# Artificially Creative
Demo 3

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Competition Introduction/ Business Understanding

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

- **Style Transfer** - transfer an image from one style to another
  - Imitate **color choices** and **brush strokes**
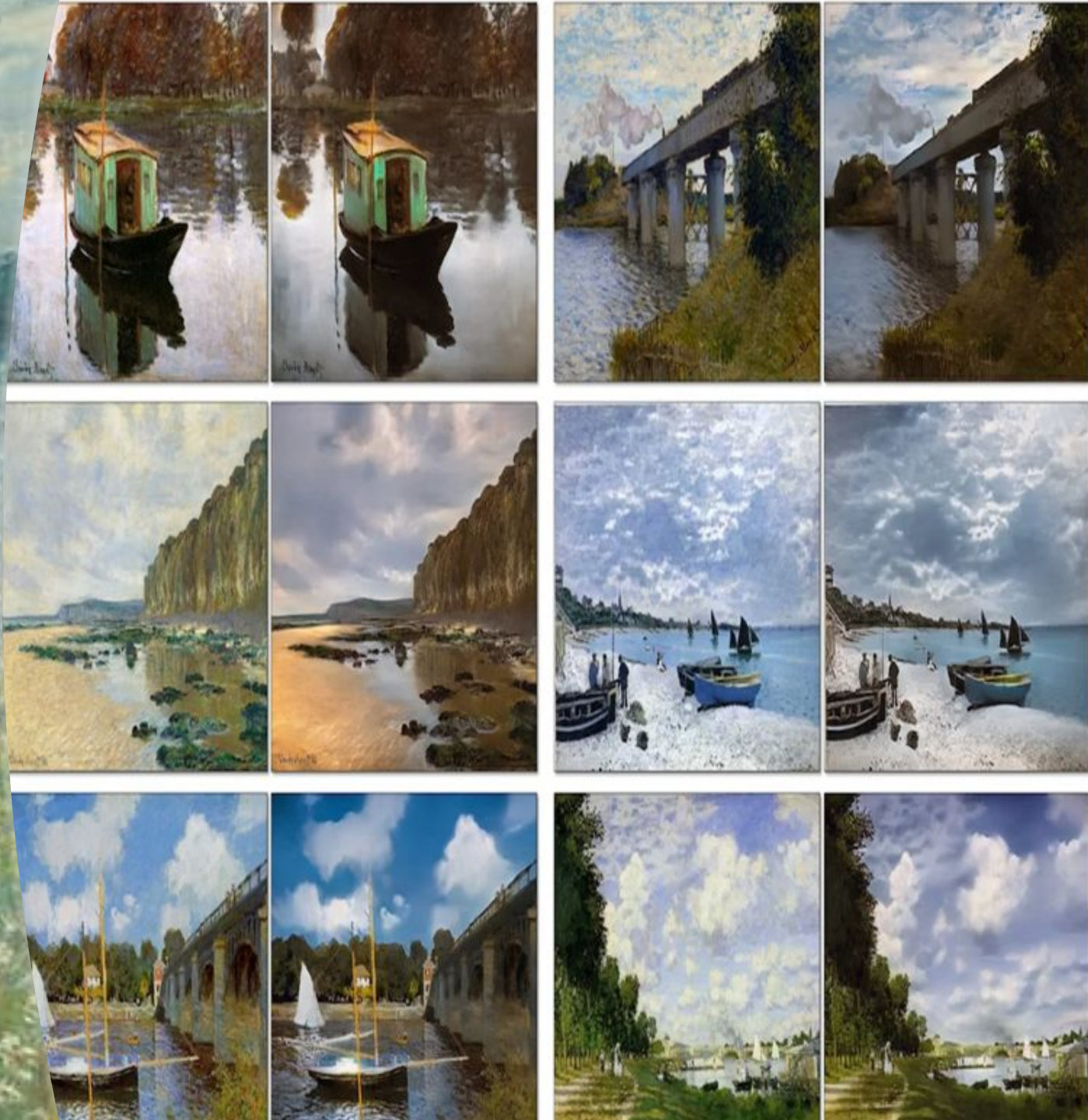
Project Scope

- **Phase One:**
  - Focus Solely on Increasing Competition Placement
  - Only worked with Kaggle-Provided Monet Paintings

- **Phase Two Onwards:**
  - **Shift**: Competition Placement General and Interactive Models for Multiple Artists
  - Use **all training data** provided by authors
  - Gather and use artist data for **Ukiyo-e**, **Van Gogh**, and **Cezanne**
  - Developed standardized train/test split based on CycleGANs' authors data through adding 10% augmentation of training data to test
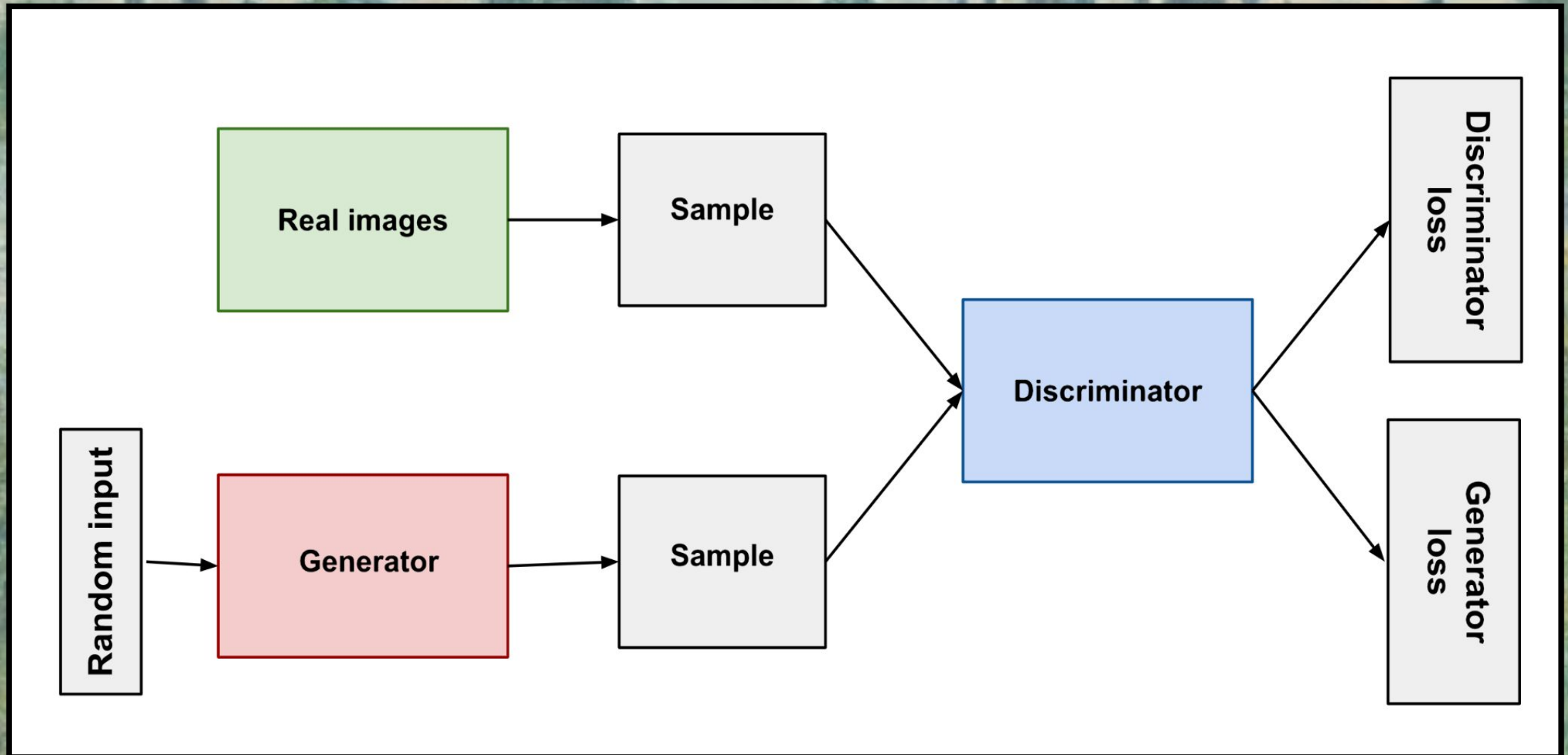
Data Acquisition For Competition

