Learnable Data Augmentation for One-Shot Unsupervised Domain Adaptation
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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. Feature space

**Source**
- **Standard setting**
  - Feature alignment
  - Impossible to align

**Target**
- **One-Shot setting**
  - Single target sample

**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**

**Step 1**
- Source sample
- Augmented source samples
- Target sample

**Step 2**
- Source sample
- Augmented source sample
- Target sample

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.

**Quantitative results**

<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>R &gt; C</th>
<th>R &gt; P</th>
<th>R &gt; S</th>
<th>P &gt; C</th>
<th>P &gt; R</th>
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<th>C &gt; S</th>
<th>S &gt; P</th>
<th>Average</th>
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<td>56.79</td>
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<td>66.20</td>
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</table>

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

**Qualitative results**

**Source samples**

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

- Fixed weights
- LearnAug-UDA

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

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

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.