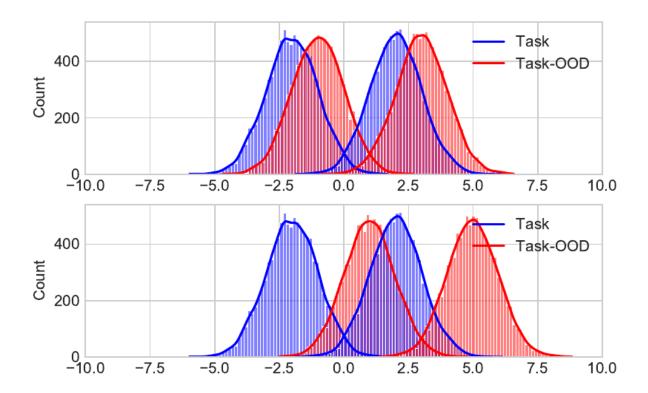
Gaussian Task

We consider a family of tasks

$$P(x,y) = \delta(y=1)X_1 + \delta(y=-1)X_{-1}$$

where X_1 and X_2 are Gaussians with means $\pm \mu$



Error of Hypothesis

Consider random variable $ar{h}$. If $ar{h}=h$, then

$$e_t(h) = rac{1}{2} \left(\left(1 - \Phi(h+\mu) + \Phi(h-\mu)
ight).$$

If we assume $ar{h} \sim \mathcal{N}(ar{\mu}, ar{\sigma})$

$$\mathbb{E}[e_t(ar{h})] = rac{1}{2} - rac{1}{2}\Phi\left(rac{ar{\mu} + \mu}{\sqrt{1+ar{\sigma}^2}}
ight) + rac{1}{2}\Phi\left(rac{ar{\mu} - \mu}{\sqrt{1+ar{\sigma}^2}}
ight)$$

LDA - Single-head model

Consider the samples to be weighted as

$$S = \alpha S_t + (1 - \alpha) S_{ood}$$

For LDA

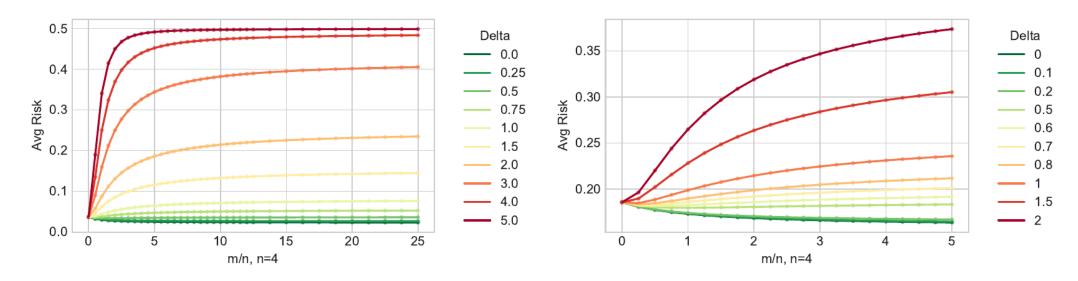
$$ar{\mu} = rac{(1-lpha)m\Delta}{lpha n + (1-lpha)m}$$

and

$$ar{\sigma}^2 = rac{(1-lpha)^2 m + lpha^2 n}{(lpha n + (1-lpha) m)^2}$$

LDA with lpha=0.5

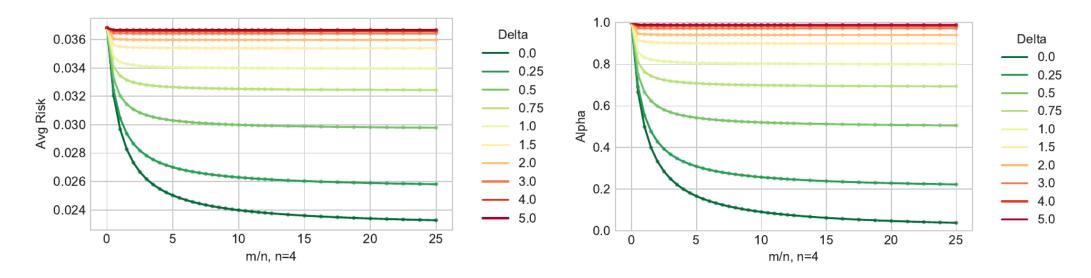
When both datasets are naively combined (lpha=0.5)



the loss increases/decreases depending on Δ .

LDA with optimized lpha

However if we optimize α , the loss is always better



Note on optimizing lpha

lpha is only usable if we can separate out samples in S_{ood} and S_t . Otherwise, we are forced to use lpha=0.5.