ACML 2023

APPLIED ARTIFICIAL INTELLIGENCE INSTITUTE

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Paper

Code

Domain Generalization with Interpolation Robustness

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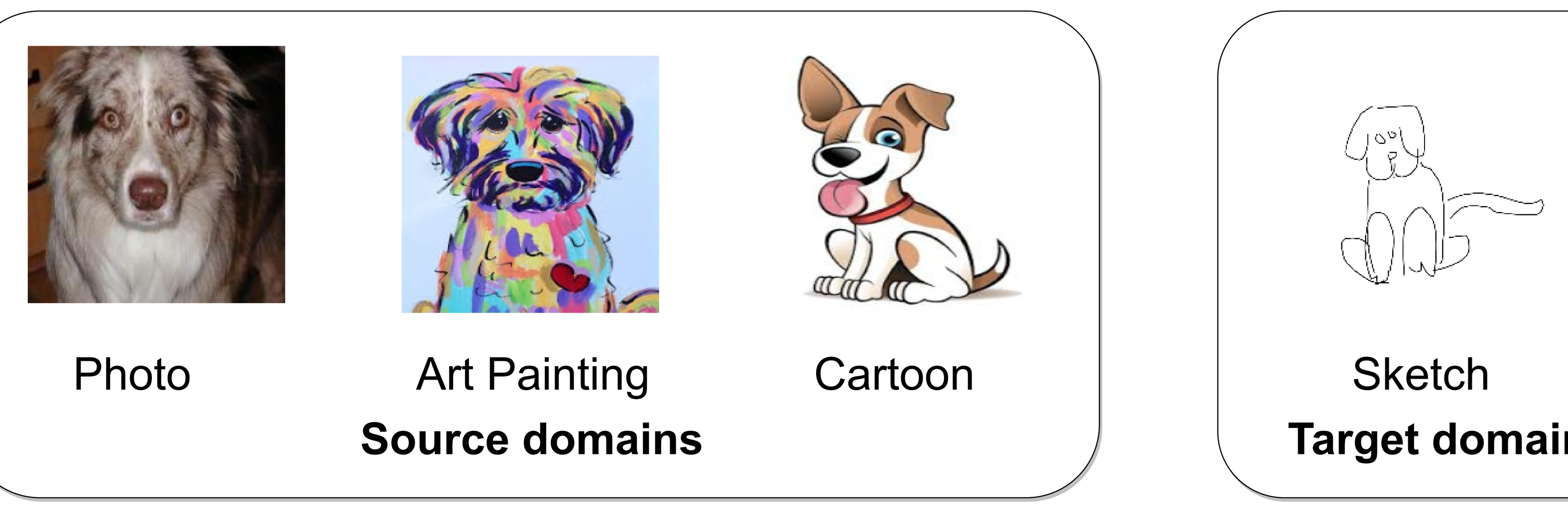
Domain Generalization



Data set consists of labelled pairs that are not identically distributed, but come from multiple source distributions that may share a few properties

Objective of ***domain generalization*** is to learn a classifier that predicts well on an unseen domain based on the source domains.

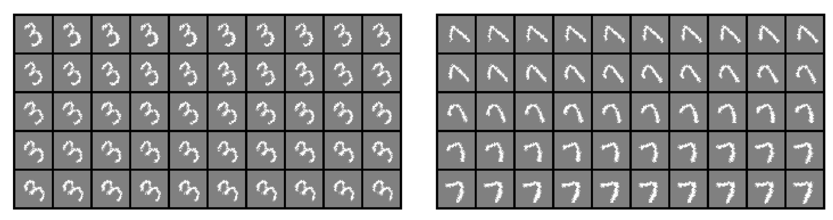
Motivation behind Interpolation

- Improve performance with limited training data

When there is insufficient training data, we need a method that ensures robust representations of images in the latent space across various imaginary domains. Interpolation achieves this by densifying the distributions of existing domains via creating new domains through interpolation.

