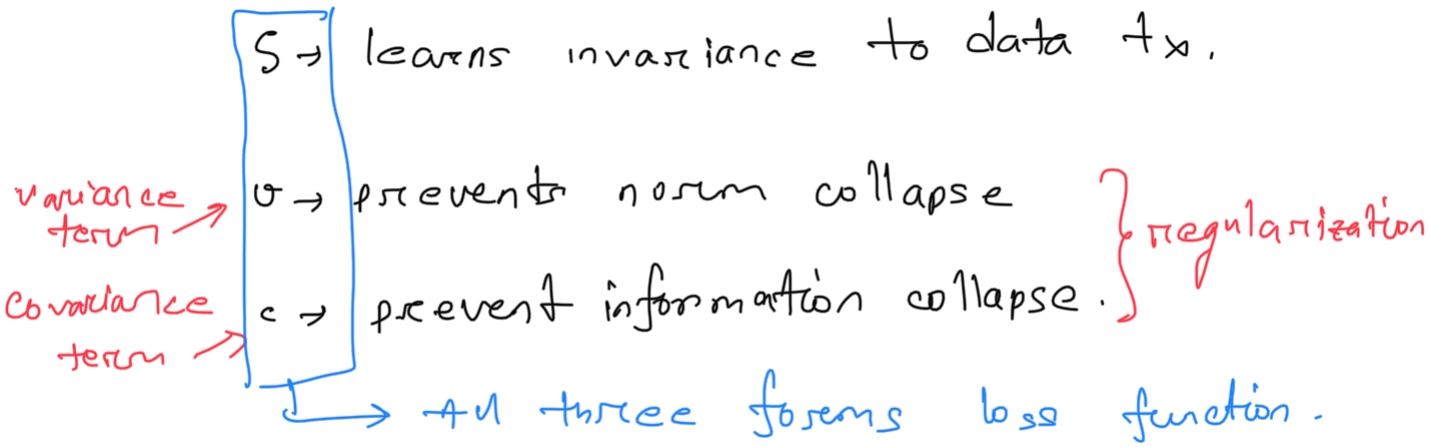
vICReg paper



Method

i sampled from dataset $\mathcal{D}$

t, t' → transformation

$$x = t(i)$$

$$x' = t'(i)$$

f_θ → y (encoder)

$$z = h_\phi(f_\theta(x))$$ Expander Network.

$$z' = h_\phi(f_\theta(x'))$$ → y'

Image in Batches:

$$Z = [z_1, z_2, \dots, z_n]$$ → z^j

$$Z' = [z_1', z_2', \dots z_n']$$

z^j ⇒ each value at dimension j of Z matrix

variance Regularization term.

$$v(Z) = \frac{1}{d} \sum^{d} \max(0, \gamma - s(z^j, \epsilon))$$

enhance variance

$$S(z^d, \epsilon) = \sqrt{\text{var}(z^d) + \epsilon}$$ // Regularized SD

↳ important to avoid collapse

Covariance matrix of z

$$C(z) = \frac{1}{n-1} \sum_{i=1}^{n} (z_i - \bar{z})(z_i - \bar{z})^T$$

where, $\bar{z} = \frac{1}{n} \sum_{i=1}^{n} z_i$

[Barlow twin setup]

Regularizer term:

$$C(Z) = \frac{1}{d} \sum_{i \neq j} [C(z)]_{i,j}^2$$

[off diagonal term close to zero]

Invariance criterion:

$$s(z, z') = \frac{1}{n} \sum_i \| z_i - z_i' \|_2^2$$

Overall loss function: Hyper parameters.

$$\ell(z, z') = \underset{1}{\hat{\lambda}} s(z, z') + \underset{1}{\hat{\mu}} \left[v(z) + v(z') \right]$$

$$+ \underset{n}{\underset{1}{v}} \left[c(z) + c(z') \right]$$

overall loss

$$\mathcal{L} = \sum_{t \in \mathcal{D}} \sum_{t' \sim T} \ell(z^t, z^{t'})$$