Image Enhancement with Conditional Adversarial Networks

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Explore the possibility of using GAN to automatically enhance images
Related Works

Image-to-Image Translation with Conditional Adversarial Networks
Conditional Adversarial Networks

Generate images based on given condition

\[
\mathcal{L}_{cGAN}(G,D) = \mathbb{E}_{x,y \sim p_{data}(x,y)}[\log D(x,y)] + \mathbb{E}_{x \sim p_{data}(x), z \sim p_z(z)}[\log(1 - D(x, G(x, z))].
\]

\[
\mathcal{L}_{L1}(G) = \mathbb{E}_{x,y \sim p_{data}(x,y), z \sim p_z(z)}[\|y - G(x, z)\|_1].
\]

Our final objective is

\[
G^* = \arg \min_G \max_D \mathcal{L}_{cGAN}(G,D) + \lambda \mathcal{L}_{L1}(G).
\]
Related Works

Conditional Adversarial Networks

Discriminator Network

Image from https://affinelsayer.com/pix2pix/
Related Works

Conditional Adversarial Networks

Generator Network

Image from https://affinelayer.com/pix2pix/
Datasets

MIT-Adobe FiveK Dataset

- 5,000 photos in DNG format
- Edited with Adobe Lightroom by 5 experts
- Most are pixel-by-pixel-aligned

Screenshots of Data 0001 in https://groups.csail.mit.edu/graphics/fivek_dataset/
Implementation

- Backend: Pytorch
- Image Size: 256 * 256
- Platform: Intel(R) Xeon(R) CPU E5-2687W with Nvidia(R) M40
- Max Epoch: 200

Screenshots of Data 0001 in https://groups.csail.mit.edu/graphics/fivek_dataset/
Results (Around 80 Epochs)

Input
Target

Output

To Cycle-GAN
Results (Around 80 Epochs)

Input
Target

To Cycle-GAN

Output
Results (Around 80 Epochs)

<table>
<thead>
<tr>
<th>Input</th>
<th>Target</th>
<th>Output</th>
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<tbody>
<tr>
<td><img src="image1" alt="Input Image" /></td>
<td><img src="image2" alt="Target Image" /></td>
<td><img src="image3" alt="Output Image" /></td>
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</tbody>
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To Cycle-GAN
Results (Around 80 Epochs)

Input
Target

Output
To Cycle-GAN
Unpaired Image-to-Image Translation using Cycle-Consistent Adversarial Networks
Related Works

Cycle-GAN architecture
Results (Around 50 Epochs)

Input
Target

Output
Results (Around 50 Epochs)

Input
Target

Output

To Pix2Pix
Results (Around 50 Epochs)
Results (Around 50 Epochs)

To Pix2Pix
Live Demo

Edge2Pokemon, trained around 130 epochs
Live Demo

[Link to Edge2Pokemon](#), trained around 130 epochs
**Future Works?**

- Use Conditional GAN with selfie enhancement
- Implement networks with larger size output image
Tips on Training and GPU

1. Use GPU to accelerate your training.
2. Use larger batch size to accelerate your training.
3. Be care using tensorflow with GPU

```python
config = tf.ConfigProto()
config.gpu_options.allow_growth = True
session = tf.Session(config=config, ...)
```
Questions