

Learnable Data Augmentation for One-Shot Unsupervised Domain Adaptation

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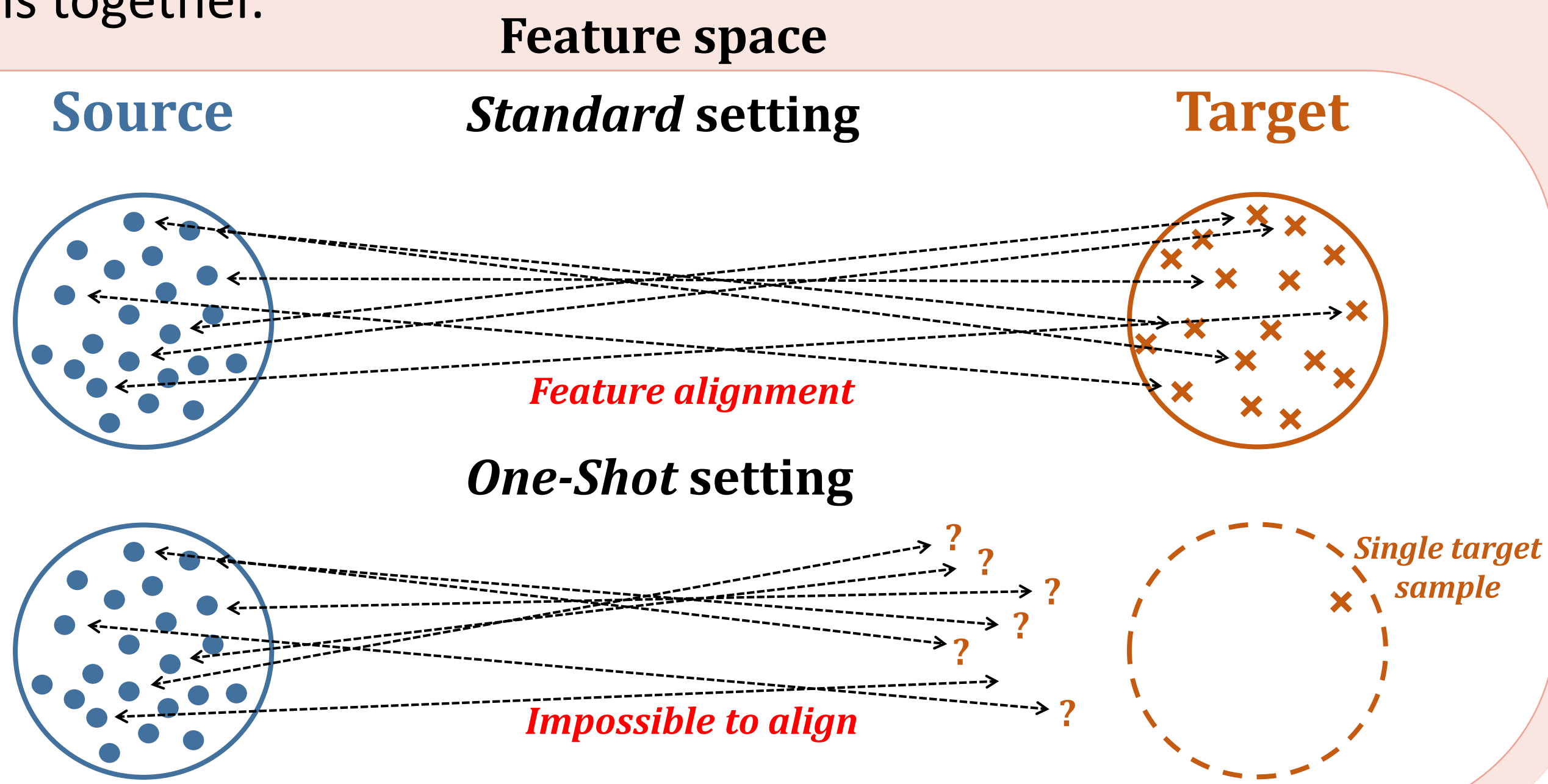
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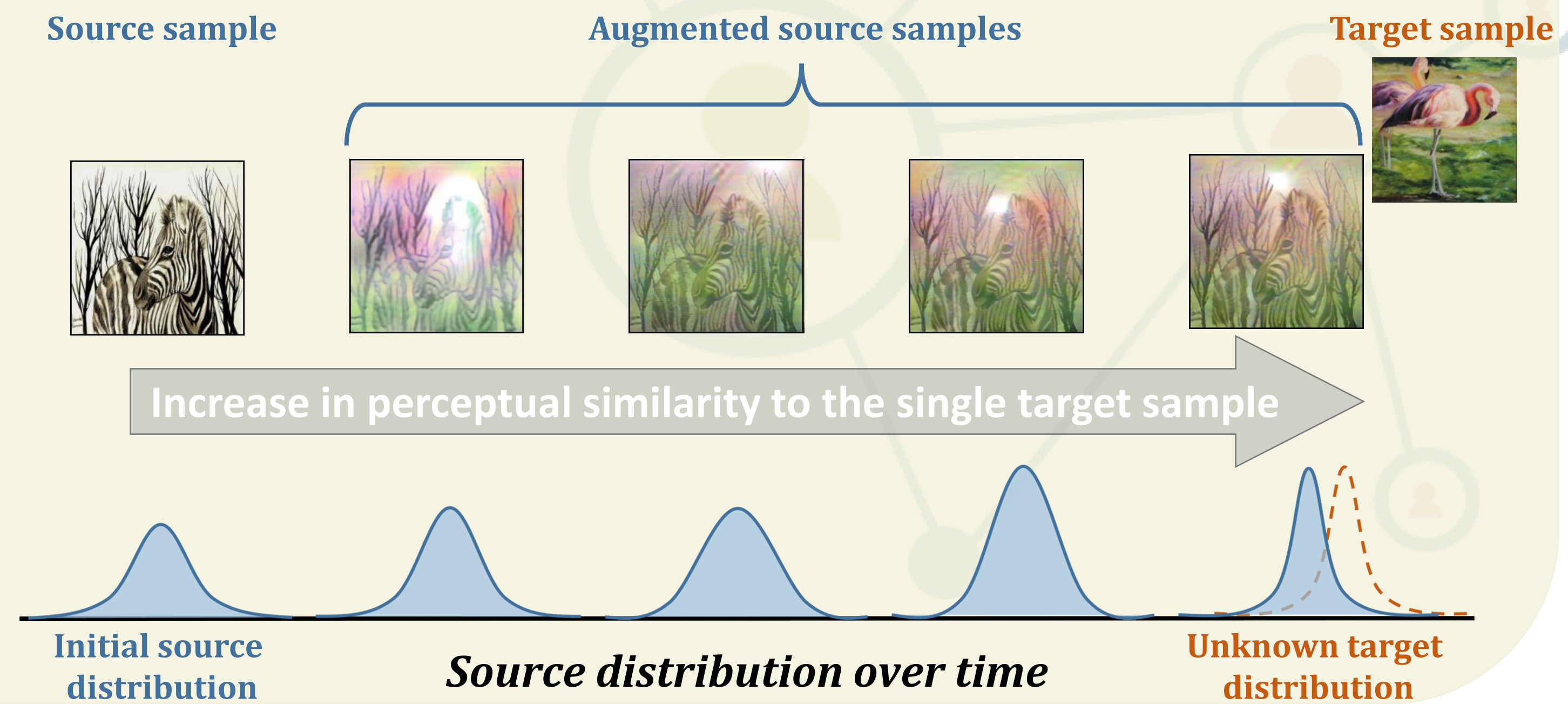
Problem formulation

