Style Augmentation: Data Augmentation via Style Randomization

Philip T. Jackson, Amir Atapour-Abarghouei, Stephen Bonner, Toby Breckon, Boguslaw Obara

Randomized style transfer can be used to remove the correlation between texture and class label, resulting in increased robustness to domain shift.

**Proposed Approach:**

We use a modified *arbitrary style transfer* network to randomly restyle training images on the fly, before passing them to a downstream network for training.

**Results:**

Our approach produces substantial accuracy boosts in both classification and monocular depth estimation tasks when domain shift is present.

**Motivation:**

- **Domain randomization** has been shown to improve generalization between domains [1].
- **Neural style transfer** has been linked theoretically to domain shift [2] and has been successfully used for domain adaptation [3].
- ImageNet-trained CNNs have been shown to rely heavily on texture at the expense of shape [4].

What if instead of using domain adaptation, we randomize the style of the source domain, so that the model becomes robust against domain shift in the first place?

- To randomize style transfer, we need only randomize the style embedding.
- Instead of computing style embeddings from random style images, we simulate this process by sampling embeddings directly from a normal distribution. This is faster and ensures a unique embedding every time.

**Test accuracy on the Office dataset [5], training on two domains, testing on the other. A,D,W refer to the Amazon, DSLR and Webcam domains, respectively.**

```
<table>
<thead>
<tr>
<th></th>
<th>Traditional Augmentation</th>
<th>Style Augmentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARAU</td>
<td>0.38</td>
<td>0.50</td>
</tr>
<tr>
<td>AURU</td>
<td>0.38</td>
<td>0.50</td>
</tr>
<tr>
<td>DUAR</td>
<td>0.38</td>
<td>0.50</td>
</tr>
<tr>
<td>DUUR</td>
<td>0.38</td>
<td>0.50</td>
</tr>
</tbody>
</table>
```

Test accuracy on the GTA-V data and testing on KITTI.

**Code and models available here:**

[https://github.com/philipjackson/style-augmentation](https://github.com/philipjackson/style-augmentation)