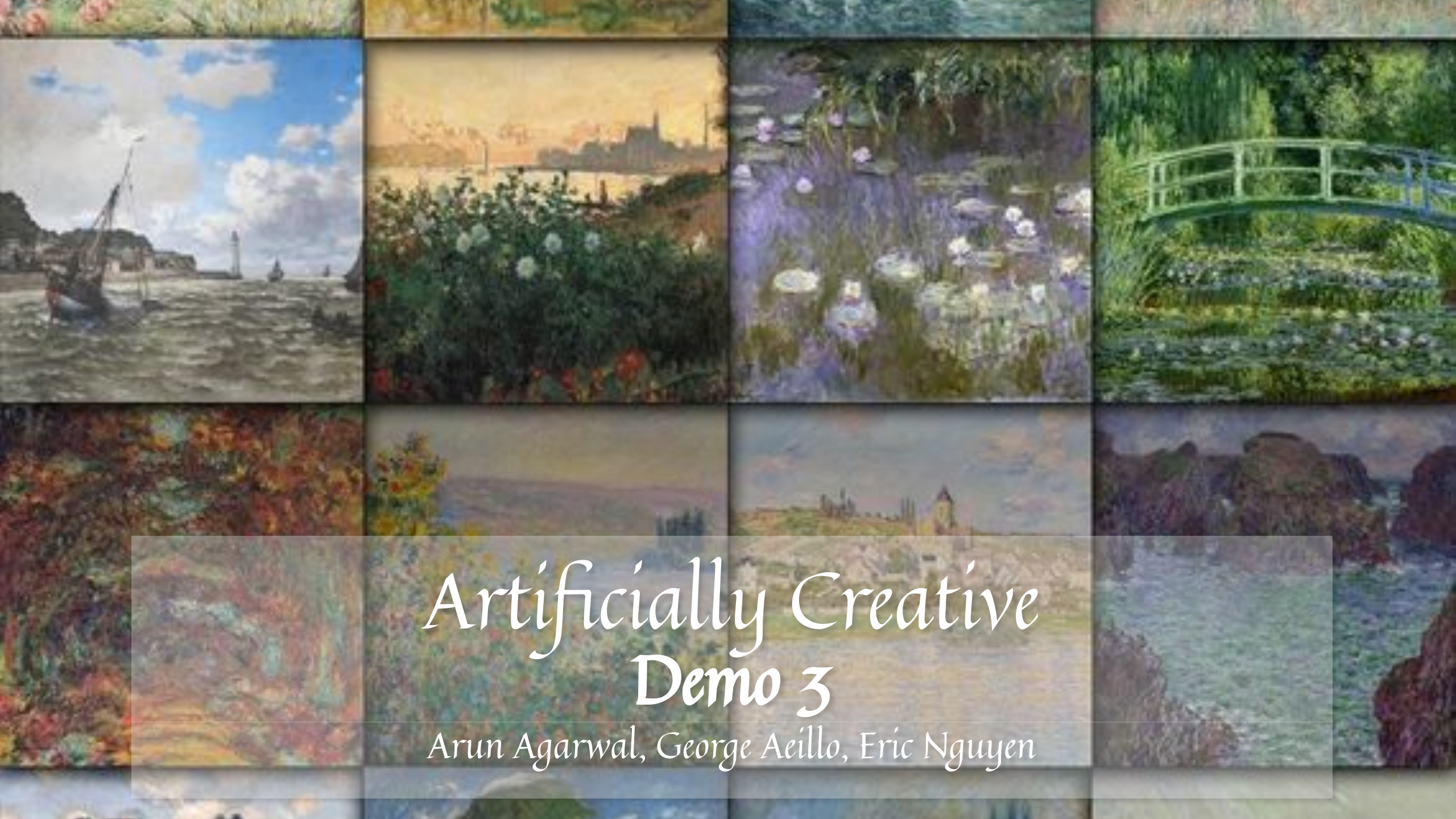


Artificially Creative

Demo 3

Arun Agarwal, George Aeillo, Eric Nguyen

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**

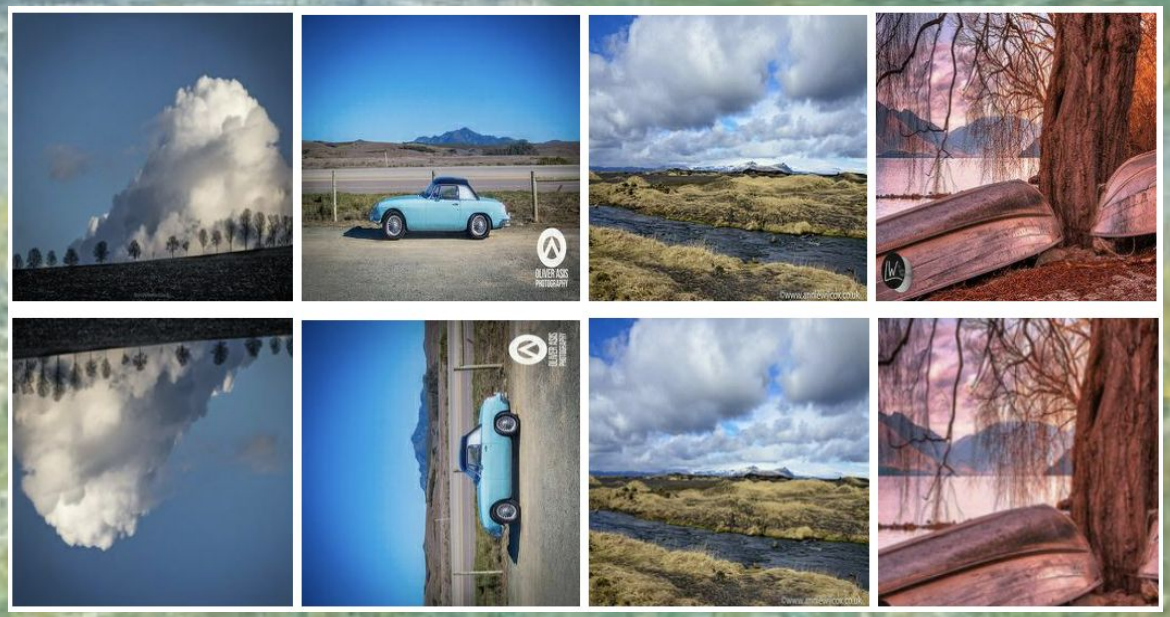
Project Scope

- **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