- Kaggle competition data
  - **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)
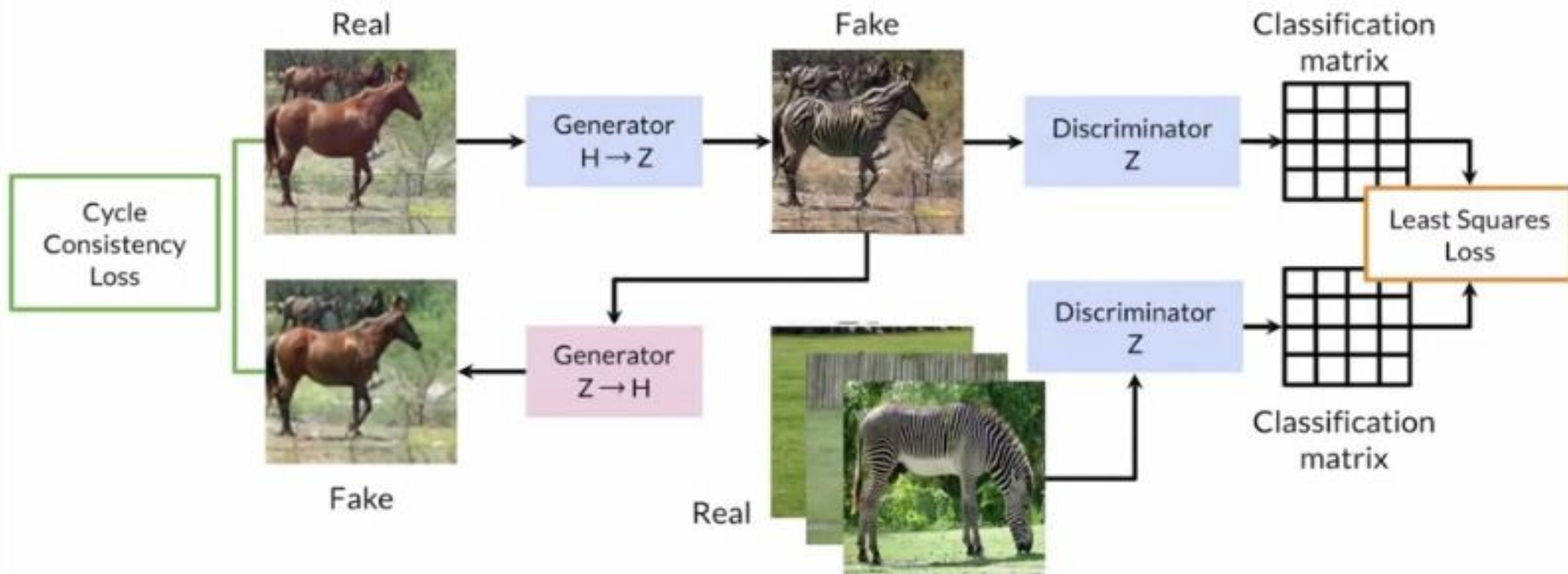
- Data augmentation
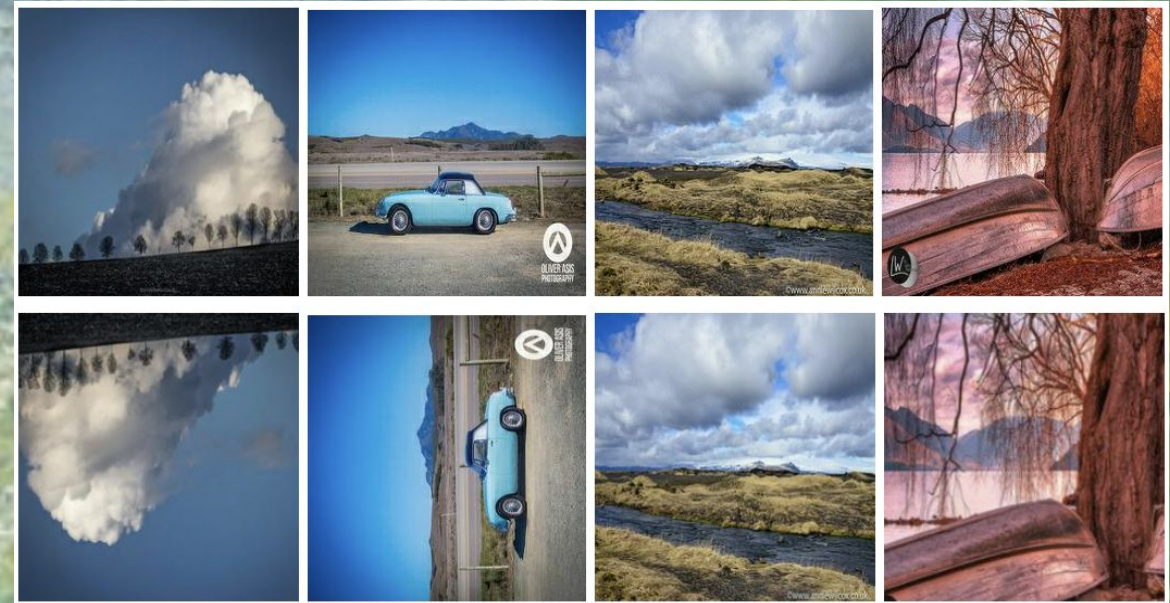
Examples of augmented images using resizing, cropping, rotation, and flipping
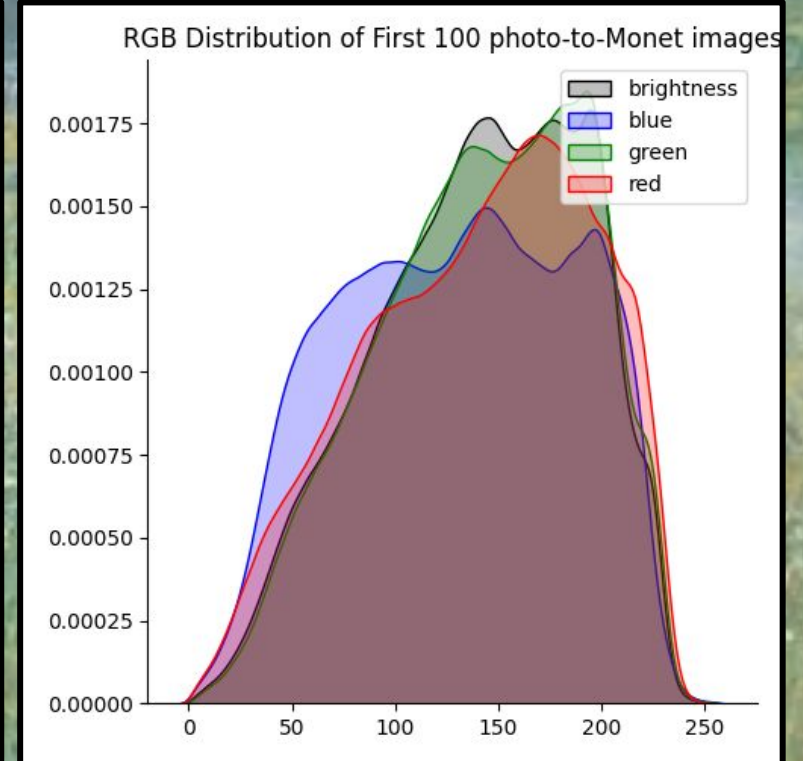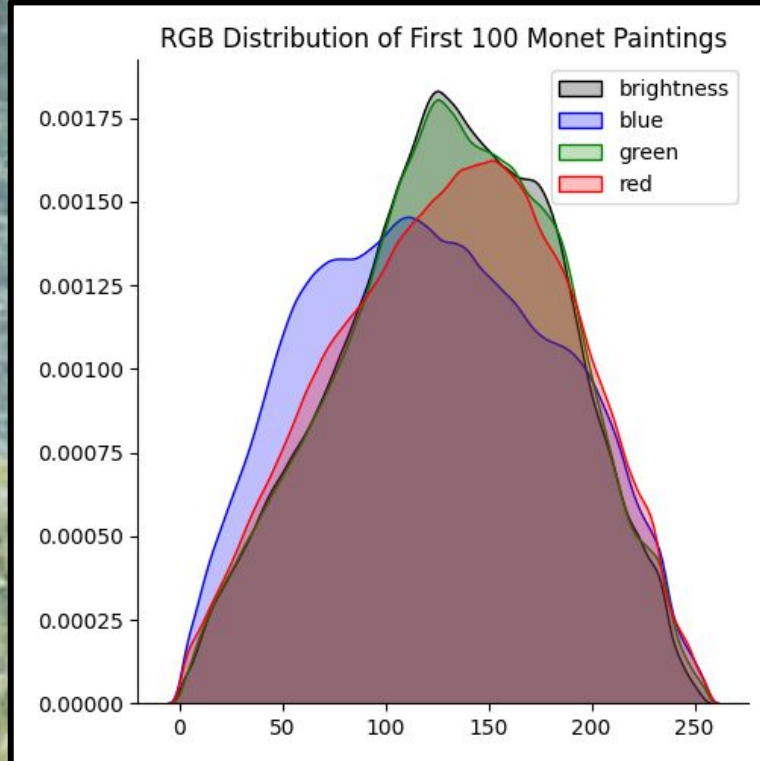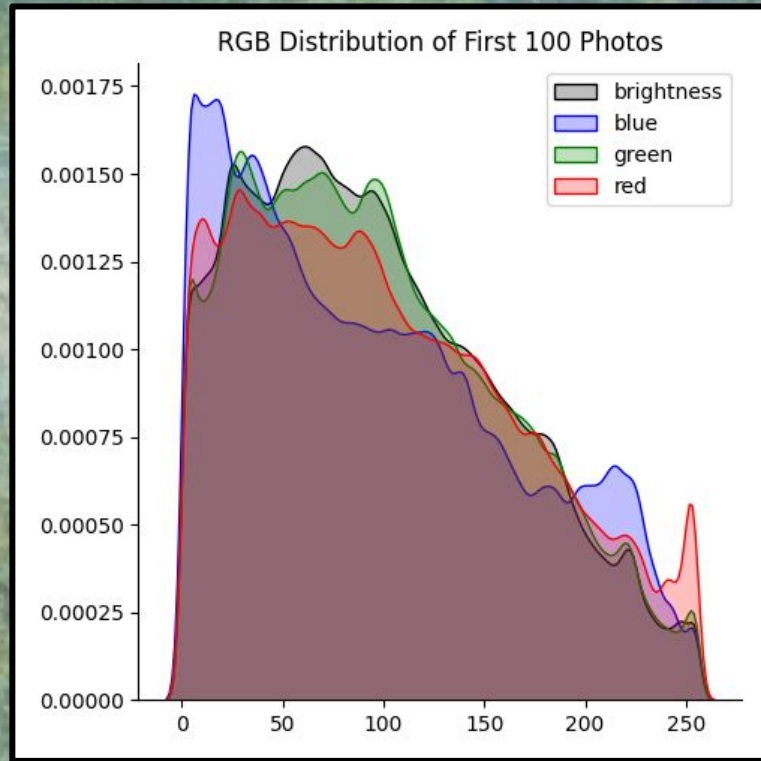
GAN Description

