

A 2x4 grid of Claude Monet's Impressionist paintings, including scenes of the Seine River, a bridge over water lilies, and various landscapes.

Artificially Creative Demo 2

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Competition Introduction/ Business Understanding (Recap)

After taking a picture of a beautiful scenery, have you ever wondered what would it look like if a famous painter was there and made a painting of it?

- Focus: translating a photograph to a **Monet** style painting
 - “Monet-ify” an image
- Style Transfer - transfer an image from one style to another
 - Imitate color choices and brush strokes



Data Acquisition (Recap)

- Both the photos and the Monet data was given to us in files from Kaggle
 - 300 Monet paintings sized 256x256 in JPEG and TFRecord formats
 - 7028 photos sized 256x256 in JPEG and TFRecord formats
 - Size: 385.87 MB
- **Project Focus:** modeling and architectures of modern data science techniques (rather than the data acquisition)

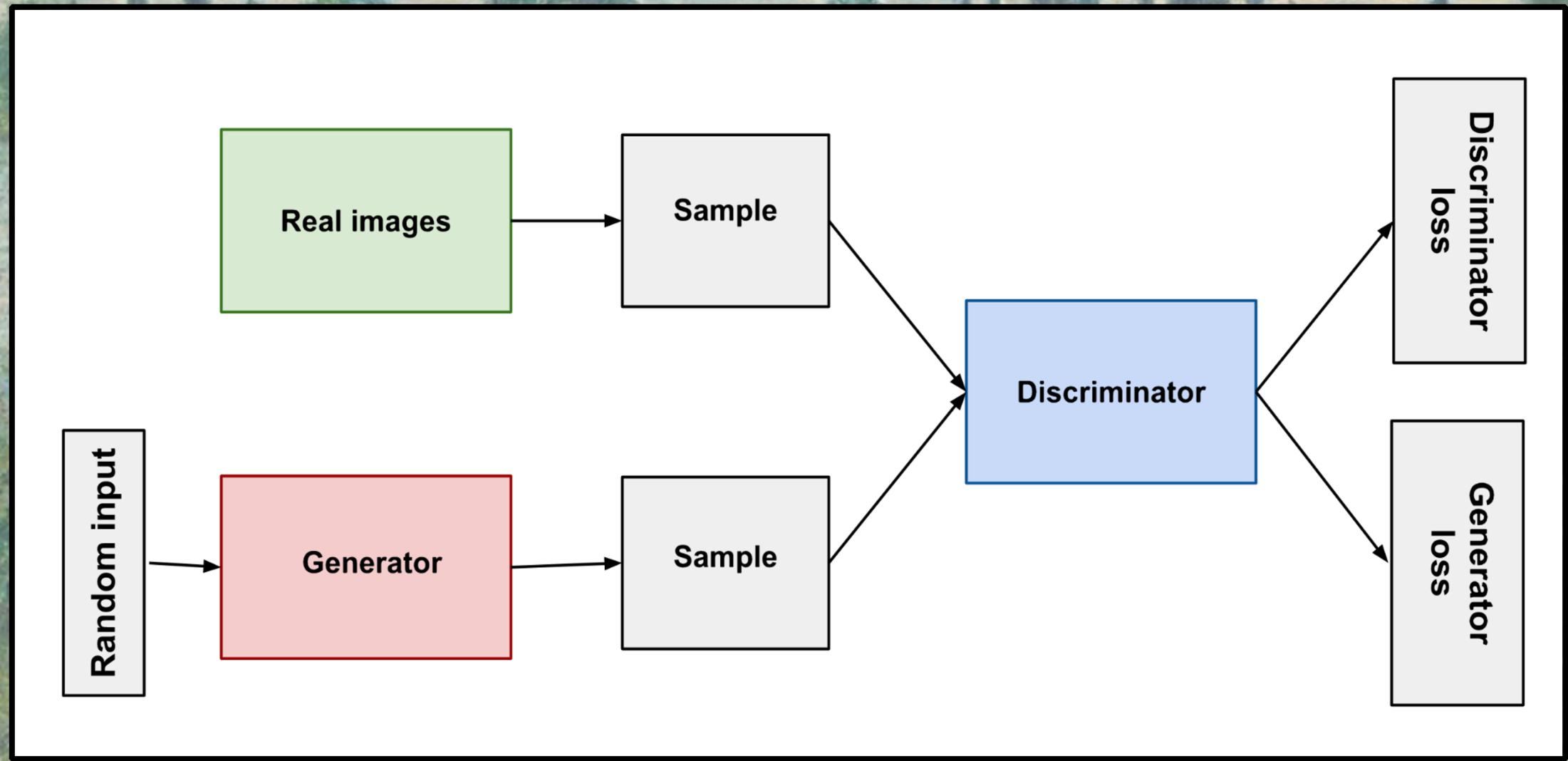


Monet Example



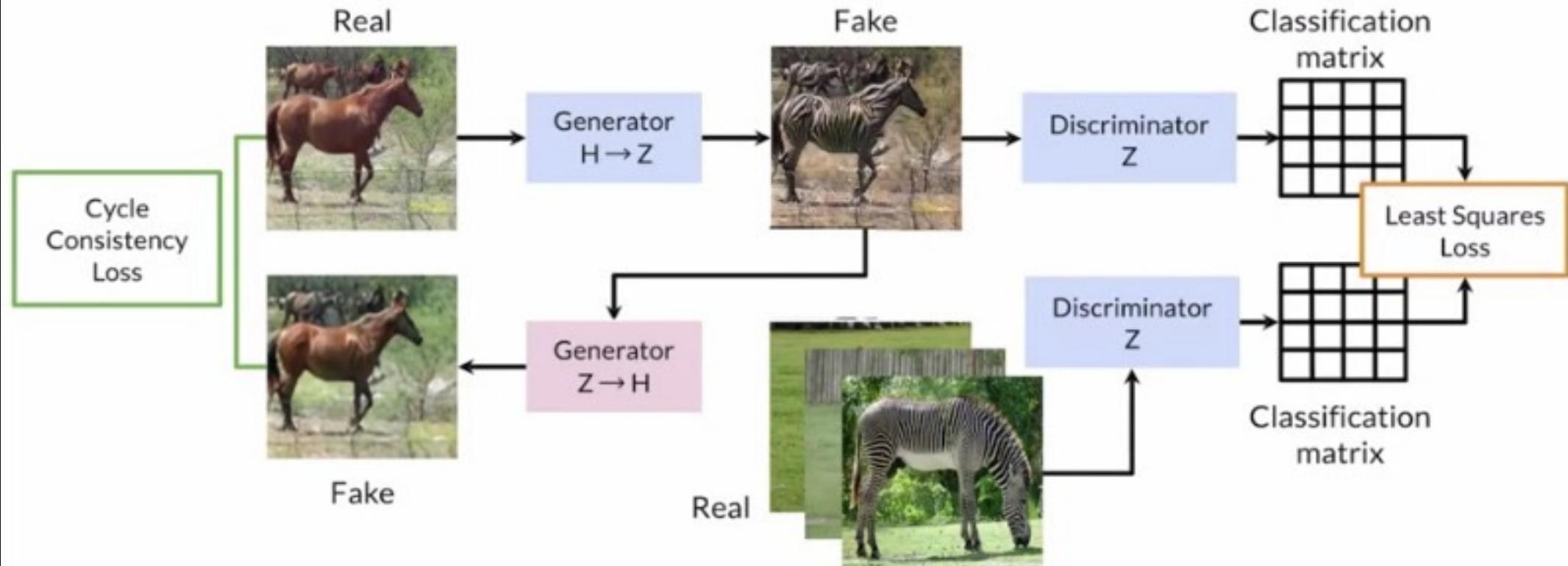
Photo Example

GAN Description (Recap)



CycleGAN Description (Recap)

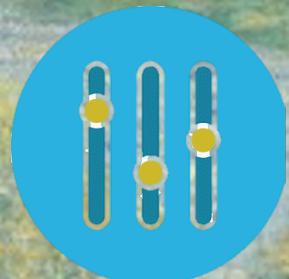
CycleGAN



Images available from: <https://github.com/togheppi/CycleGAN>

New Work Overview

- Exploratory Data Analysis
- Adjusted model parameters (steps per epoch, batch size)
- Data Augmentation
- Adjusted generator loss function to include label smoothing
- Built website skeleton
- Implemented FID score on Kaggle



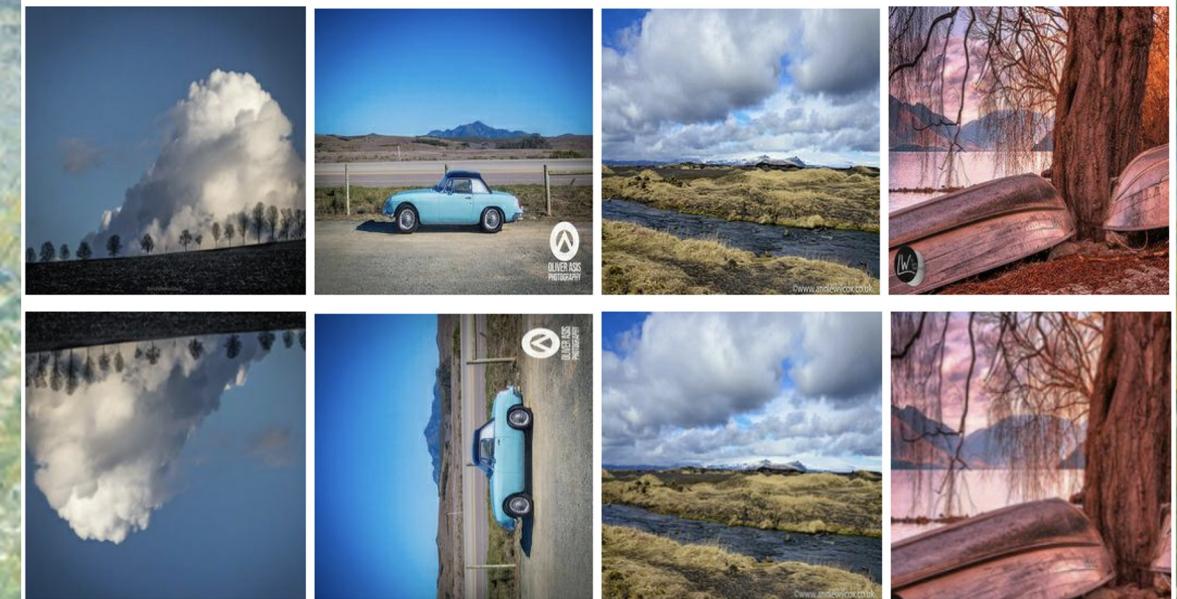
Shift in Mindset: Application to New Artists

