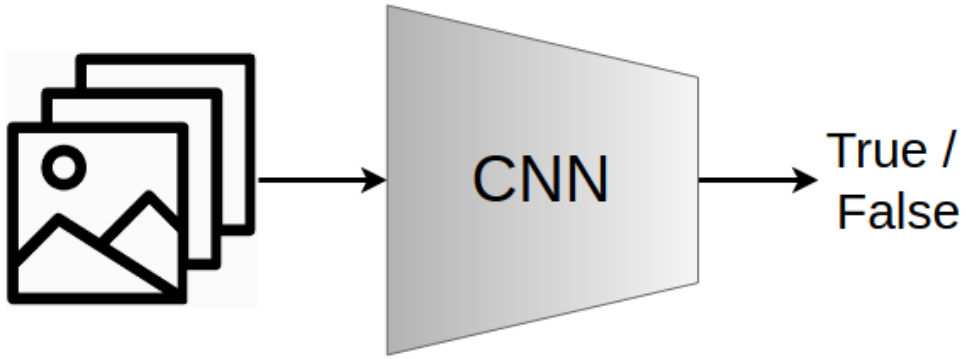
Transparent Self-Supervised Learning for Anomaly Detection Decision Support in Medical Imaging

Bradley Wheeler, Dr. Seong Jae Hwang
School of Computing and Information
University of Pittsburgh

Current Limitations

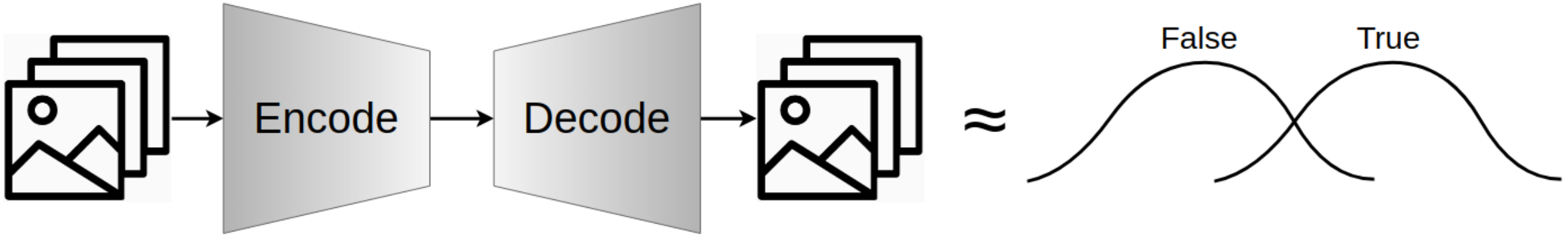
Supervised Learning



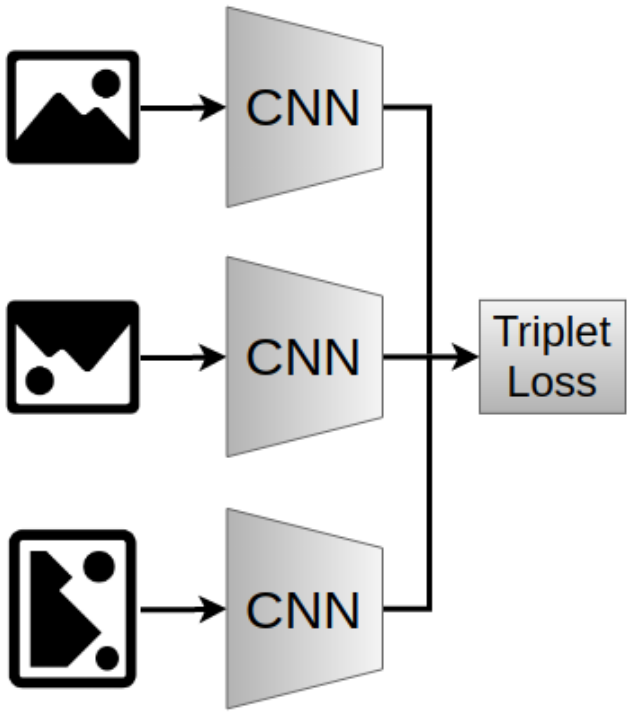
Limitations

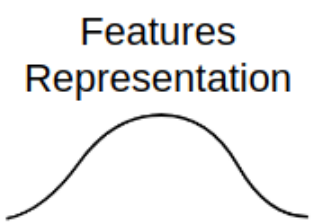
1. Resource intensive
2. Num training samples
3. Learning transparency