CycleGAN Description

CycleGAN

Cycle Consistency Loss

Real → Generator H → Z → Fake → Discriminator Z → Classification matrix

Fake ← Generator Z → H

Real → Discriminator Z → Classification matrix

Least Squares Loss

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

EDA: RGB Distribution (Competition)

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

Progress Since Demo 2 (Overview)

- Train and evaluate on Van Gogh data
- Worked with Artist-to-Artist Models
- Placed most accurate models on the website
- Allowed for more image formats to be uploadable
- Fixed RGB Distribution Plot
- Allowed for images of any size to be uploaded to RGB distribution plot
- Played around with Decaying Learning Rate for competition
- Created and added icons for the website
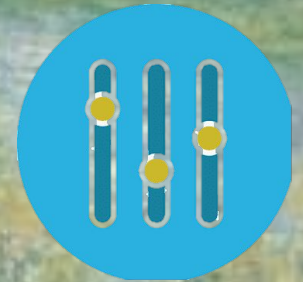
Baseline Model ☐ Final Model

- **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, **Learning Rate = 0.00005**
- ~2.75 hours
  - Within 3-hour limit for TPU
- TPU v3-8
- Kaggle Notebook
- **Data augmentation & label smoothing**
- **Steps per epoch = number of photo samples/batch size**
- **Batch Size = 4**

Performance Evaluation

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
- More generalizable and widely used
- Used for general models

MiFID: Kaggle-created modification of FID

- Used for competition

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

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

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

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

Performance Evaluation Cont.

Demo 1:
MiFID Score:
51.49
Leaderboard:
49/94
Percentile:
~52nd

Demo 2:
MiFID Score:
39.73
Leaderboard:
17/143
Percentile:
~12th

Demo 3:
MiFID Score:
38.29
Leaderboard:
10/146
Percentile:
~7th

Note: best scores have been in mid 30s throughout the competition

#	Team	Members	Score	Entries	Last	Join
1	MauricioCalderonB		35.72642	1	1mo	
2	a_beautiful_girl		36.29805	4	18d	
3	Nandita Bhattacharya		37.06163	9	4d	
4	ofek koren		37.64216	5	2mo	
5	Issam Ben Moussa		37.71797	1	6d	
6	rabbie		37.90285	11	10d	
7	刚起来没多久，这下又犯困了		38.11900	1	18d	
8	CLIPTraVeLGAN		38.19282	4	9d	
9	Alena Shevtsova		38.22178	6	1mo	
10	**Artificially Creative**		38.29769	32	1d	