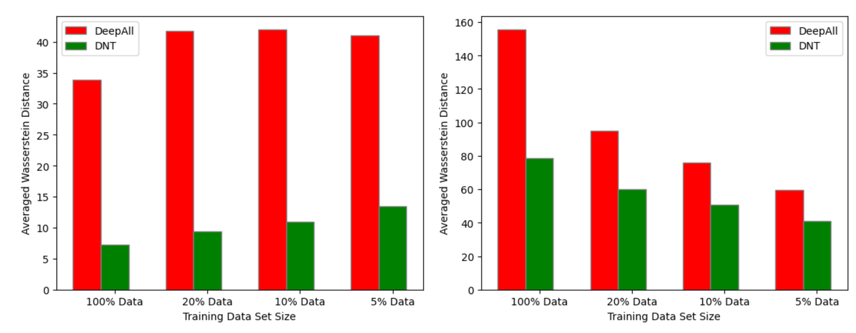
- Imagine domains beyond sources

Latent interpolation can imagine data between the source domains: 15° and 30° or 30° and 0°

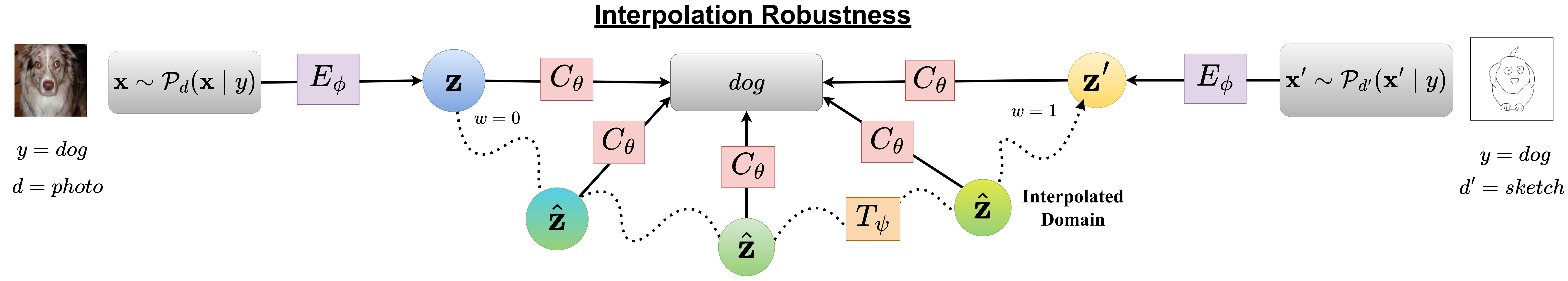


- Reduce domain-domain gap between:

source-source domains **source-target domains**



Interpolation Robustness



$$\mathbf{z} = E_\phi(\mathbf{x}),\ \mathbf{z}' = E_\phi(\mathbf{x}')$$ *\\ Encode the inputs from the same class* ***y*** *into a latent space*

$$\hat{\mathbf{z}} = \mathbf{z} + \omega * T_\psi(\mathbf{z}' - \mathbf{z})$$ *\\ Compute the interpolated representations*

$$\hat{y} = C_\theta(\mathbf{z}) \qquad \hat{y} = C_\theta(\mathbf{z}') \qquad \tilde{y} = C_\theta(\hat{\mathbf{z}})$$ *\\ Compute the model predictions of original and interpolated representations*

$$\mathcal{L}_{final} = l(y, \hat{y}) + \lambda * (l(y, \tilde{y}) + \| T_\psi(\mathbf{z}' - \mathbf{z}) - (\mathbf{z}' - \mathbf{z}) \|_2)$$ *\\ Minimize cross entropy (l) between the predictions and the labels*