Shift: Competition Placement → General and Interactive Models for Multiple Artists

- Now make full use of **all training data** provided by authors
- Gather and use artist data for **Ukiyo-e-e**, **Van Gogh**, and **Cezanne**
 - Transformed into TFREC Format
- Developed standardized train/test split based on **CycleGANs' authors data**
 - 10% augmentation to training data and added it to testing data
 - We **do not** crop in these new augmentations to reduce pixelation

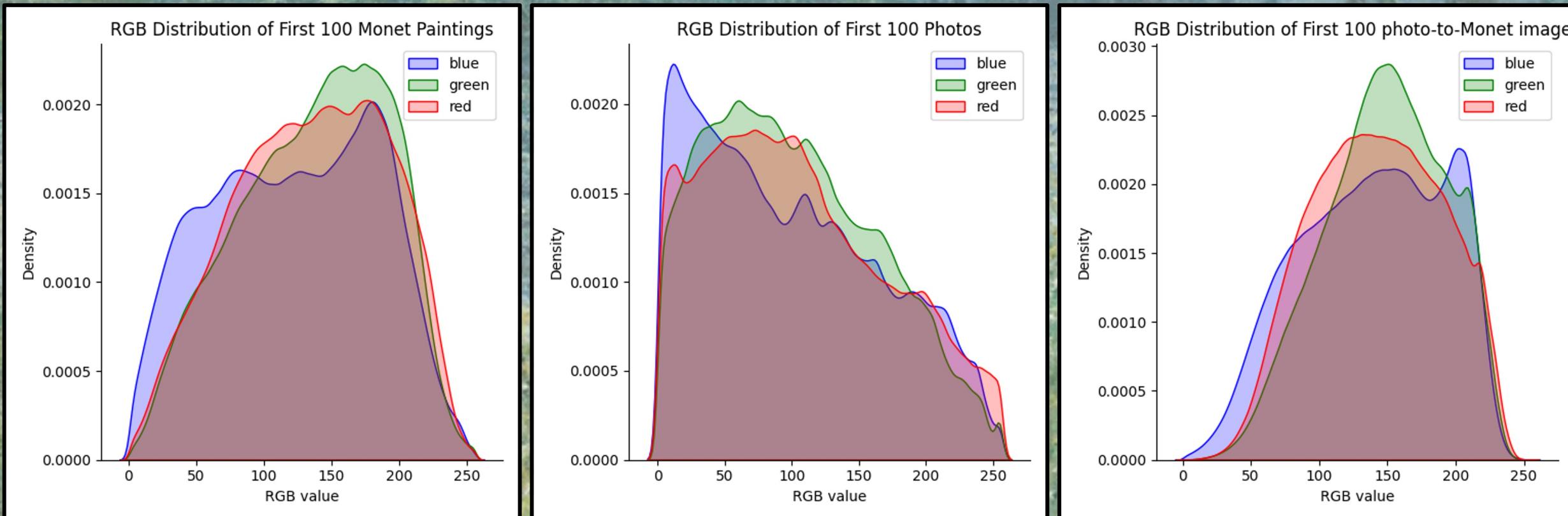
Data Acquisition Changes (Competition Specific)

- Business/Problem Understanding remains the same
- Most of Data Acquisition process remains the same
- Added data augmentation to our basic model, consisting of crops, flips, and rotations