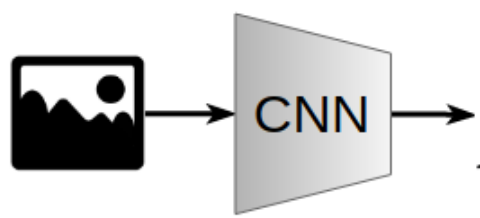
Self-Supervised Learning

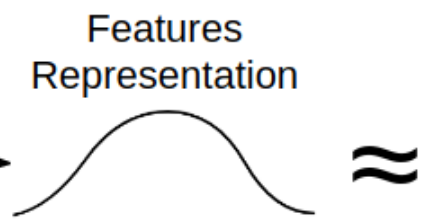


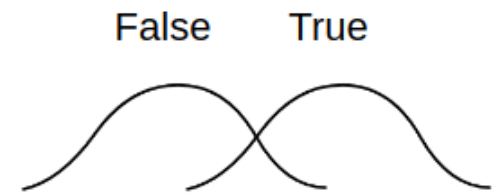
Our Method











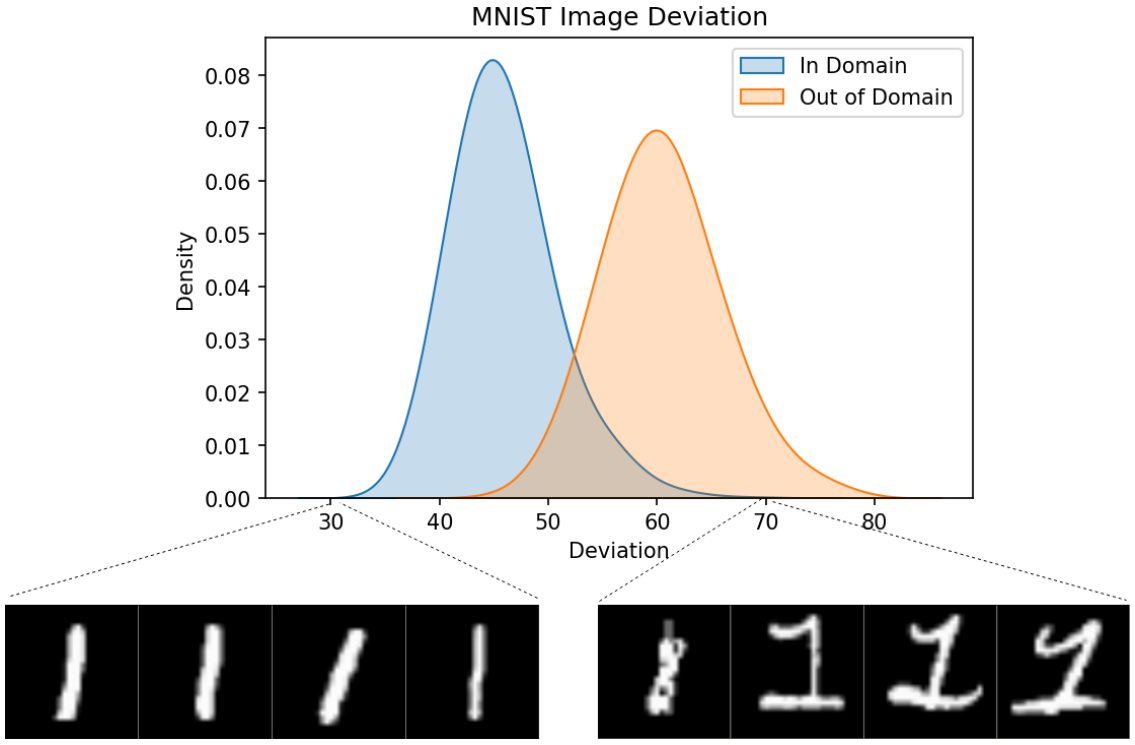
$$\mathcal{L}(x,\theta) = \alpha + \sum_{i}^{m}(f(x^a,\theta)_i - f(x^p,\theta)_i)^2 - \sum_{i}^{m}(f(x^a,\theta)_i - f(x^n,\theta)_i)^2$$