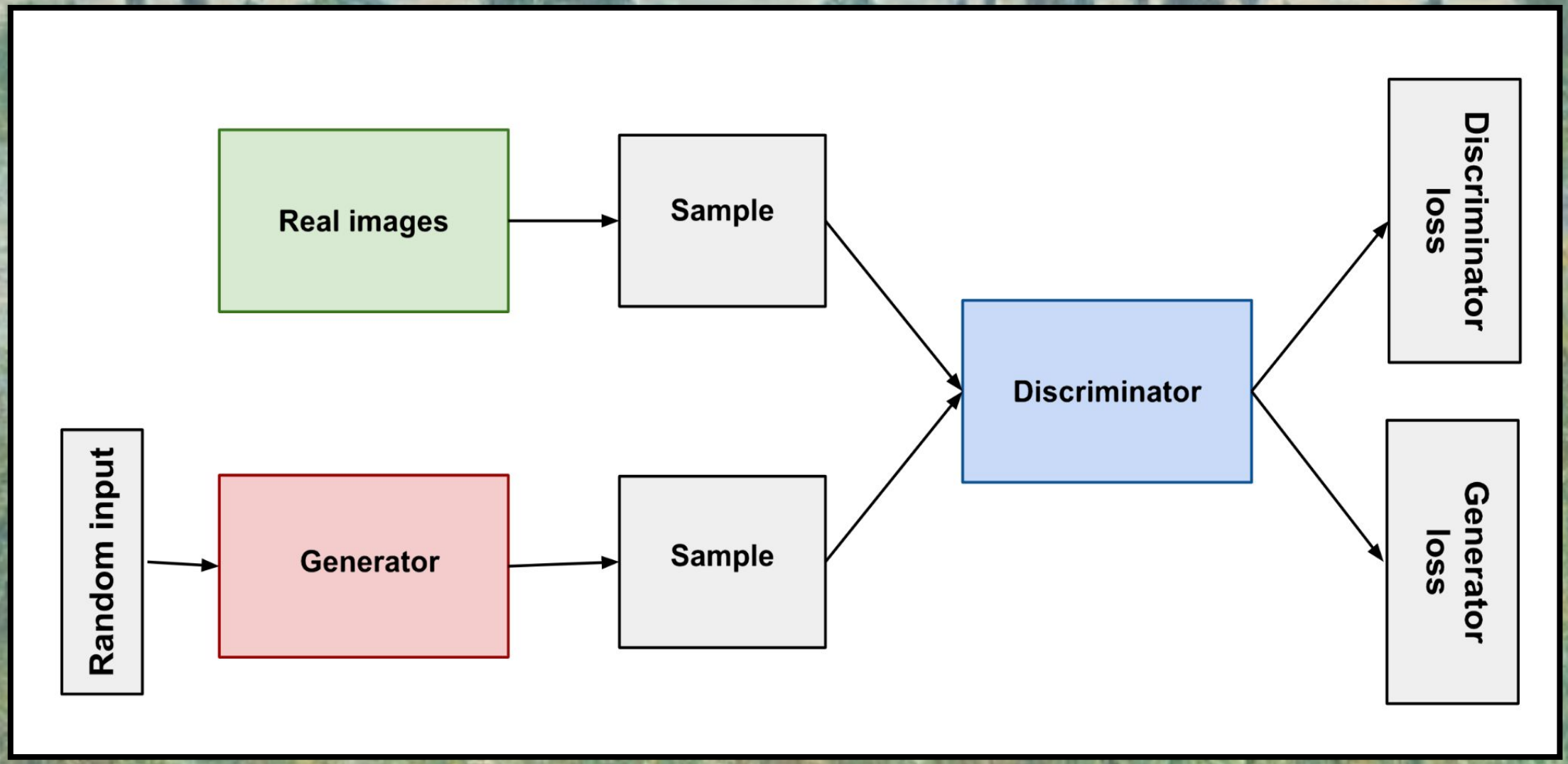
- Kaggle competition data
  - **300 Monet paintings** sized 256x256 in JPEG and TFRecord formats
  - **7028 photos** sized 256x256 in JPEG and TFRecord formats
  - Size: 385.87 MB
- **Project Focus**: modeling and architectures of modern data science techniques