🙂 Your Best Entry!
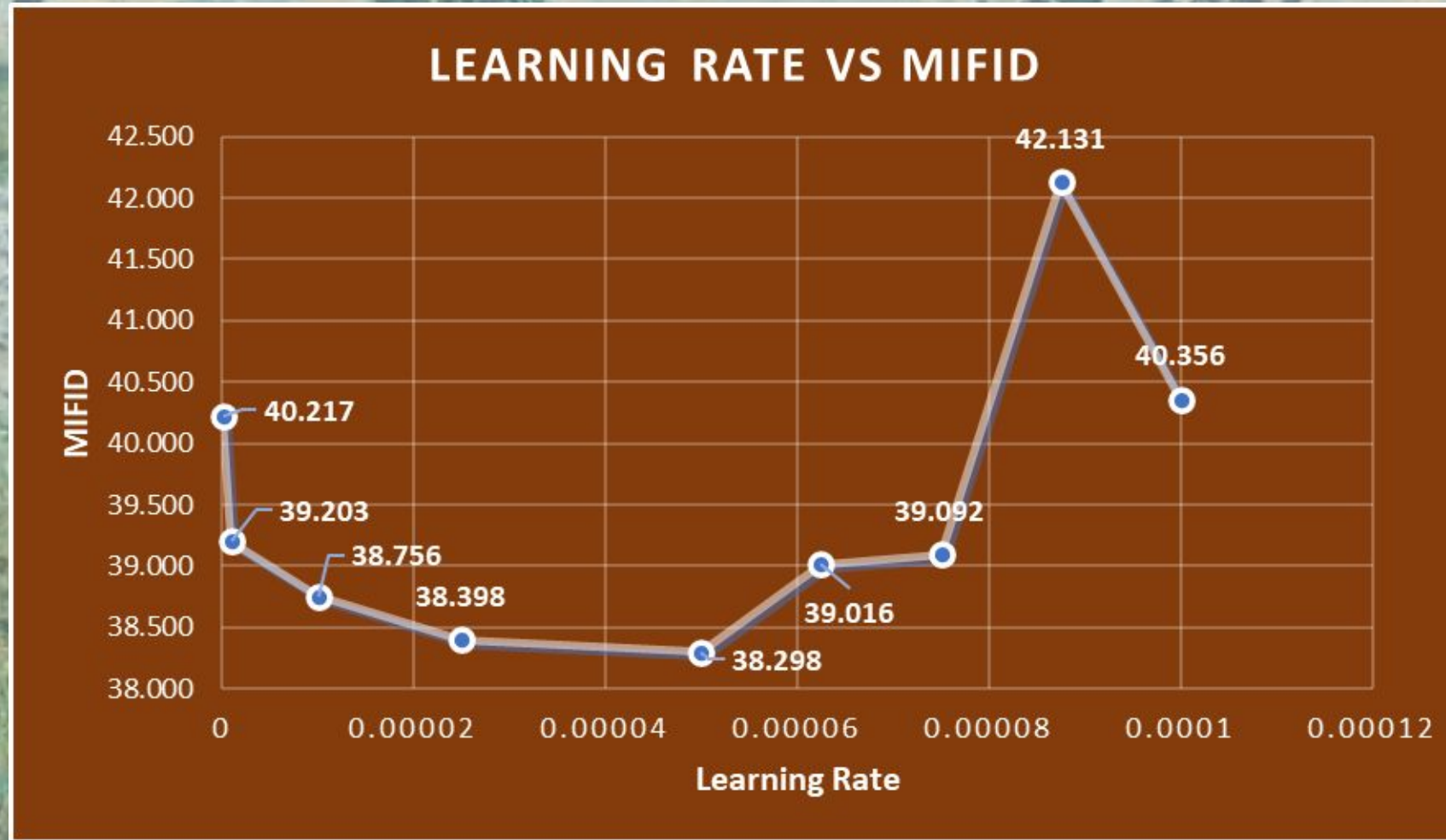Your submission scored 42.13121, which is not an improvement of your previous score. Keep trying!

Competition Performance Comparison

Epochs vs MiFID

Demo 1 values: 89.935, 62.699, 51.784, 51.493, 55.557

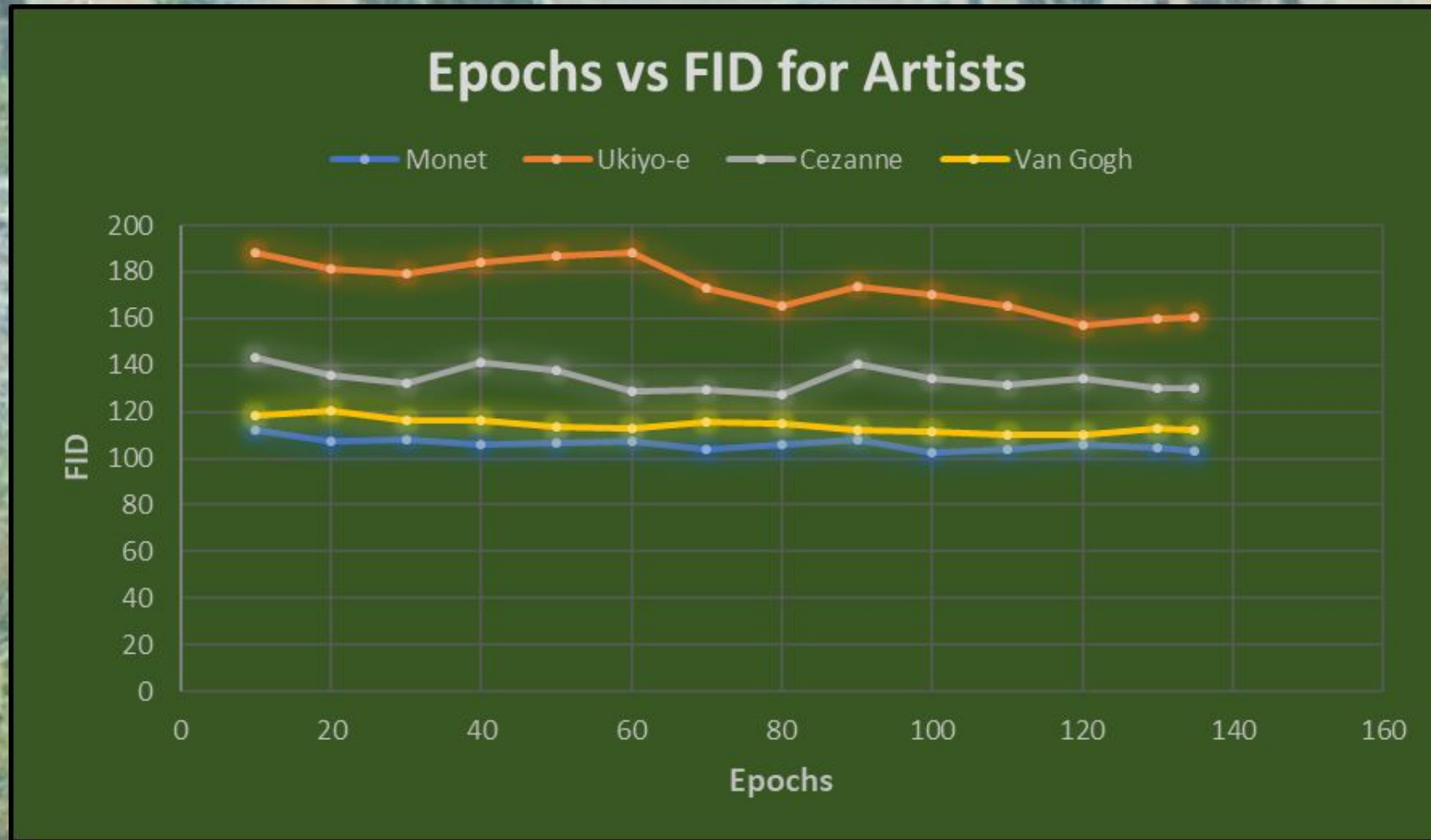Demo 2 values: 44.789, 46.030, 41.000, 44.422, 39.732