Domain adaptation methods focus typically on aligning features of both domains in a share feature space. However, the One-Shot setting makes this impossible as there are not enough target samples to pull both domains together.

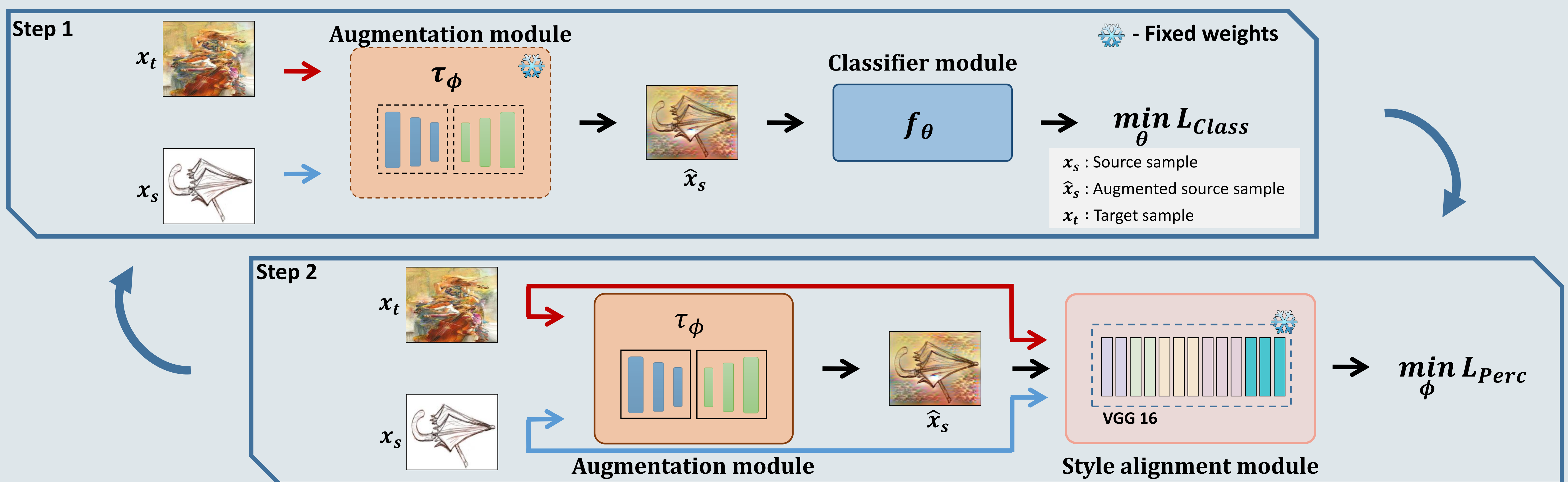


Our Solution

LearnAug-UDA employs a data augmentation approach by exploiting style transfer to generated samples with perceptual similarities to the single target sample. As a result, the gap between source and target domains is reduced.

