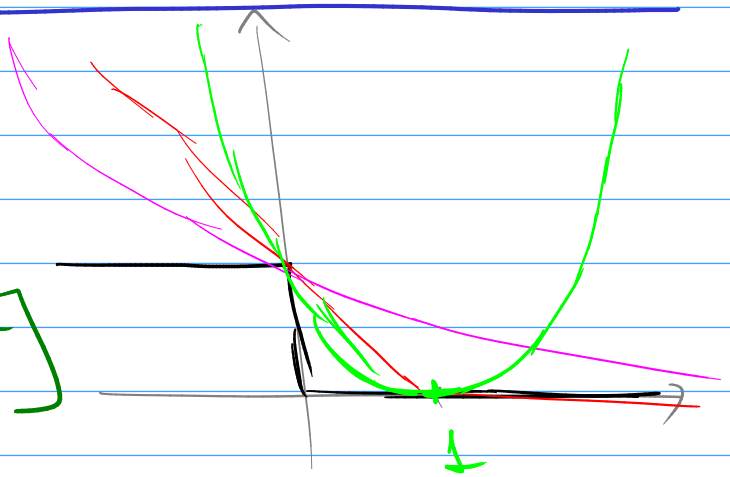
① LSGAN least squares

$$L_D = \mathbb{E}_{p_{data}}[(D(x)-b)^2] + \mathbb{E}_{p_{gen}}[(D(x)-a)^2]$$

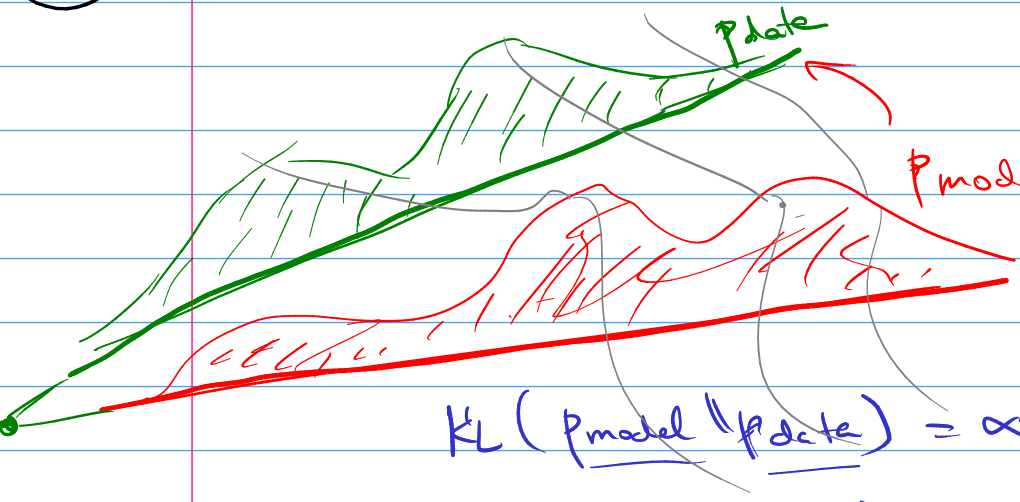
($b=1$, $a=0$)

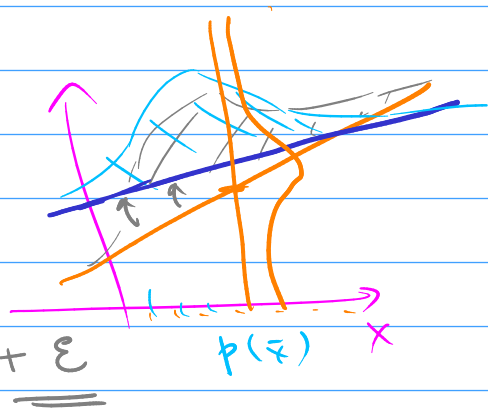


$$L_G = \mathbb{E}_{z}[(D(G(z))-c)^2]$$

($c=1$)