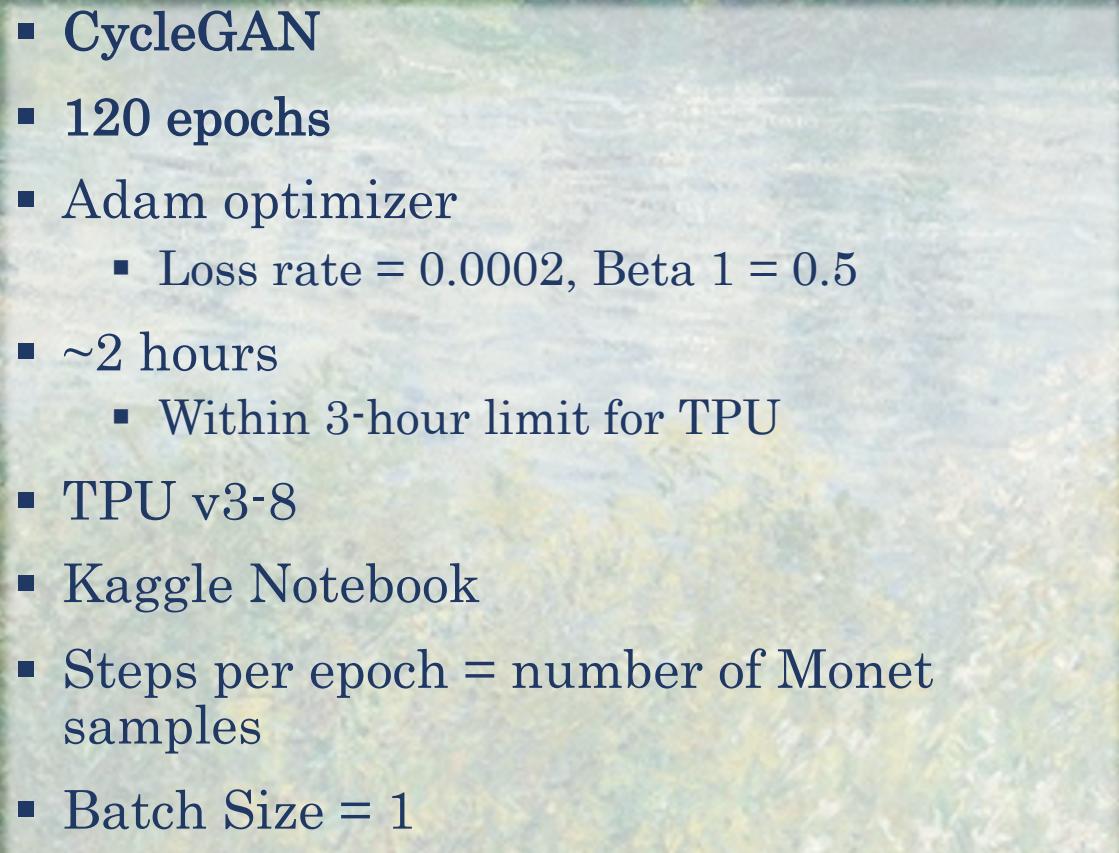
Examples of augmented images using resizing, cropping, rotation, and flipping

EDA: RGB Distribution



RGB distribution of the first 100 Monet paintings (left), the first 100 photos (middle), and the first 100 generated photo-to-Monet images (right), with zeros excluded

Baseline Model → New Model

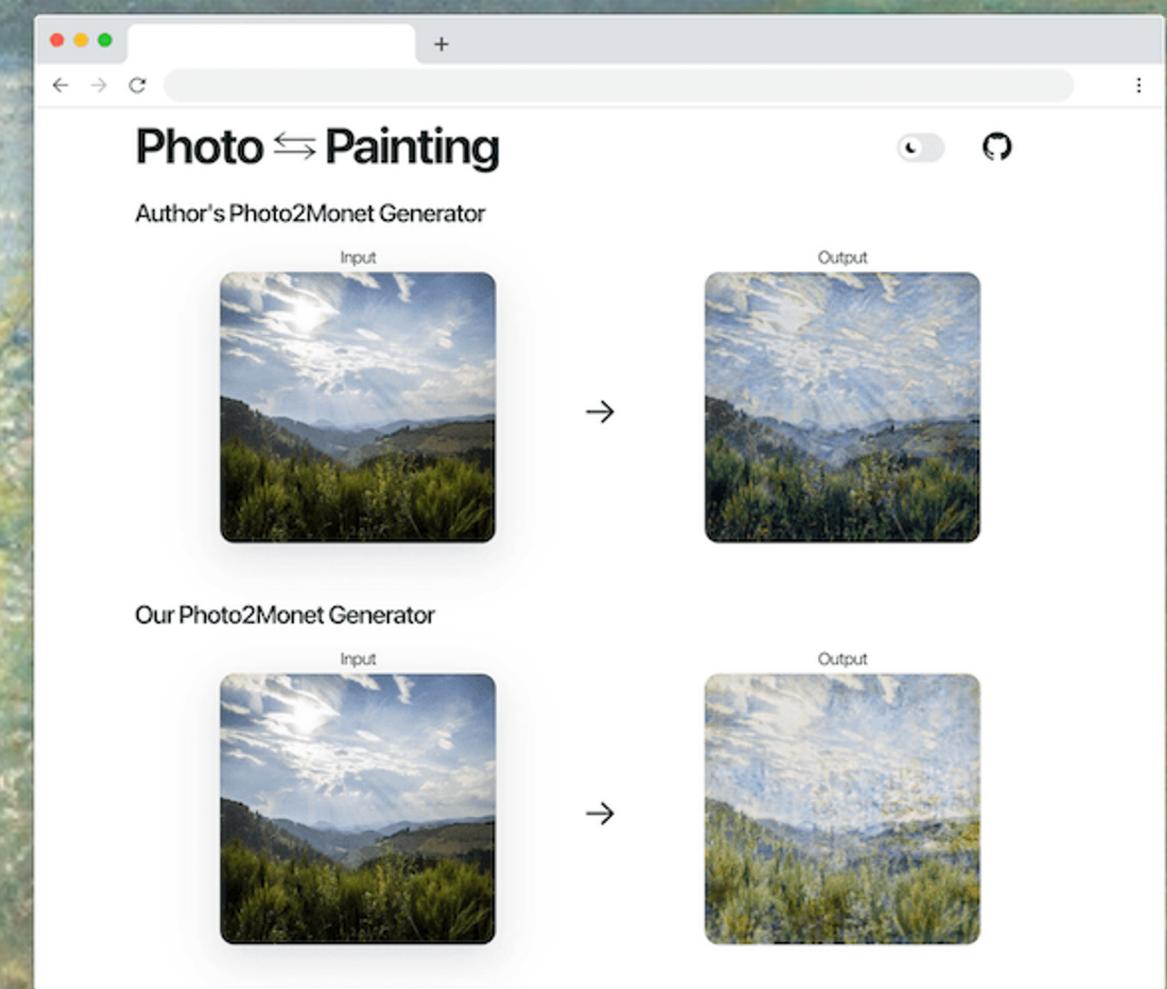
- CycleGAN
 - 120 epochs
 - Adam optimizer
 - Loss rate = 0.0002, Beta 1 = 0.5
 - ~2 hours
 - Within 3-hour limit for TPU
 - TPU v3-8
 - Kaggle Notebook
 - Steps per epoch = number of Monet samples
 - Batch Size = 1
- 
- CycleGAN
 - 30 epochs
 - Adam optimizer
 - Loss rate = 0.0002, Beta 1 = 0.5
 - ~2.75 hours
 - Within 3-hour limit for TPU
 - TPU v3-8
 - Kaggle Notebook
 - Added data augmentation & label smoothing
 - Steps per epoch = number of photo samples
 - Batch Size = 4