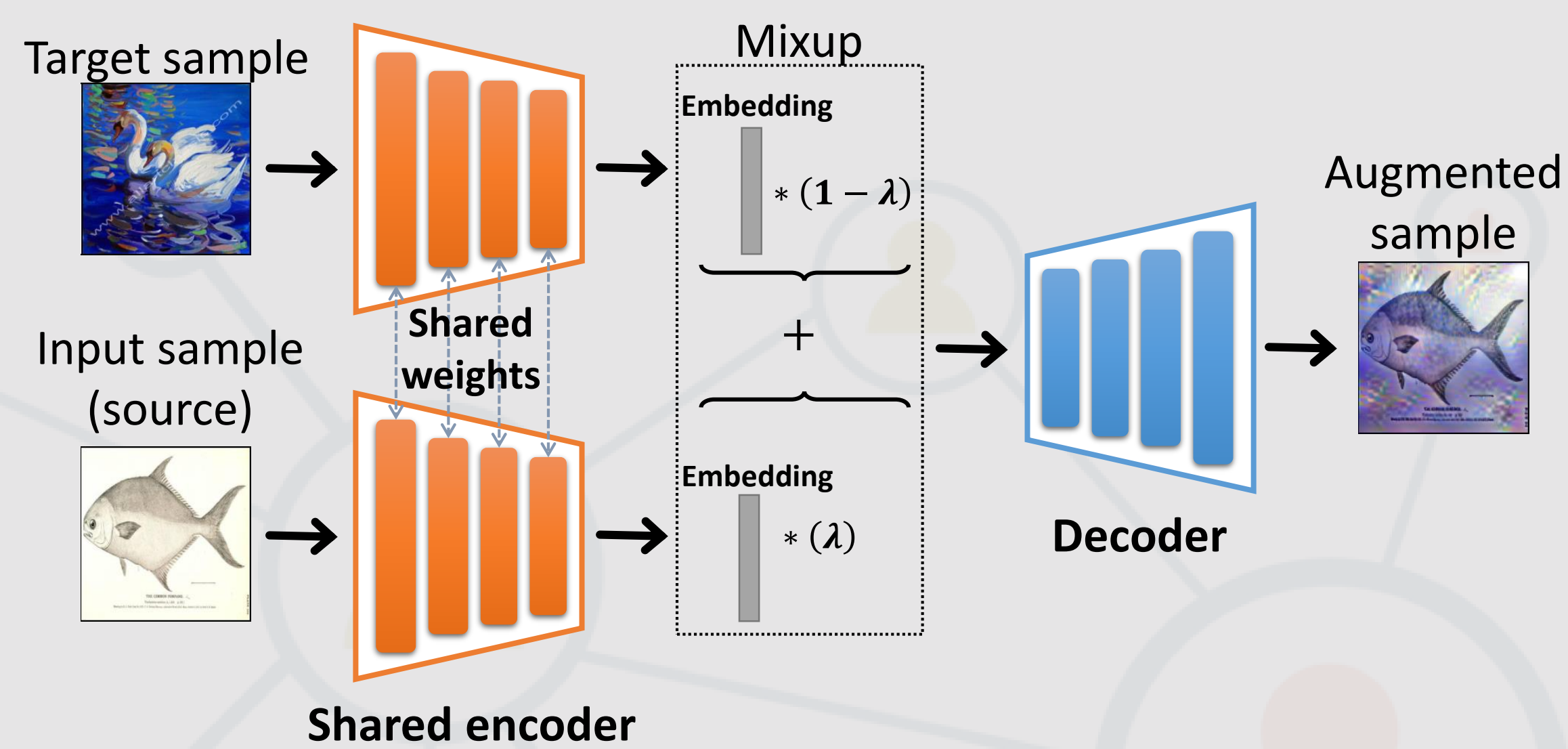


LearnAug-UDA architecture



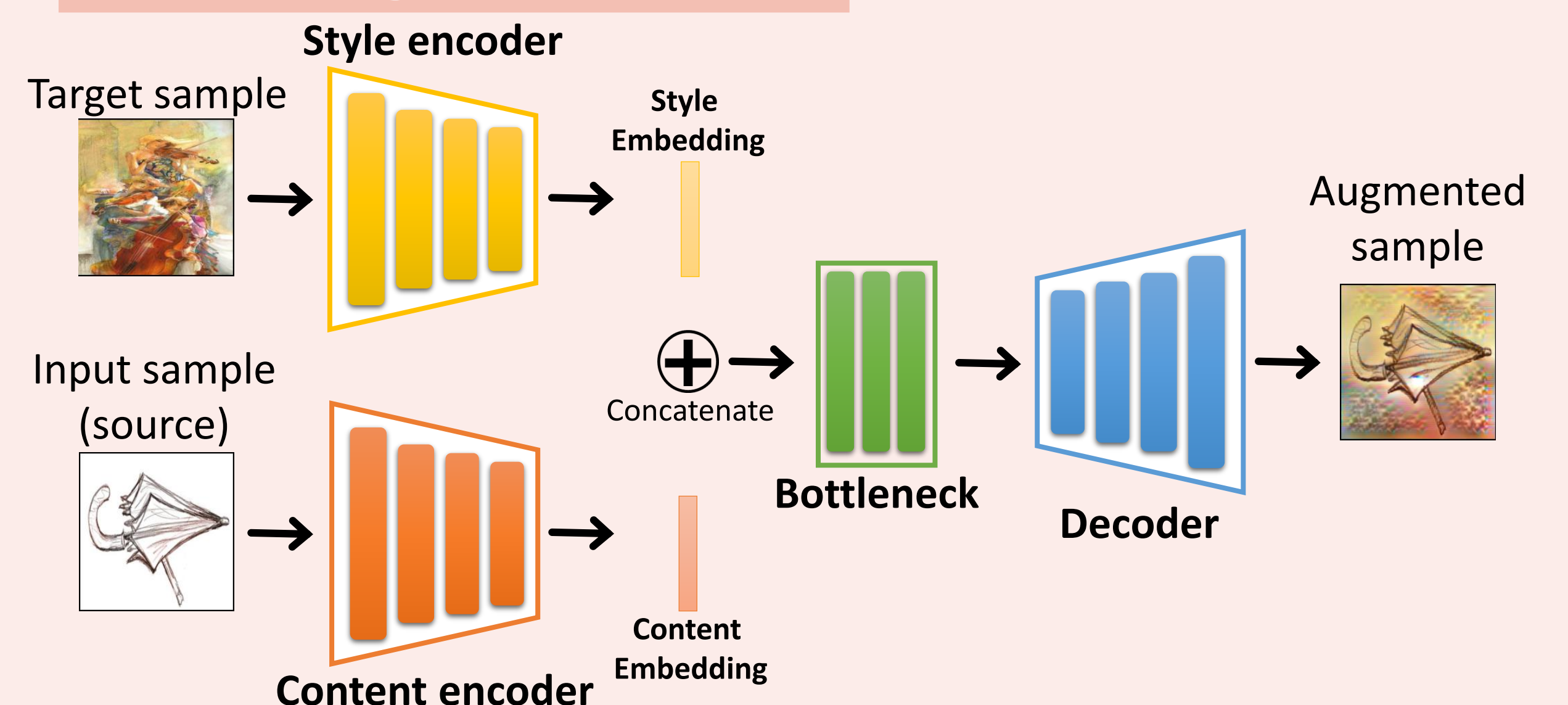
The optimization of the classifier and the augmentation module is split in two steps. An extra reconstruction loss can be added to improve the learning process of the Augmentation module.

Shared Encoder



The Share Encoder exploits a **Mixup** inspired data augmentation approach where the resulting feature maps contain characteristics of both domains.