Demo 3 value: 38.298
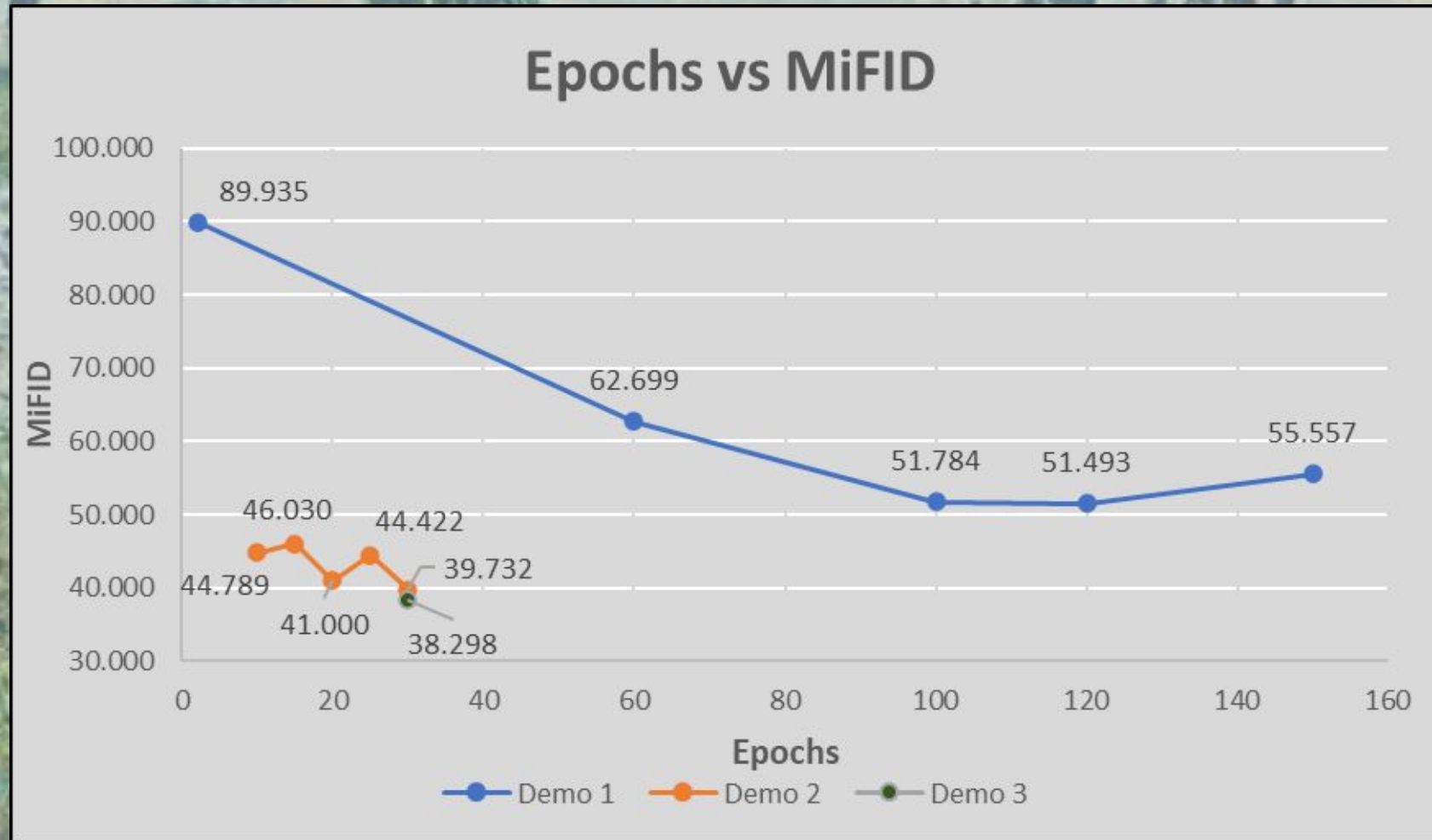
Line Graph Displaying Scores for Epochs Tested
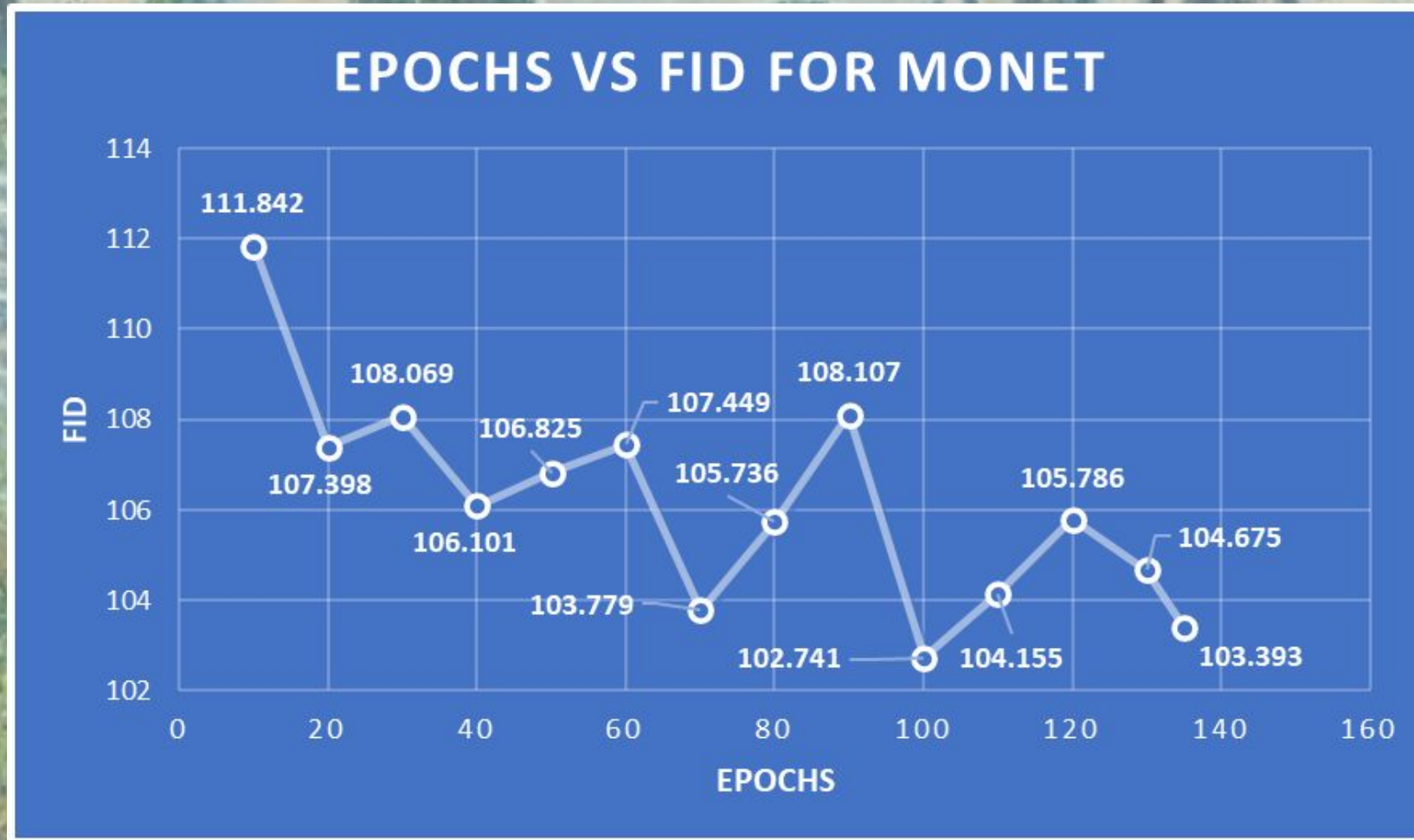
Learning Rate Performance Comparison

Line Graph Displaying Scores for Learning Rates Tested at 30 Epochs
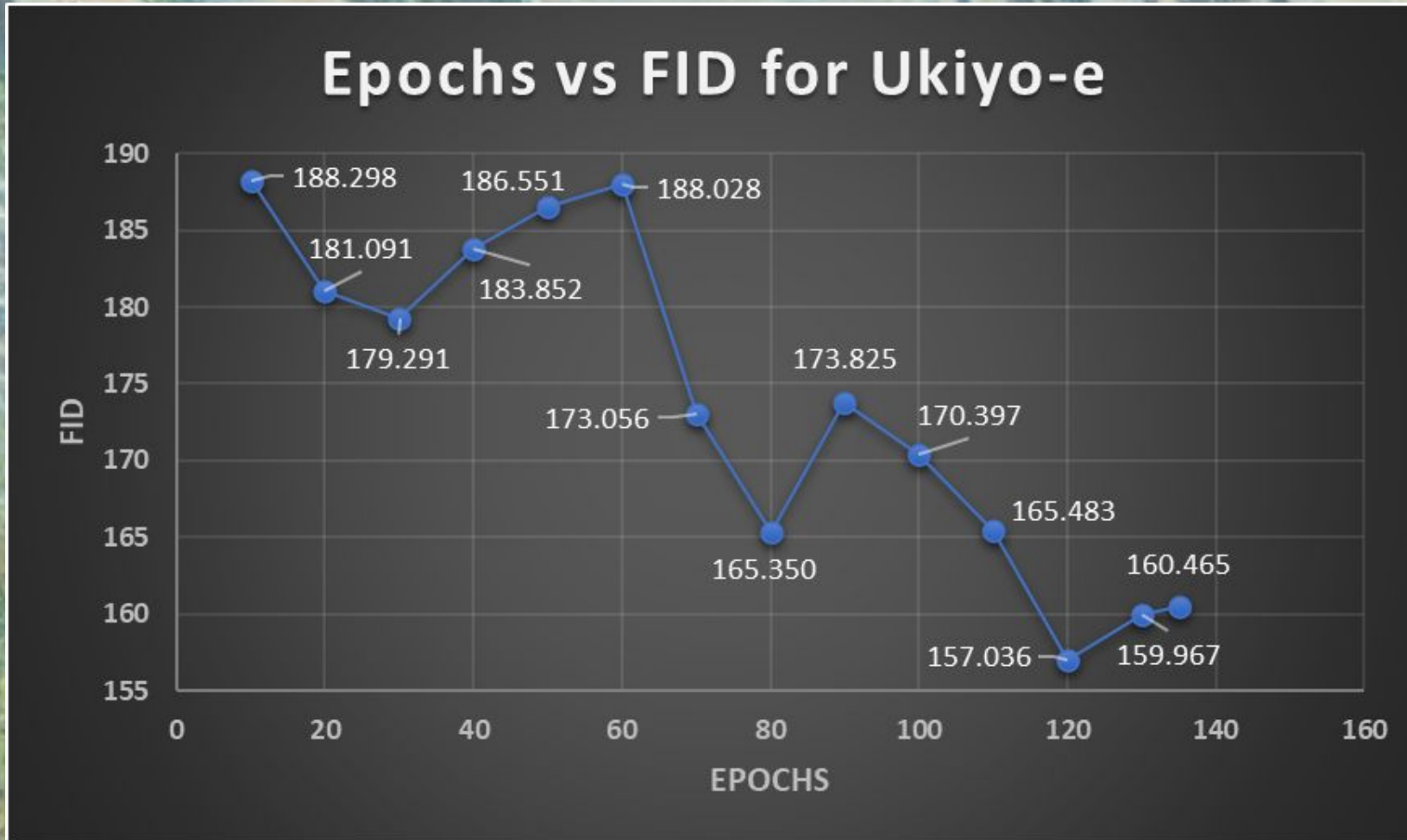
All Artists Performance Comparison