  (rather than the data acquisition)
- Data augmentation

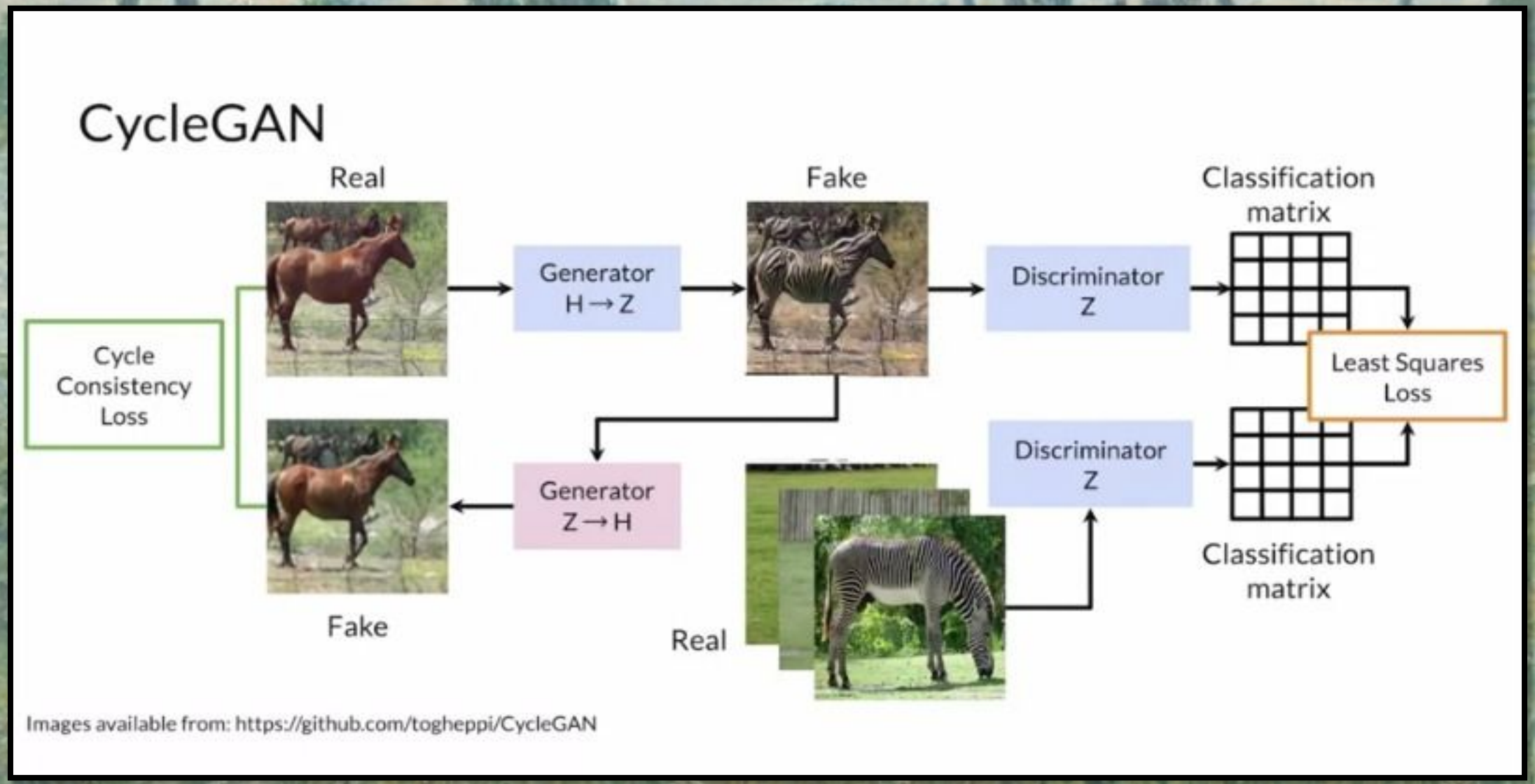


Examples of augmented images using resizing, cropping, rotation, and flipping

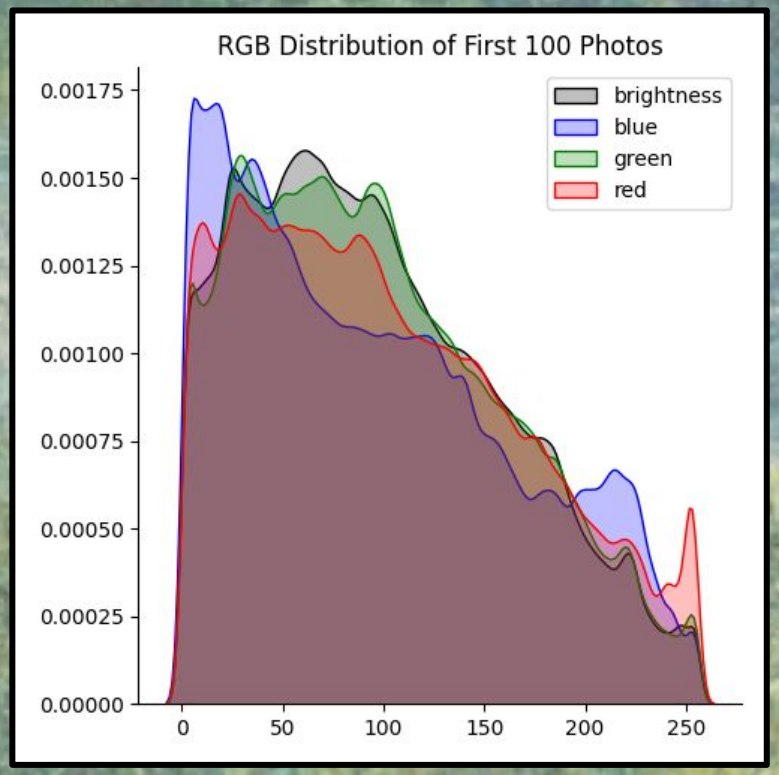
GAN Description

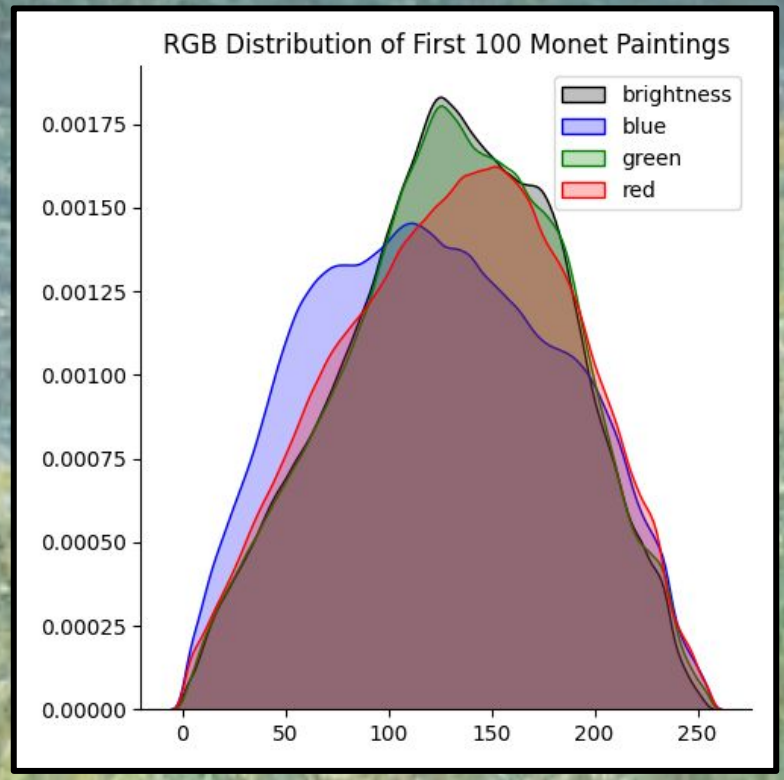


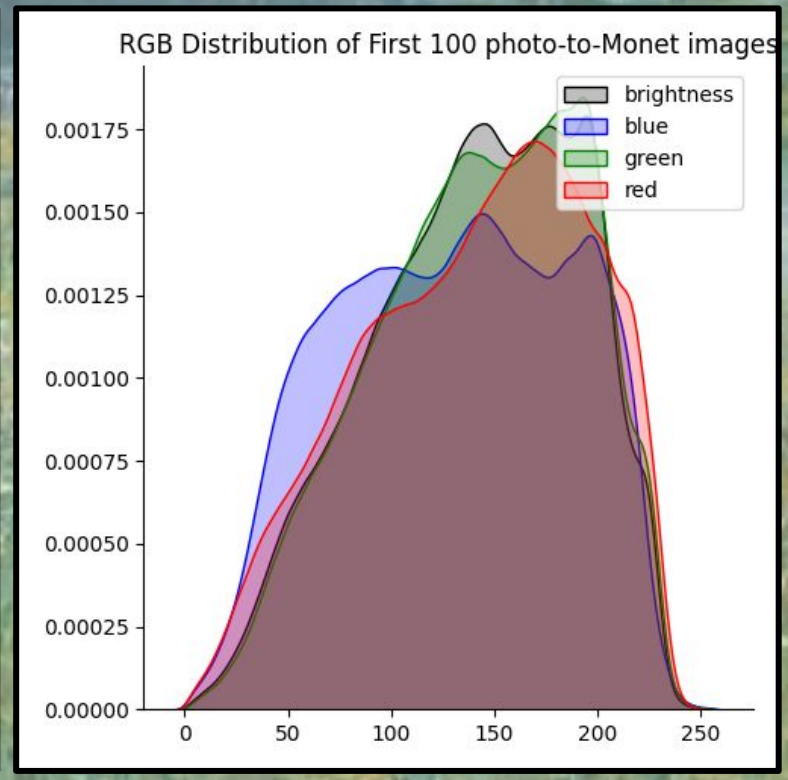
CycleGAN Description



EDA: RGB Distribution (Competition)



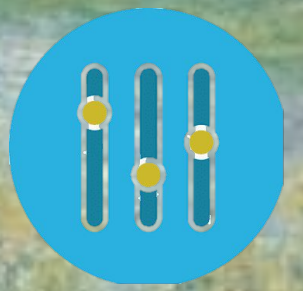




RGB distribution of the first 100 photos (left), the first 100 Monet paintings (center), and the first 100 generated photo-to-Monet images (right), with zeros excluded

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
  - Initial Learning 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
  - Initial Learning rate = 0.0002, Beta 1 = 0.5, Final **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

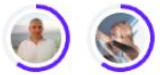
Performance Evaluation Cont.

