END EVAL PROJECT 1 GANFORGE

Title: Image Style Transfer using CycleGANs

1. Introduction Image Style Transfer is a computer vision task that combines the content of one image with the artistic style of another. In this project, we explore how Generative Adversarial Networks (GANs), specifically CycleGANs, can be used to perform artistic style transfer without requiring paired datasets. Our focus is on transferring the painting style of Claude Monet to real-world photographs, a task that demonstrates the creative potential of deep learning.

2. Motivation Traditional style transfer techniques rely on paired datasets or predefined features, which limits their flexibility. CycleGAN offers a breakthrough by enabling unpaired image-to-image translation. This allows us to learn the style of an artist and apply it to any image without needing a direct match in the dataset.

3. Dataset We used the publicly available `monet2photo` dataset from the official CycleGAN project. It contains:

- `trainA`: Monet paintings
- `trainB`: Real-world photographs
- `testA` and `testB`: Used for evaluation

The dataset is unpaired, which means there is no one-to-one correspondence between images in domain A (paintings) and domain B (photos).

4. Methodology

4.1 CycleGAN Overview CycleGAN is an architecture that includes:

• Two Generators: G (Photo → Painting), F (Painting → Photo)
• Two Discriminators: D_A (for Monet), D_B (for Photo)
• Three Loss Functions:
• Adversarial Loss: Makes generated images look real
• Cycle Consistency Loss: Ensures translation back and forth returns the original image
• Identity Loss: Helps preserve color and composition

4.2 Implementation Steps

1. Cloned the official CycleGAN GitHub repository.
2. Installed dependencies via `requirements.txt` and manual installation of `dominate` and `visdom`.
3. Downloaded the `monet2photo` dataset.
4. Trained the model using:

```
!python train.py --dataroot ./datasets/monet2photo --name
monet2photo_cyclegan --model cycle_gan
```

5. Alternatively, used a pretrained model for testing:

```
!bash ./scripts/download_cyclegan_model.sh monet2photo
!python test.py --dataroot ./datasets/monet2photo --name
monet2photo_pretrained --model test --no_dropout
```

5. Results

- The generated Monet-style images from real-world photos showed high visual quality.
- We used matplotlib to display the first 20 results in a 4x5 grid.
- Results were saved in `./results/monet2photo_pretrained/test_latest/images/`

6. Observations

- CycleGAN is highly effective for unpaired image translation.
- Identity loss helps reduce color shifts.
- Generated images closely resembled Monet's style with clear texture and color transfer.

7. Applications & Future Work

- Real-time style filters for photo apps
- Creative content generation in media and games
- Extension to other artists or cartoonization
- Integration with webcam input for live style transfer

8. Conclusion This project demonstrated how CycleGANs can achieve high-quality artistic style transfer without the need for paired datasets. By leveraging adversarial training and cycle consistency, we successfully transformed ordinary photographs into artwork in the style of Claude Monet. This has broad implications for creative AI and media generation.

9. References

- Zhu et al., "Unpaired Image-to-Image Translation using Cycle-Consistent Adversarial Networks"
- https://github.com/junyanz/pytorch-CycleGAN-and-pix2pix
- https://people.eecs.berkeley.edu/\~taesung_park/CycleGAN/datasets/