Line Graph Displaying Scores for Epochs Tested

Monet General Performance Comparison
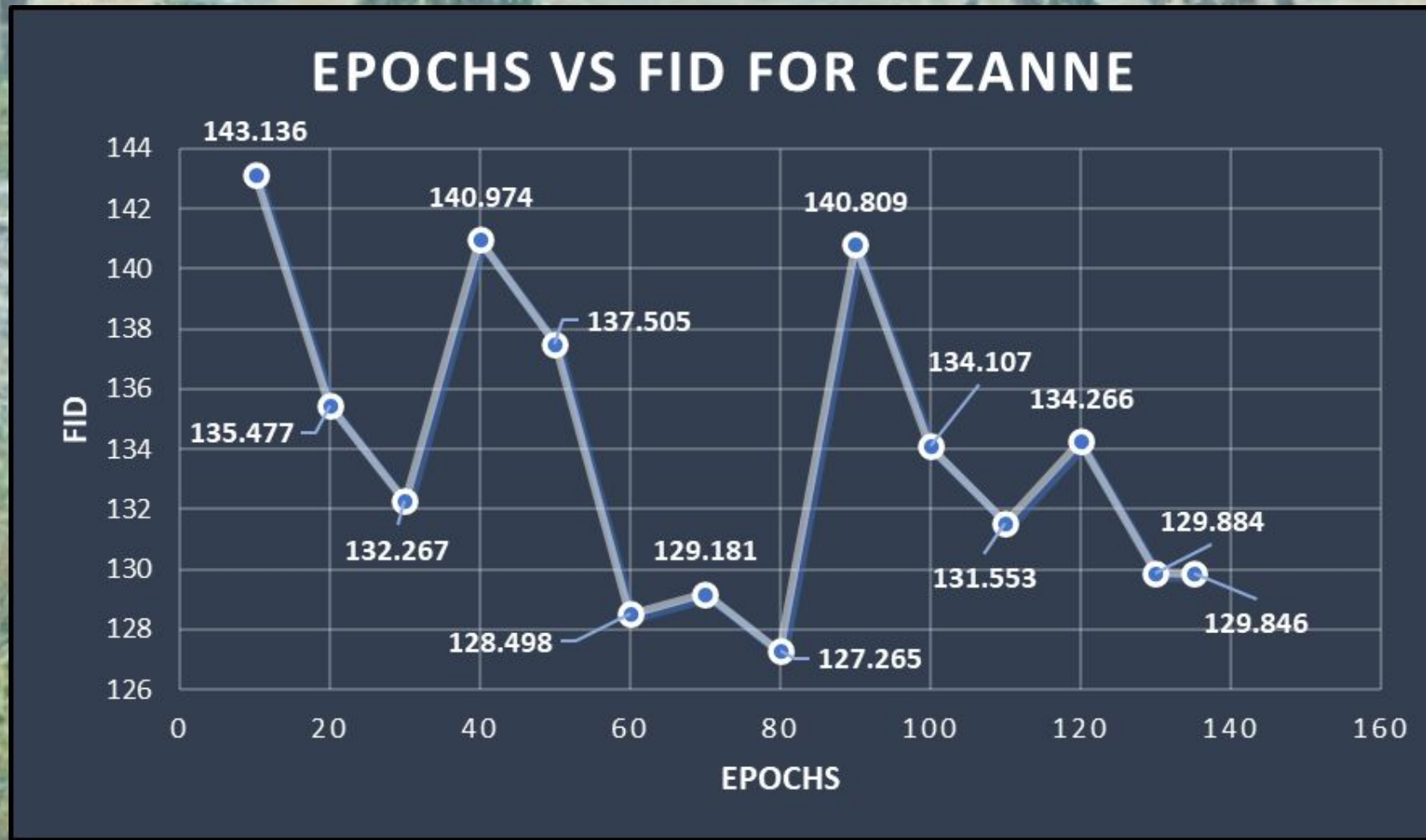

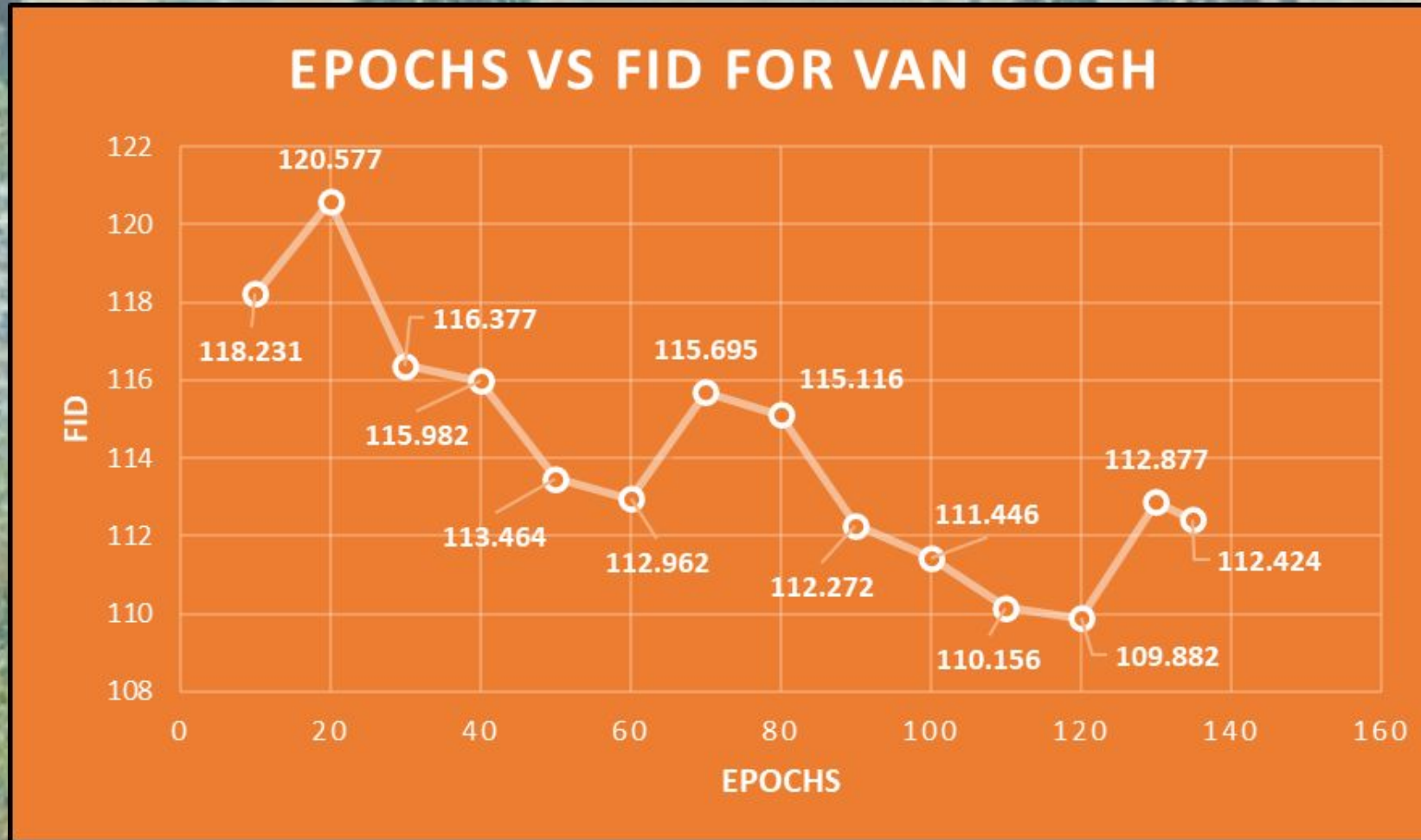**EPOCHS VS FID FOR MONET**

Line Graph Displaying Scores for Epochs Tested

Ukiyo-e Performance Comparison

Line Graph Displaying Scores for Epochs Tested

Cezanne Performance Comparison

EPOCHS VS FID FOR CEZANNE

Line Graph Displaying Scores for Epochs Tested

Van Gogh Performance Comparison

EPOCHS VS FID FOR VAN GOGH

- 118.231
- 120.577
- 116.377
- 115.982
- 115.695
- 115.116
- 113.464
- 112.962
- 112.272
- 111.446
- 112.877
- 112.424
- 110.156
- 109.882

FID (y-axis): 108, 110, 112, 114, 116, 118, 120, 122

EPOCHS (x-axis): 0, 20, 40, 60, 80, 100, 120, 140, 160

Line Graph Displaying Scores for Epochs Tested

# Competition Output Observations

Pros:

- Good with nature
- Performs well with "sprawling images"