$$\sigma^2 = \frac{1}{n}\sum_{1}^{n}(X_i - \bar{X})(X_i - \bar{X})^T$$

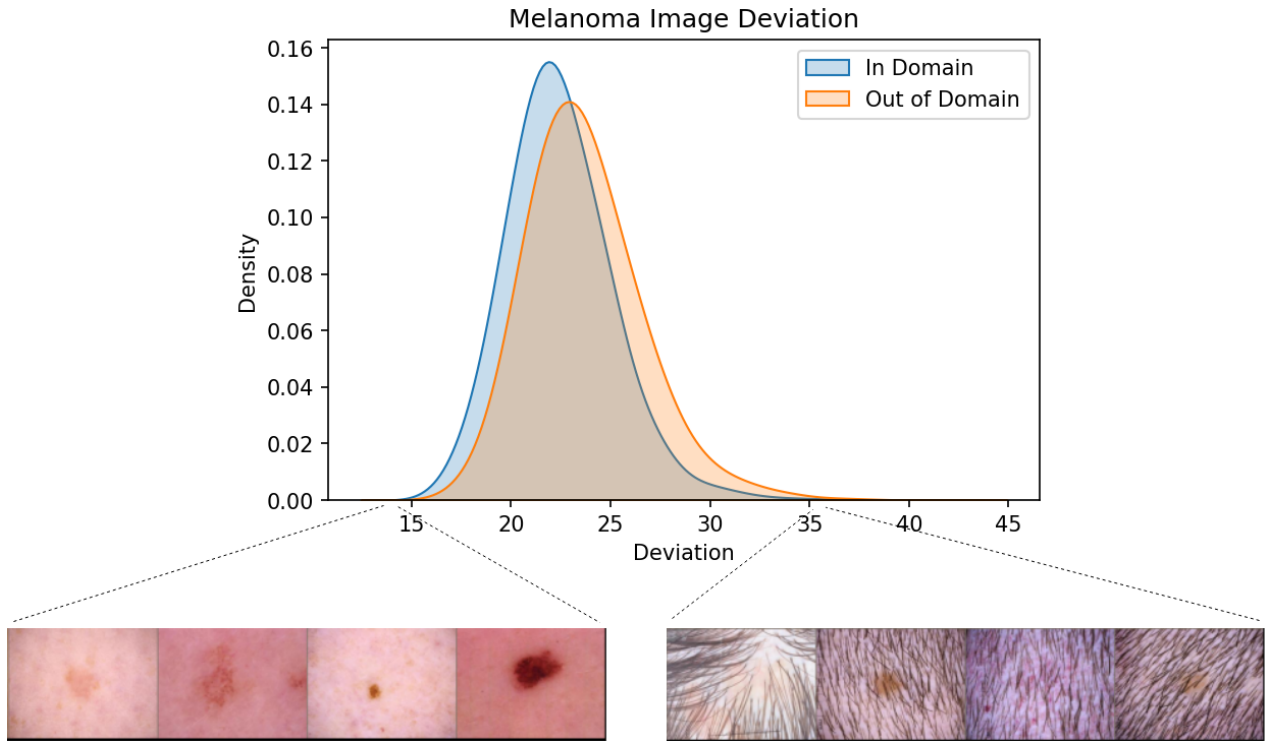
$$\mu = \bar{X} = \{\bar{x}_1,\ldots,\bar{x}_j,\ldots,\bar{x}_m\} \; where \; \bar{x}_j = \frac{1}{n}\sum_{i}^{n} x_{ij}$$

$$d = \sqrt{(x - \mu)^T(\sigma^2)^{-1}(x - \mu)}$$

Results



Sensitivity: 0.9552
Specificity: 0.9057
AUROC: 0.9766
Cut-off: 52.08



Sensitivity: 0.5849
Specificity: 0.6003
AUROC: 0.6269
Cut-off: 22.81