Deployment (Kaggle)

- Kaggle was used for model evaluation and development
- We choose Kaggle due to HPC reliability issues along with access to a TPU which significantly speeds up our training
- This involved designing various notebooks to allow “plugging in” of multiple datasets from different artists to generate different weights along with multiple image files

Deployment (Website)

- Convert Pytorch model to ONNX (Open Neural Network Exchange) format
- Convert TensorFlow model to TensorFlow.js
- Deployed with Vercel



Performance Evaluation from Our Baseline Model

MiFID Score: 51.49337 → 39.73202

Leaderboard: 49/94 → 17/143

- ~52nd percentile → ~12th percentile

Best Scores are still in mid 30s

FID: assesses the quality of images created by a generative model (ex: GAN)

- Finds the distance between feature vectors calculated for real and generated images

MIFID: Kaggle-created modification of FID

$$FID = \|\mu_r - \mu_g\|^2 + \text{Tr}(\Sigma_r + \Sigma_g - 2(\Sigma_r \Sigma_g)^{1/2})$$

Mean μ , covariance Σ , real images r, generated images g, sum of diagonal elements Tr

Adjustments:

MiFID → FID:

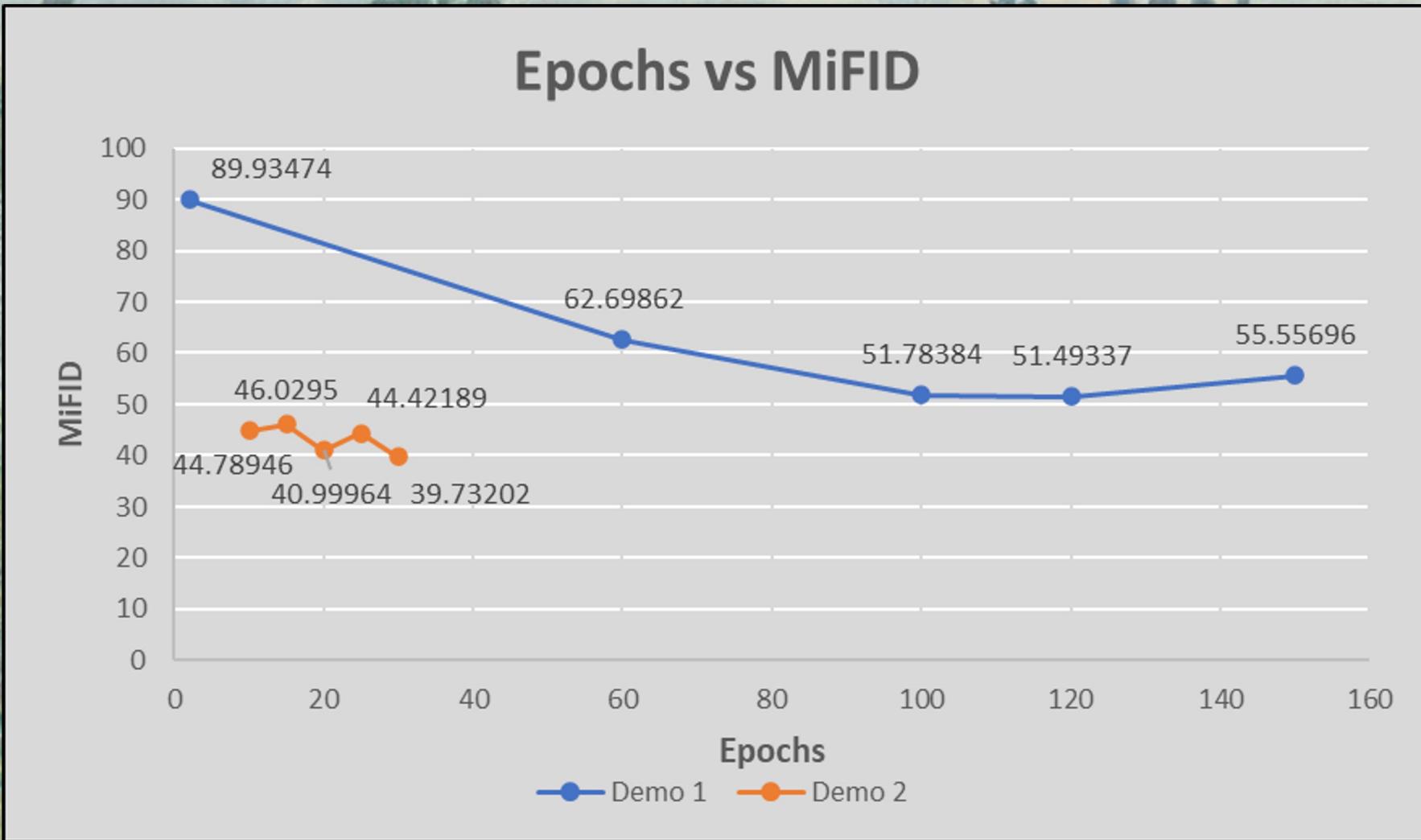
- FID - more generalizability and widely used