② WGAN Wasserstein GAN





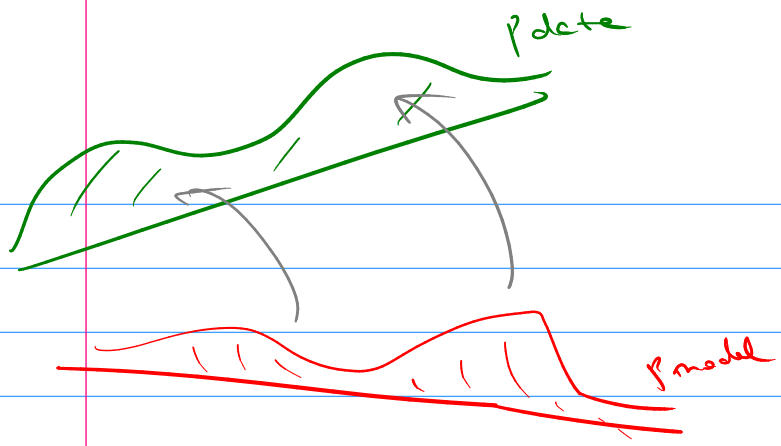
$$KL(p\|q) = \int p \ln \frac{q}{p}\, dx$$

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

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

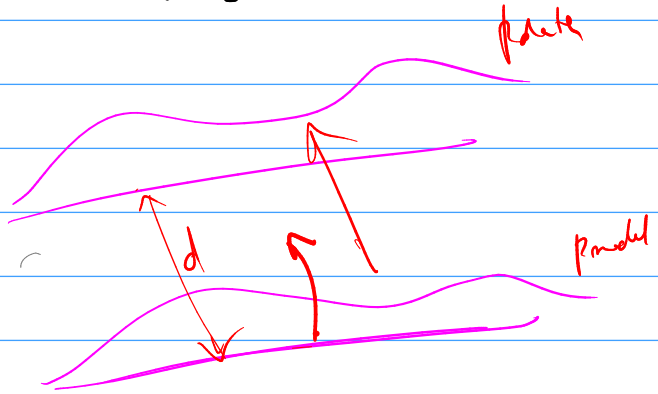
$$JSD(p_{data}\|p_{model}) = \text{const}$$

$$p_{model} = N(y \mid \vec{w}^T\vec{x}, \sigma^2)$$

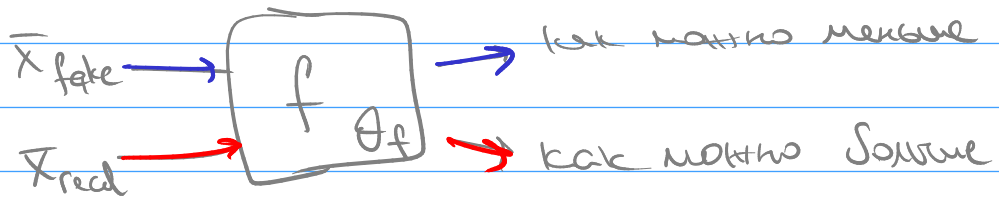


EMD

Earth mover distance

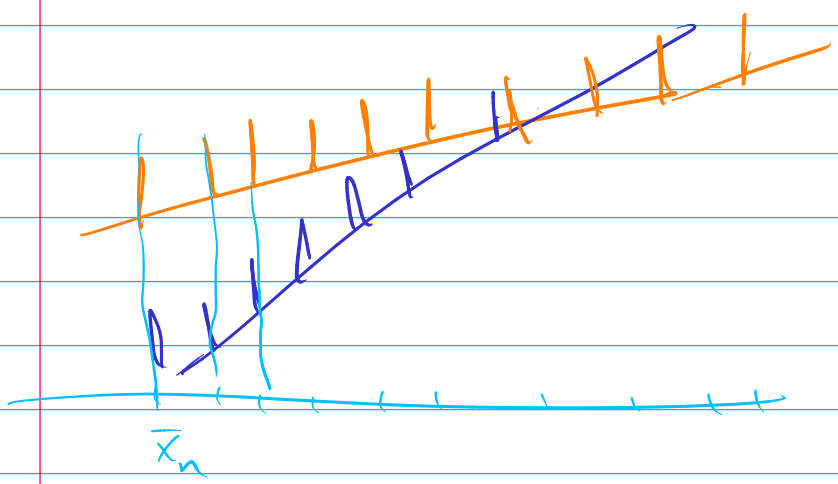


$$W = \sup_{\|f\|_L \le 1} \left(\mathbb{E}_{\bar{x} \sim p_{data}} [f(\bar{x})] - \mathbb{E}_{\bar{x} \sim p_{model}} [f(\bar{x})] \right)$$



$$\{ \bar{x}_1^2, \dots, \bar{x}_k^2, \bar{x}_1^f, \dots, \bar{x}_k^f \}$$

$$\frac{1}{k} \sum f(\bar{x}_i^2) - \frac{1}{k} \sum f(\bar{x}_i^f) \xrightarrow{f} \max$$



self-adversarial training