Cons:

- Not always good with people, modern architecture, defined lines/boundaries
- Not always high performance with darker images
- For detailed photos, the paintings mostly become blurred and hard to discern
- Translation among photos varies
    - Some see little change
- Some photos become pixelated/blurred
    - Good or Bad?

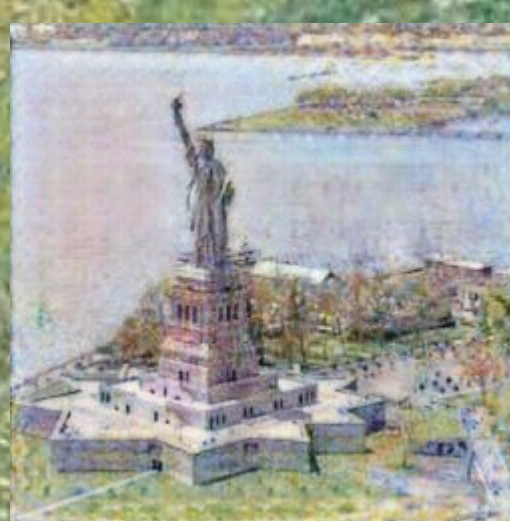# Good Example Outputs (Redo based on decayed learning rate)

Input
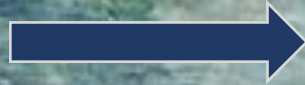
Final competition model

Author's model

Bad Example Outputs (Competition)

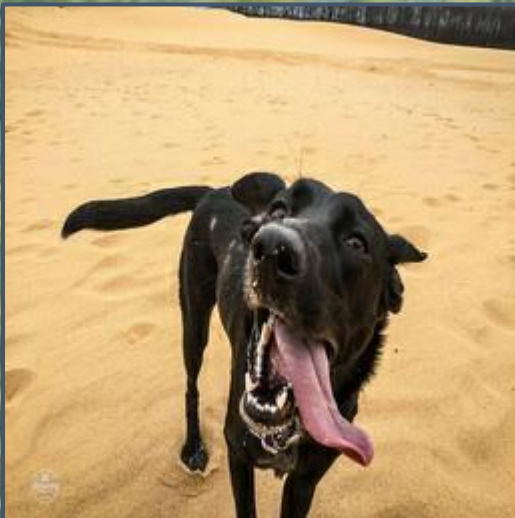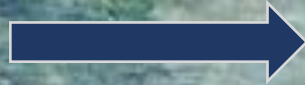

Input   Our competition model   Author's model

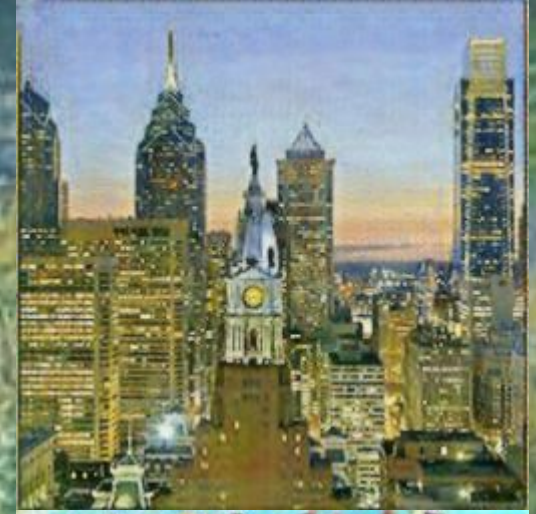# Monet General Output Good/Bad Examples
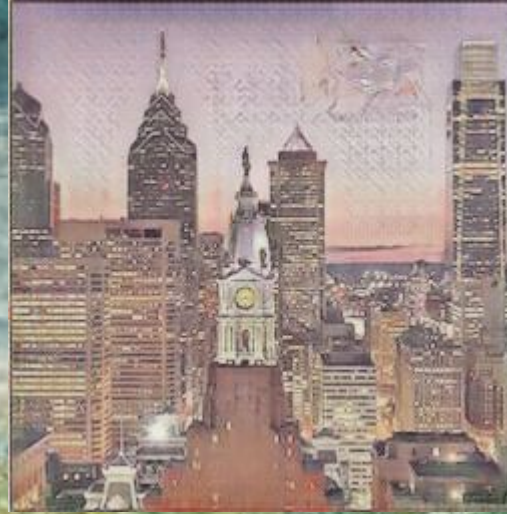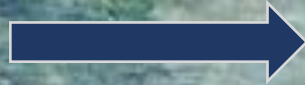
Input