Altered Pytorch-FID code to be used on Kaggle/Google Cloud Platform in “plug and play” fashion

$$MiFID = FID \cdot \frac{1}{d_{thr}}$$

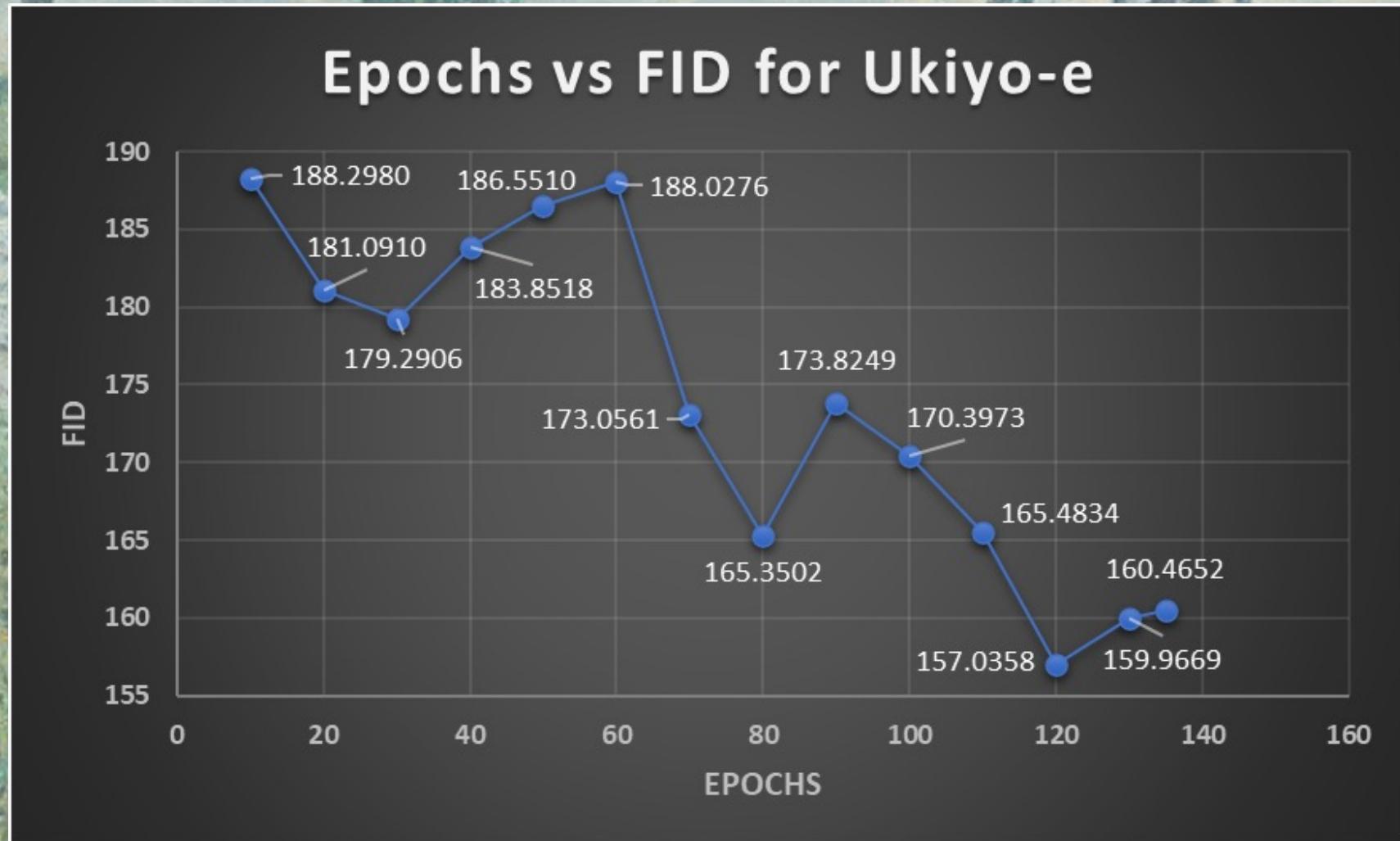
d_{thr} is the memorization distance with a threshold applied