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

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

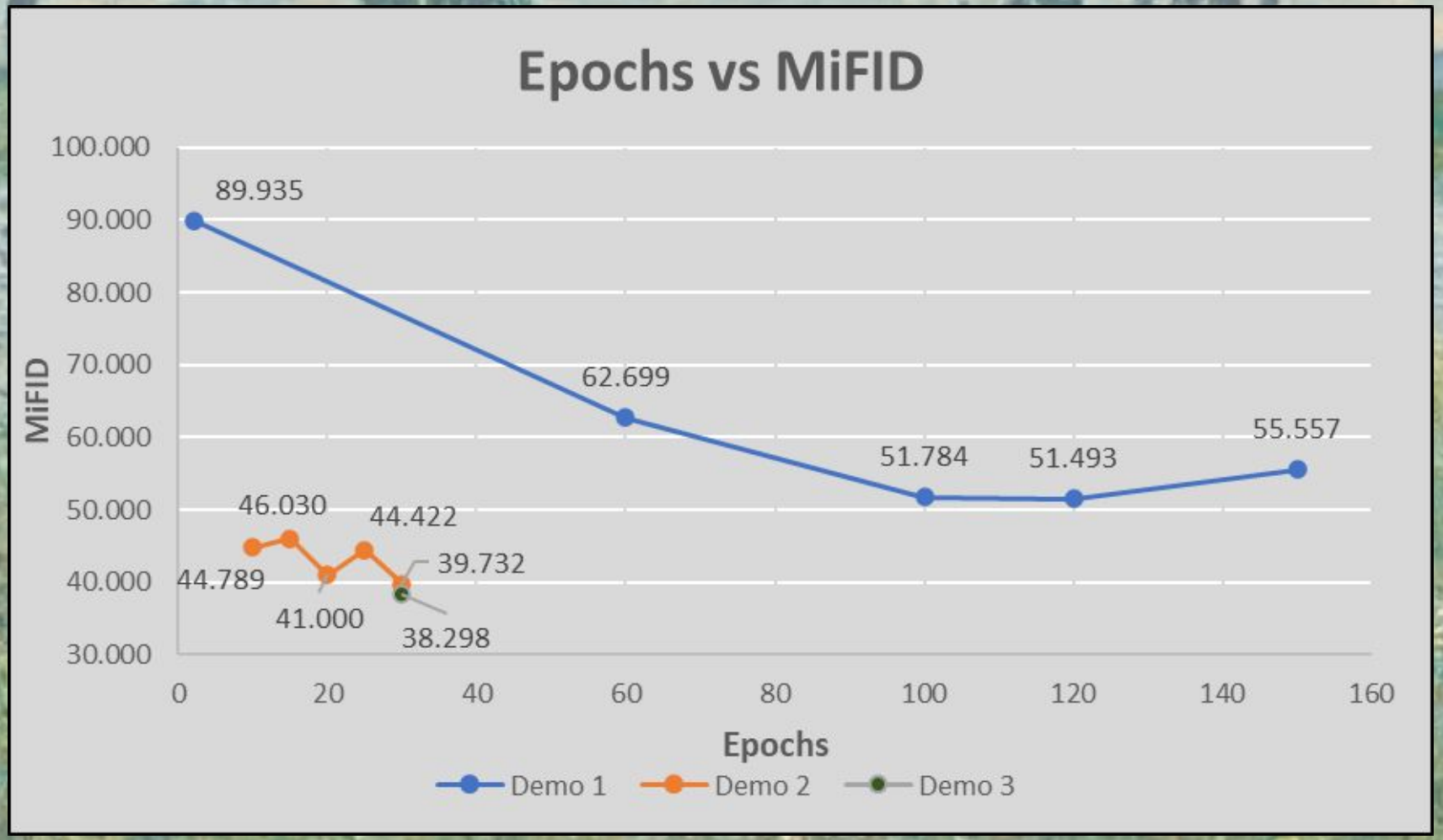
Demo 3:
MiFID Score:
38.29
Leaderboard:
10/146
Percentile:
~7th