Disentangled Encoders



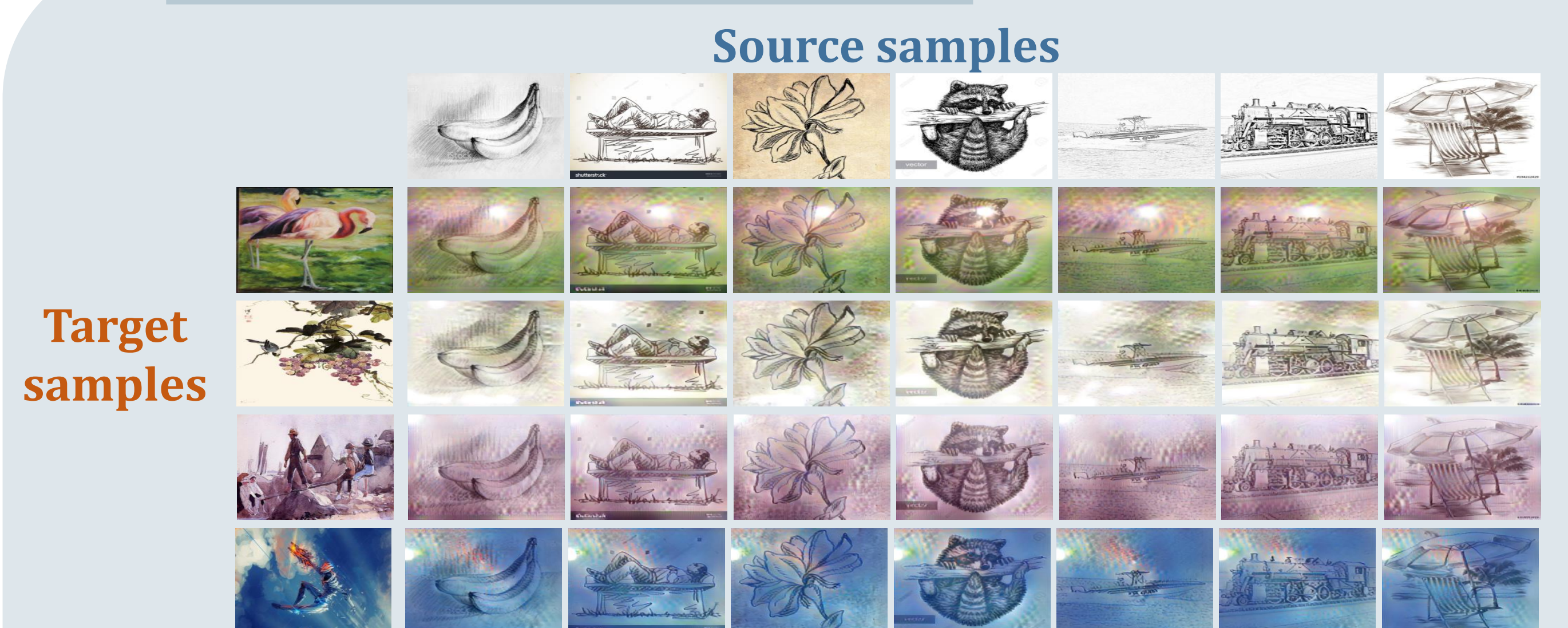
The Disentangle Encoders intuition is that different domains exhibit **shared** and **domain-specific** characteristics.

Quantitative results

Model	Type	R->C	R->P	R->S	P->C	P->R	C->S	S->P	Average
Source only	-	56.59	56.79	46.25	55.55	66.20	52.07	44.81	54.04
TeachAugment [1]	-	53.84	56.70	46.70	50.40	58.64	50.52	44.89	51.67
ASM [2]	One-Shot	39.74	46.39	31.37	4.31	5.87	37.12	19.67	26.35
TOS-UDA [3]	One-Shot	58.11	58.57	49.87	54.24	62.72	52.88	47.94	54.90
LearnAug-UDA (SE)	One-Shot	49.89	57.52	39.07	51.55	58.08	37.47	42.09	47.95
LearnAug-UDA (DE + RL)	One-Shot	56.74	61.02	47.03	54.24	69.06	53.42	52.95	56.35
LearnAug-UDA (SE)	Few-Shot (3)	57.06	61.95	49.18	52.52	66.79	51.69	50.08	55.61
LearnAug-UDA (DE + RL)	Few-Shot (3)	57.96	62.43	47.95	56.70	69.59	55.37	54.58	57.80

Classification accuracy of the **LearnAug-UDA** method on DomainNet for seven DA tasks.

Qualitative results



Augmented source samples after training with **LearnAug-UDA** and only one target sample.