Competition Performance Comparison



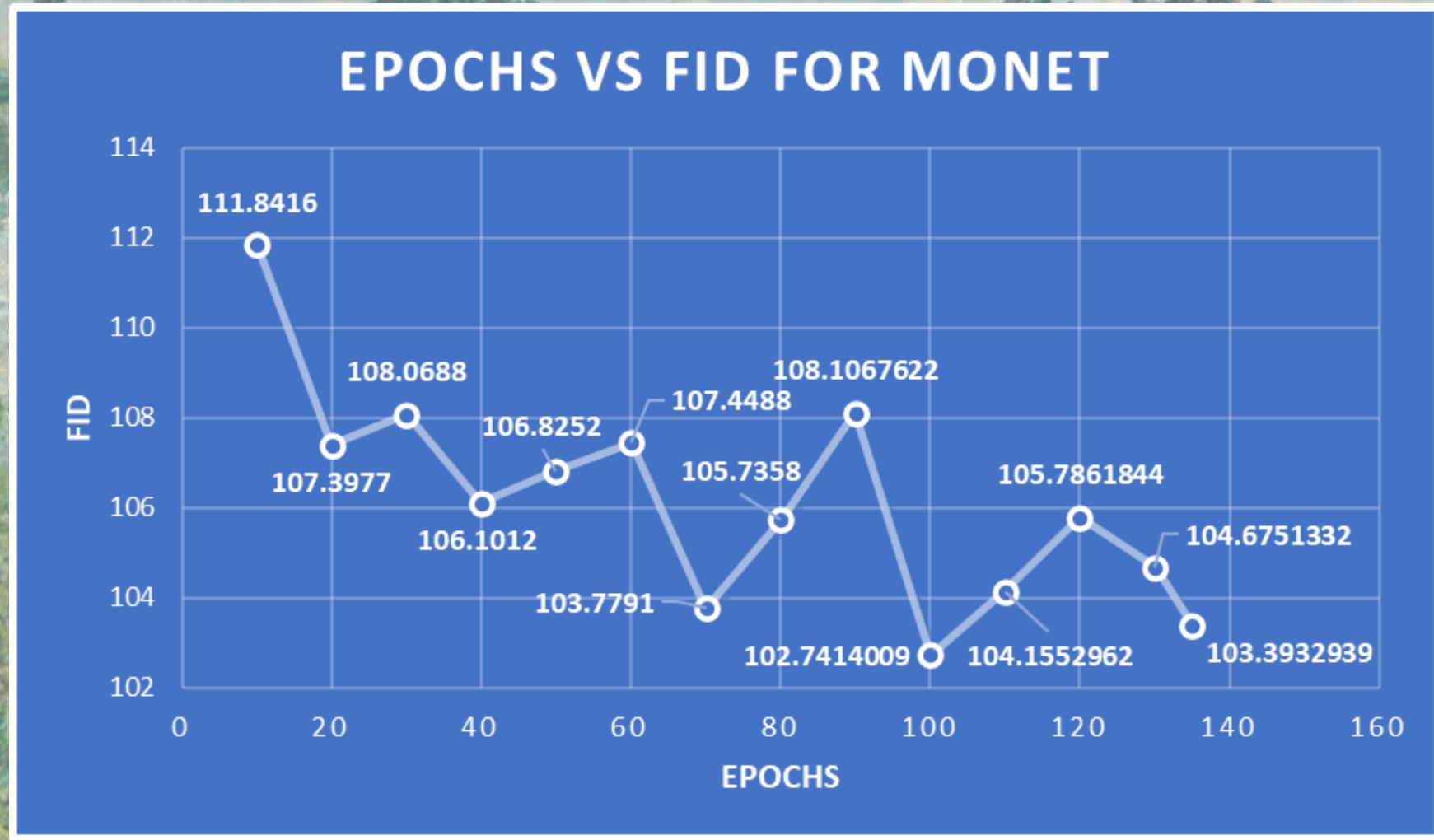
Line Graph Displaying Scores for Epochs Tested

Ukiyo-e Performance Comparison



Line Graph Displaying Scores for Epochs Tested

Monet General Performance Comparison



Line Graph Displaying Scores for Epochs Tested

Output Observations: Old → New

Pros:

- Good with nature

Cons:

- Bad with people, modern architecture, defined lines/boundaries
- For detailed photos, the paintings mostly become blurred and hard to discern
- Translation among photos varies
- Almost everything is pixelated
 - Good or Bad?

