HW9

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$$D^2_E(p_{test}, q_\pi) = 2\,\mathbb{E}_{x'\sim p_{test},\, x\sim q_\pi}\|x'-x\| - \mathbb{E}_{x',\tilde{x}'\sim p_{test}}\|x'-\tilde{x}'\| - \mathbb{E}_{x,\tilde{x}\sim q}\|x-\tilde{x}\|$$

constant

for simplicity, $\mathbb{E}_{x\sim p, x'\sim p'} := \mathbb{E}_{x\sim p, x'\sim p'}\|x-x'\|$

$$D^2_E(p_{test}, q_\pi) = 2\left(\pi\,\mathbb{E}_{x'\sim p_{test},\, x\sim p_{train}(x|+1)} + (1-\pi)\,\mathbb{E}_{x'\sim p_{test},\, x\sim p_{train}(x|-1)}\right)$$

$$-\left(\pi^2\,\mathbb{E}_{x,\tilde{x}\sim p_{train}(x|+1)} + 2\pi(1-\pi)\,\mathbb{E}_{x\sim p_{train}(x|+1),\,\tilde{x}\sim p_{train}(x|-1)} + (1-\pi)^2\,\mathbb{E}_{x,\tilde{x}\sim p_{train}(x|-1)}\right) + C$$

$$= 2\left(\pi b_{+1} - \pi b_{-1} + b_{-1}\right) - \left(\pi^2 A_{+1,+1} + \left(2\pi - \pi^2\right)A_{+1,-1} + \pi^2 A_{-1,-1} - 2\pi A_{-1,-1} + A_{1,-1}\right) + C$$

constant

$$= \pi^2\left(2A_{+1,-1} - A_{+1,+1} - A_{-1,-1}\right) - 2\left(A_{+1,-1} - A_{-1,-1} - b_{+1} + b_{-1}\right)\pi + C$$