Experimental Results - Leave One Domain Out Accuracy

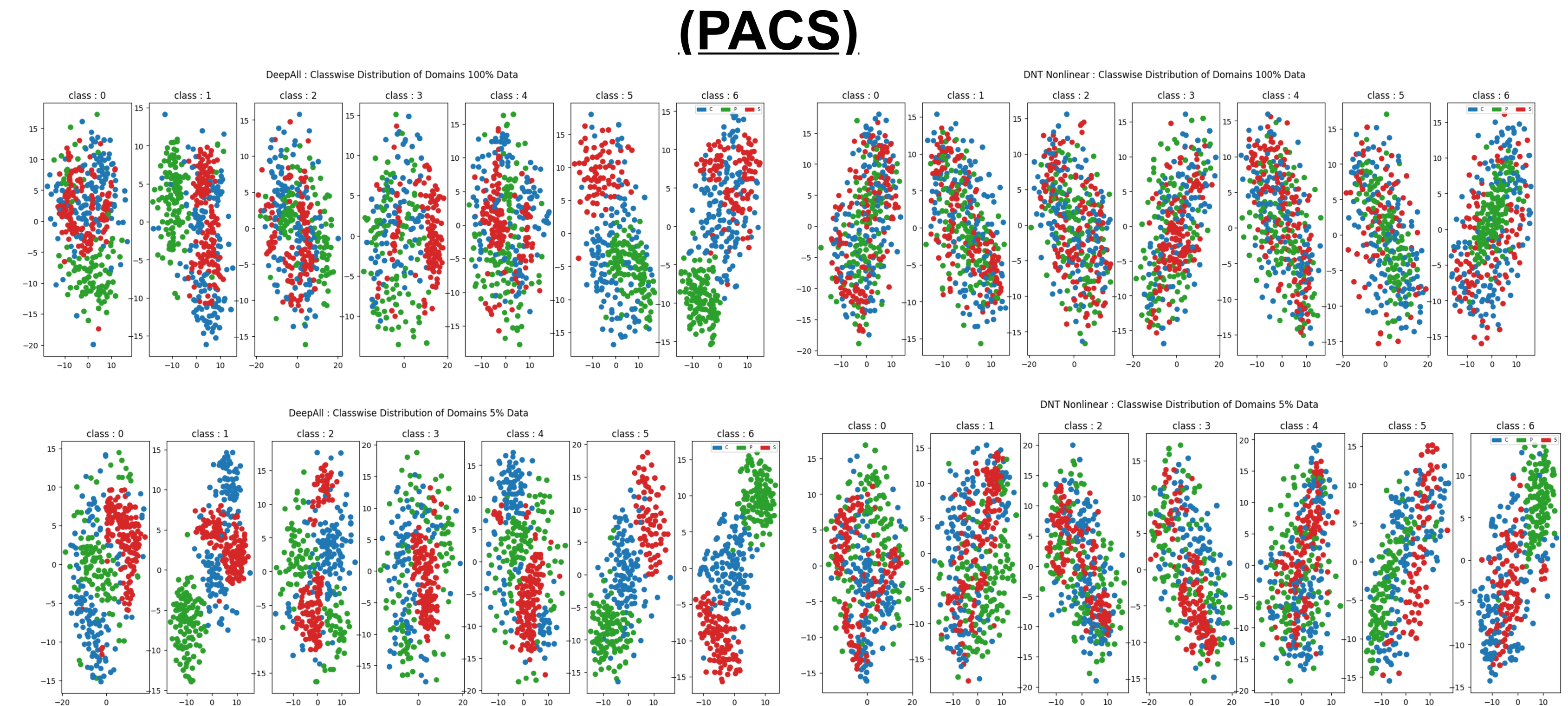
Baselines are in red and our models are in green. Our models are created by adding the interpolation regularization to each baseline. Our models have superior average target domain accuracy. Moreover, accuracy gap is larger for smaller amount of data.