Pros:

- Performs well on “sprawling images”

Cons:

- Does not perform well on darker images
- Does not perform well on non-landscapes
- Some images see little change
- Detailed photos get blurred sometimes

<http://clipart-library.com/clipart/pi5rLryMT.htm>

<https://archello.com/story/91136/attachments/photos-videos/2>

Good Example Outputs

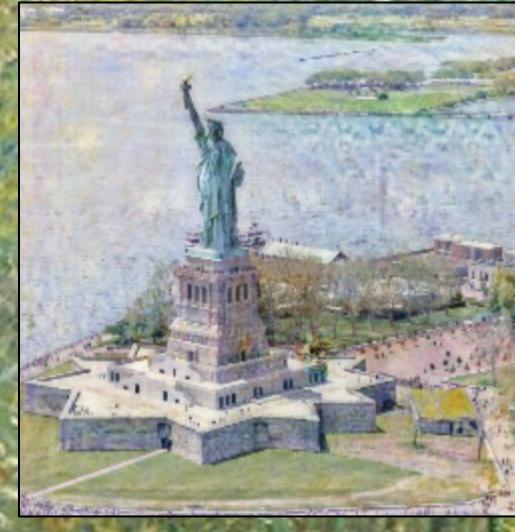
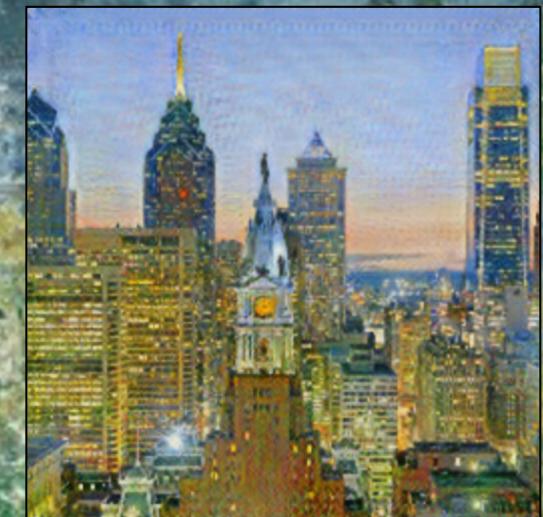
Input



Our competition model



Author's model

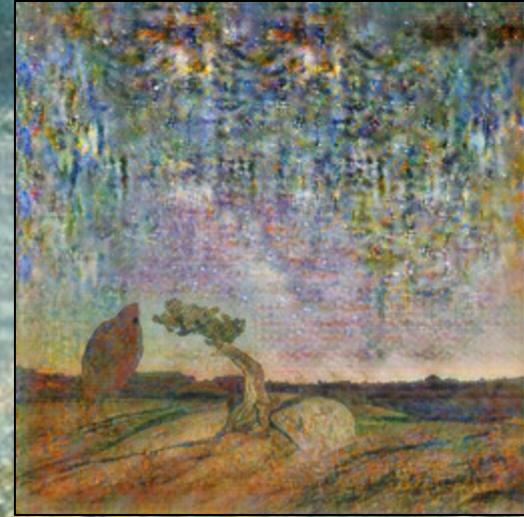


Bad Example Outputs

Input



Our competition model



Author's model



Existing Roadblocks

- **Memory limits**
 - Model runs out of memory when not generated on TPU, making TPU vital to our work
- **Time limits**
 - Difficult to implement new changes and play around with epochs
 - Even on TPU, testing and evaluation is costly and difficult
- **Runtime limits**
 - Inhibited us from experimenting with other models such as UVC-GAN



Road
(generated)



Block
(generated)

Remaining Steps (Phase 3)

- Adding more data samples for other artists (Van-Gogh, Cezanne)
- Development and evaluation of models for the other artist
- Expanding website for other artists and for artist-to-artist transfers based on author's weights



Cezanne

Van Gogh



Ukiyo-e



References

[Our GitHub Repository](#)

[I'm Something of a Painter Myself | Kaggle](#)

[CycleGAN: a GAN architecture for learning unpaired image to image transformations \(haikutechcenter.com\)](#)

[This AI Can Convert Paintings Into Photos and Summer Into Winter | PetaPixel](#)

[Time Wallpaper \(73+ images\) \(getwallpapers.com\)](#)

[Van Gogh's Most Famous Paintings \(thoughtco.com\)](#)

[Homer Painting](#)

[Van Gogh Painting](#)

[Monet Painting](#)

[Cezanne Painting](#)

[FID Explained](#)

[Lot - Various Ukiyo-e Artists \(Japanese 18th-Early 19th Century\) Actors: Seven Woodblock Prints The... \(weschlers.com\)](#)