General Model

Author's model

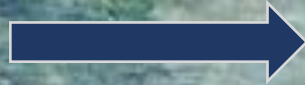Ukiyo-e General Output Good/Bad Examples

Input — General Model — Author's model

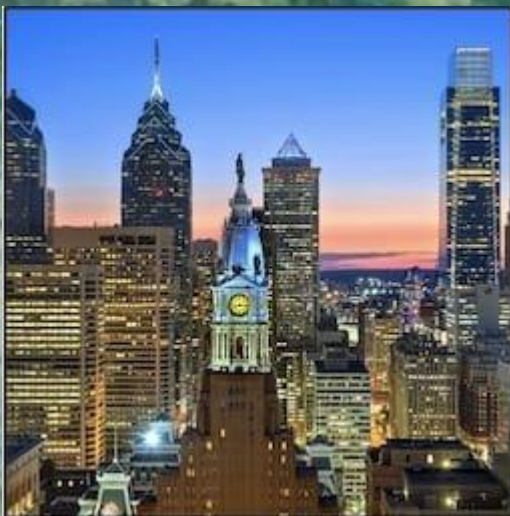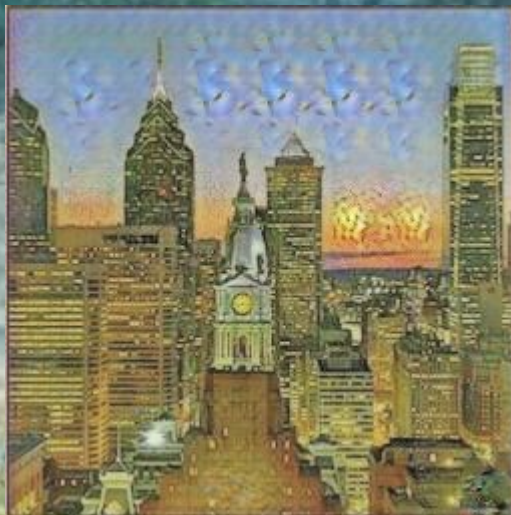# Cezanne General Output Good/Bad Examples

Input

General Model

Author's model

Van Gogh General Output Good/Bad Examples
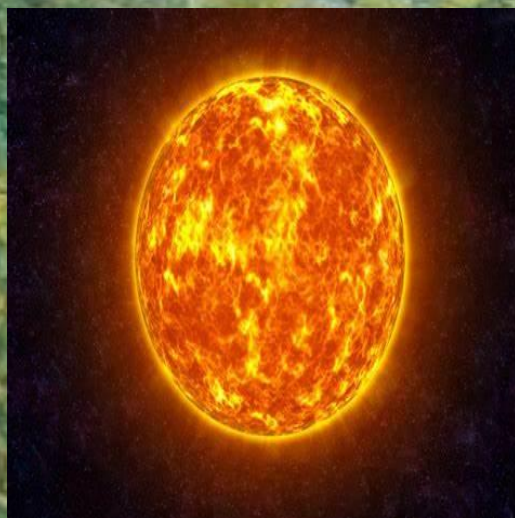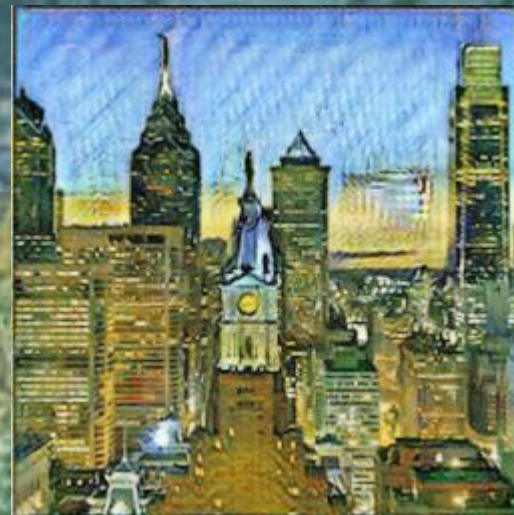
Input   General Model   Author's model

Cezanne To Ukiyo-e Transfer Examples
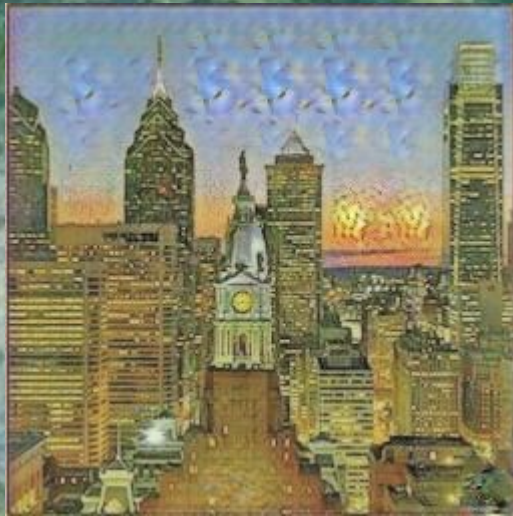
Input | Artist to Photo Transfer | Final Output
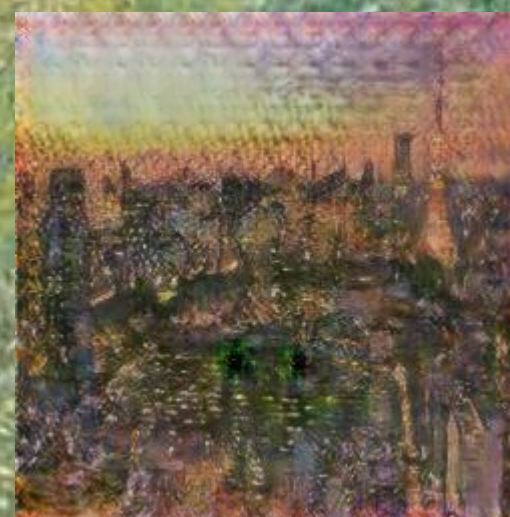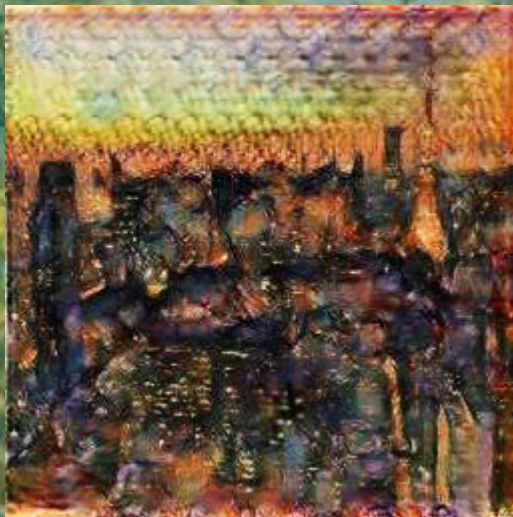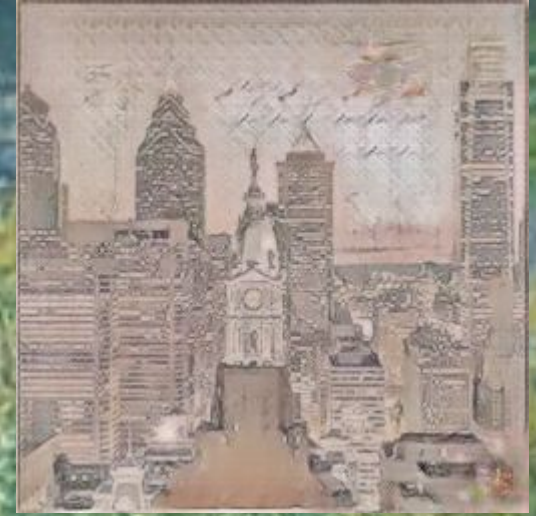
Challenges

- **Memory limits**
  - Out of memory error when not using TPU
- **Time limits**
  - Hard to experiment with different approaches
  - Can't use better models such as UVC-GAN
- **Evaluation limits**
  - Unable to quantitatively compare our competition model and our generic model due to train/test differences

Road

(generated)

Block

(generated)

Potential Future Steps

- Gather data for more epochs

- Experiment with smaller batch sizes

- Experiment further with decaying learning rate

- Experiment with more powerful models (UVCGAN V2)

Expected Questions

How long did it take you to run models?

- About 8 hours to generate weights, 2 hours for evaluation

Where do you see this technology in the future?

- Advancing, but increasing time, compute, and data required for SOTA results

References

[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](#)

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

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[Tokyo Activities - 980 Suggested Activities | Visit A City](#)

[Monet Painting](#)

[Sgt. Pepper's Lonely Heart's Club Band Analysis | Late Critic | Music Reviews](#)

[FID Explained](#)

[Index of /~taesung_park/CycleGAN/datasets (berkeley.edu)](#)

[Overview of GAN Structure | Machine Learning | Google Developers](#)

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

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

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[Question Marks Animation - ClipArt Best](#)

[Next steps concept stock image. Image of guide, next - 46566849 (dreamstime.com)](#)