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	

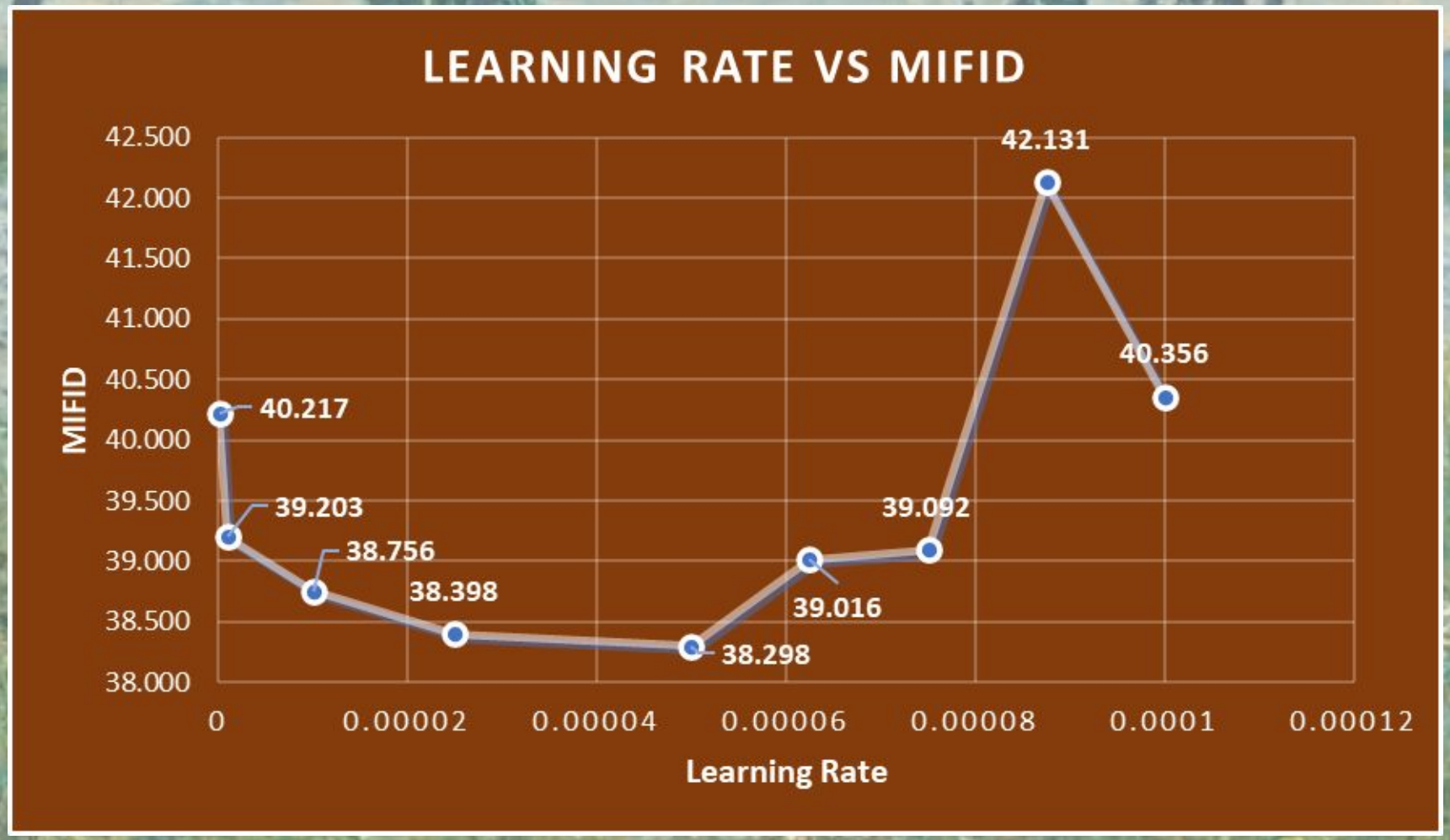
Your Best Entry!
Your submission scored 42.13121, which is not an improvement of your previous score. Keep trying!