PACS

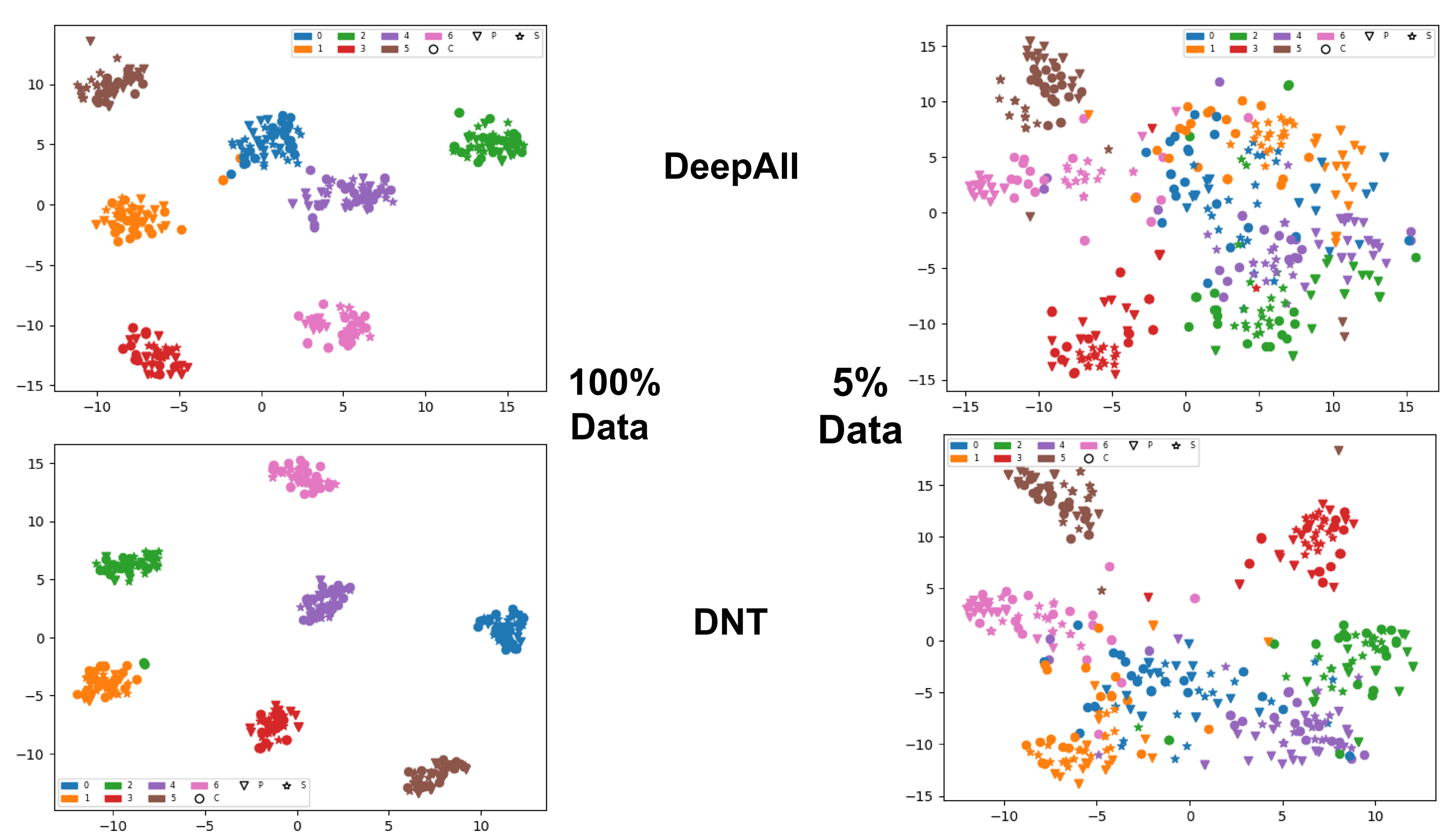
VLCS

Rotated MNIST

Experimental Results - Classwise Visualization of $\mathbf{z}$ Space (PACS)



Experimental Results - Visualization of $\mathbf{z}$ Space (PACS)



Sensitivity of Hyperparameter λ (PACS)