Generative Adversarial Nets GANs
- and how it’s used to generate art

Final project presentation

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Outline

1. Claude Monet
2. CycleGAN
3. Approach
4. Evaluation
5. Lessons Learned
Oscar-Claude Monet was a French painter (1840 –1926)

He is one of the founders of the impressionism (an art movement) along with his friends Renoir, Sisley and Bazille.

Reference: https://www.claudemonetgallery.org/
Style of Monet

courtesy of www.claudemonetgallery.org
Use GANs to create art

CycleGAN

CycleGAN is a very popular GAN architecture primarily being used to learn transformation between images of different styles.

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Unpaired Image-to-Image Translation.
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Unpaired Image-to-Image Translation.

- As an example: a transformation between images of horse and zebra,

CycleGAN

- A transformation between winter image and summer image and so on.

![Summer to Winter Transformation](image)

summer $\rightarrow$ winter
CycleGAN

- A transformation between winter image and summer image and so on.

FaceApp is one of the most popular examples of CycleGAN where human faces are transformed into different age groups.
GAN Architecture - Part II

CycleGAN builds 2 networks $G$ and $F$ to construct images from one domain to another (a real image to a Monet style picture) and in the reverse direction (a Monet style picture to a real image).
GAN Architecture - Part II

- G converts real images to Monet style painting and Dy is used to distinguish whether the image is real or generated.
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- G converts real images to Monet style painting and D_y is used to distinguish whether the image is real or generated.

- CycleGAN builds 2 networks G and F to construct images from one domain to another (a real image to a Monet style picture) and in the reverse direction (a Monet style picture to a real image).
Cost function - Part III

\[ \mathcal{L}(G, F, D_X, D_Y) = \mathcal{L}_\text{GAN}(G, D_Y, X, Y) + \mathcal{L}_\text{GAN}(F, D_X, Y, X) + \lambda \mathcal{L}_\text{cyc}(G, F), \]
Cost function - Part III

\[ \mathcal{L}(G, F, D_x, D_y) = \mathcal{L}_{\text{GAN}}(G, D_y, X, Y) + \mathcal{L}_{\text{GAN}}(F, D_x, Y, X) + \lambda \mathcal{L}_{\text{cyc}}(G, F), \]

- Cycle consistency loss which measures the L1-norm reconstruction cost for the real image and the Monet paintings.

Pre-processing

Monet images: 300
Fake photos: 7038
(256 x 256 x 3)
Applying Augmentation

- Applied random jittering
- Applied random rotation (270°, 180°, 90°)
- Applied random mirroring (flipping left/right/up/down)
Building CycleGAN

- Downsampling
- Upsampling
- Build the generator
- Build the discriminator
- Define the discriminator and generator loss function (BinaryCrossentropy)
- Define the optimizer
The architecture

- Generator has 16 CNNs (Conv2D and Conv2DTranspose), Dropout, instance normalization, 8 LeakyReLu activations and 7 ReLu activations
- Discriminator has 5 Conv2D, 3 Dropouts, Batch normalization, 4 LeakyReLu
- Total 54,414,979 trainable parameters
- EPOCHS = 35
- Each epoch takes about 61s (with TPU)
Generate the dataset
Generate the dataset

![Image 1](image1.png)

![Image 2](image2.png)
Generate the dataset
<table>
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<tr>
<th>Rank</th>
<th>Team</th>
<th>Score</th>
<th>Days Left</th>
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<td>48.23406</td>
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Your submission scored 48.23406, which is an improvement of your previous score of 59.28510. Great job!
Lessons Learned

- Augmentation does improve the performance

- More number of epochs helps to increase the performance but number of epochs too high can cause over-fitting
Kernels used:
- https://www.kaggle.com/amyjang/monet-cyclegan-tutorial
- https://www.kaggle.com/dimitreoliveira/improving-cyclegan-monet-paintingsAugmentations

Our implementation:
- https://github.com/measmolika/GANs-P33
Thank You For Listening