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Question: Show that the global minimum of $C(G) = \max_V (G, D)$ is achie...

Show that the global minimum of $C(G) = \max_D V(G, D)$ is achieved if and only if $p_G = p_{\text{data}}$. At that point, show that $C(G)$ achieves the value $-\log 4$.

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Theorem:- Show that the global minimum of $C(\theta) = \max_{\theta} V(\theta, D)$ is achieved if and only if $\theta = \theta_{data}$. At that point show that $C(\theta)$ achieves the value $-\log k$.

Proof:-

→ First let us look at the objective function,

$$\min_{\theta} \max_{\theta} [E_{x \sim p_{data}} \log D_{\theta}(x) + E_{z \sim p_{\theta}} \log (1 - D_{\theta}(G_{\theta}(z)))]$$

→ We will expand it to its integral form

$$C = \min_{\theta} \max_{\theta} \left(\int_x p_{data}(x) \log D_{\theta}(x) + \int_z p_{\theta}(z) \log (1 - D_{\theta}(G_{\theta}(z))) \right)$$

→ Let $p_G(x)$ denote the distribution of x 's generated by the generator and since x is a function of z we can replace the real integral as shown below

$$\min_{\theta} \max_{\theta} \left(\int_x p_{data}(x) \log D_{\theta}(x) + \int_z p_G(z) \log (1 - D_{\theta}(G_{\theta}(z))) \right)$$

→ Revised objective is given by

$$\min_{\theta} \max_{\theta} \int_x (p_{data}(x) \log D_{\theta}(x) + p_G(x) \log (1 - D_{\theta}(x))) dx$$

→ To find the optima we will take the derivative of the term inside the integral w.r.t $D_{\theta}(x)$ and set it to zero

$$\frac{d}{d(D_{\theta}(x))} (p_{data}(x) \log D_{\theta}(x) + p_G(x) \log (1 - D_{\theta}(x))) = 0$$

$$p_{data}(x) \frac{1}{D_{\theta}(x)} + p_G(x) \frac{1}{1 - D_{\theta}(x)} (-1) = 0$$

$$\frac{p_{data}(x)}{D_{\theta}(x)} = \frac{p_G(x)}{1 - D_{\theta}(x)}$$

$$(p_{data}(x)(1 - D_{\theta}(x)) = (p_G(x) D_{\theta}(x))$$

- / we need to find the derivative of

$$D^*_{G_1}(G_1(x)) = \frac{p_{G_1}(x)}{p_{G_1}(x) + p_{G_2}(x)}$$

→ Now the 1st part of the theorem says "if $p_{G_1} = p_{G_2}$ "

→ So let us substitute $p_{G_1} = p_{G_2}$ into $D^*_{G_1}(G_1(x))$ and see what happens to the loss function:-

$$D^*_{G_1} = \frac{p_{G_1}}{p_{G_1} + p_{G_1}} = \frac{1}{2}$$

$$\begin{aligned} V(G_1, D^*_{G_1}) &= \int_{\mathcal{X}} p_{G_1}(x) \log D^*_{G_1}(x) + p_{G_2}(x) \log (1 - D^*_{G_1}(x)) dx \\ &= \int_{\mathcal{X}} p_{G_1}(x) \log \frac{1}{2} + p_{G_2}(x) \log \left(1 - \frac{1}{2}\right) dx \\ &= \log 2 \int_{\mathcal{X}} p_{G_1}(x) dx - \log 2 \int_{\mathcal{X}} p_{G_2}(x) dx \\ &= -2 \log 2 = -\log 4 \end{aligned}$$

∴ Proved

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Anonymous posted 11 months ago

I appreciate the answer, but is very difficult to understand. Please can you rewrite the same. I am very sorry to ask like this.



Anonymous posted 11 months ago

give me some time will do it

Anonymous posted 11 months ago

 Anonymous posted 10 months ago

Can I please have the answer



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Q: 6. Show that the global minimum of $C(G) = \max V(G, D)$ is achieved if and only if $P_G = P_{data}$. At that point, show that $C(G)$ achieves the value $-\log 4$. D

A: [See answer](#)

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Q: 6. Show that the global minimum of $C(G) = \max V(G, D)$ is achieved if and only if $P_G = P_{data}$. At that point, show that $C(G)$ achieves the value $-\log 4$. D

A: [See answer](#)

Q:
1. Let $f: \mathbb{R}^n \rightarrow \mathbb{R}$ be a convex function that is $f(tx_1 + (1-t)x_2)$

A: [See answer](#) 100% (1 rating)

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