Competition Performance Comparison



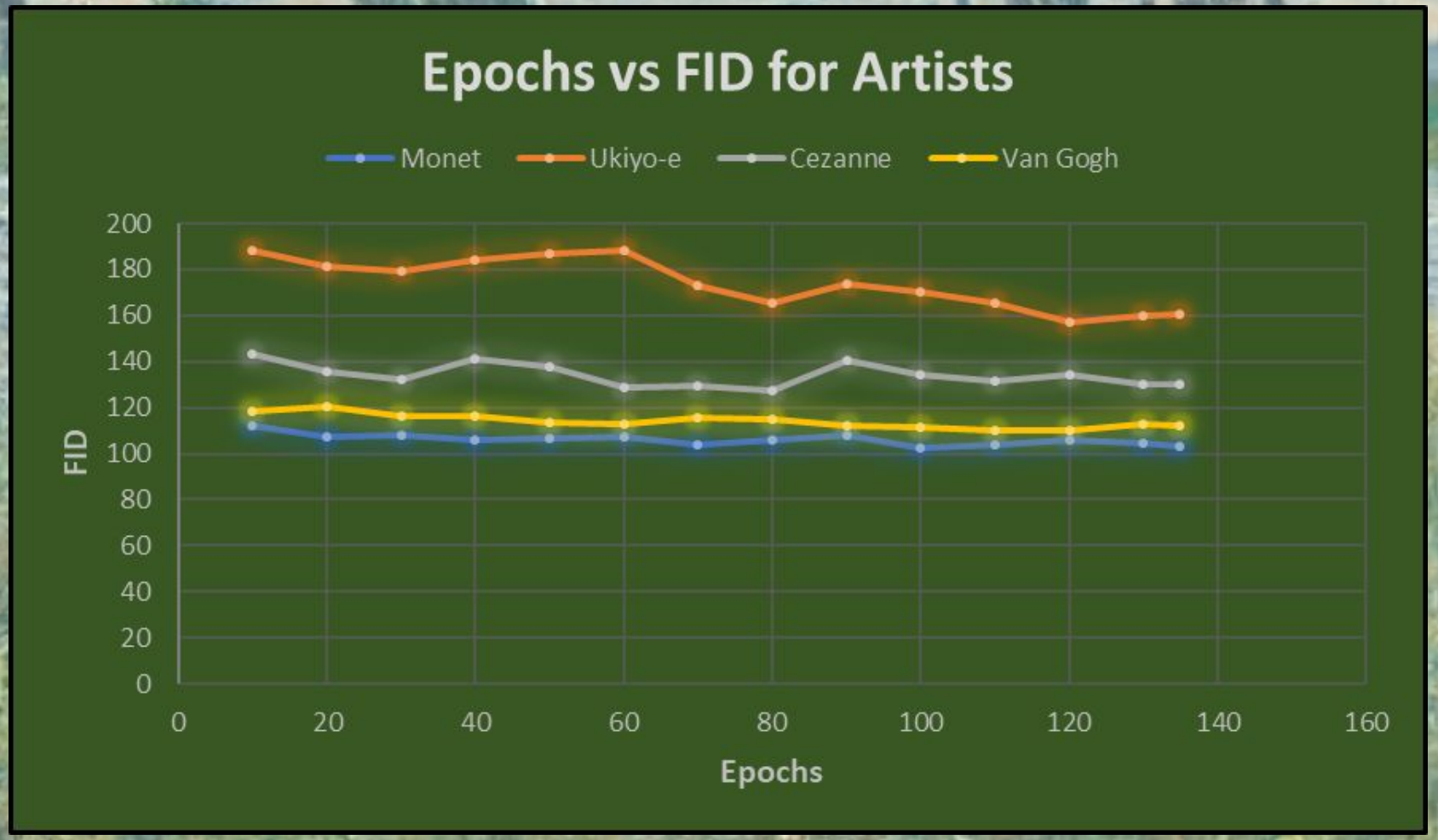
Line Graph Displaying Scores for Epochs Tested

Learning Rate Performance Comparison



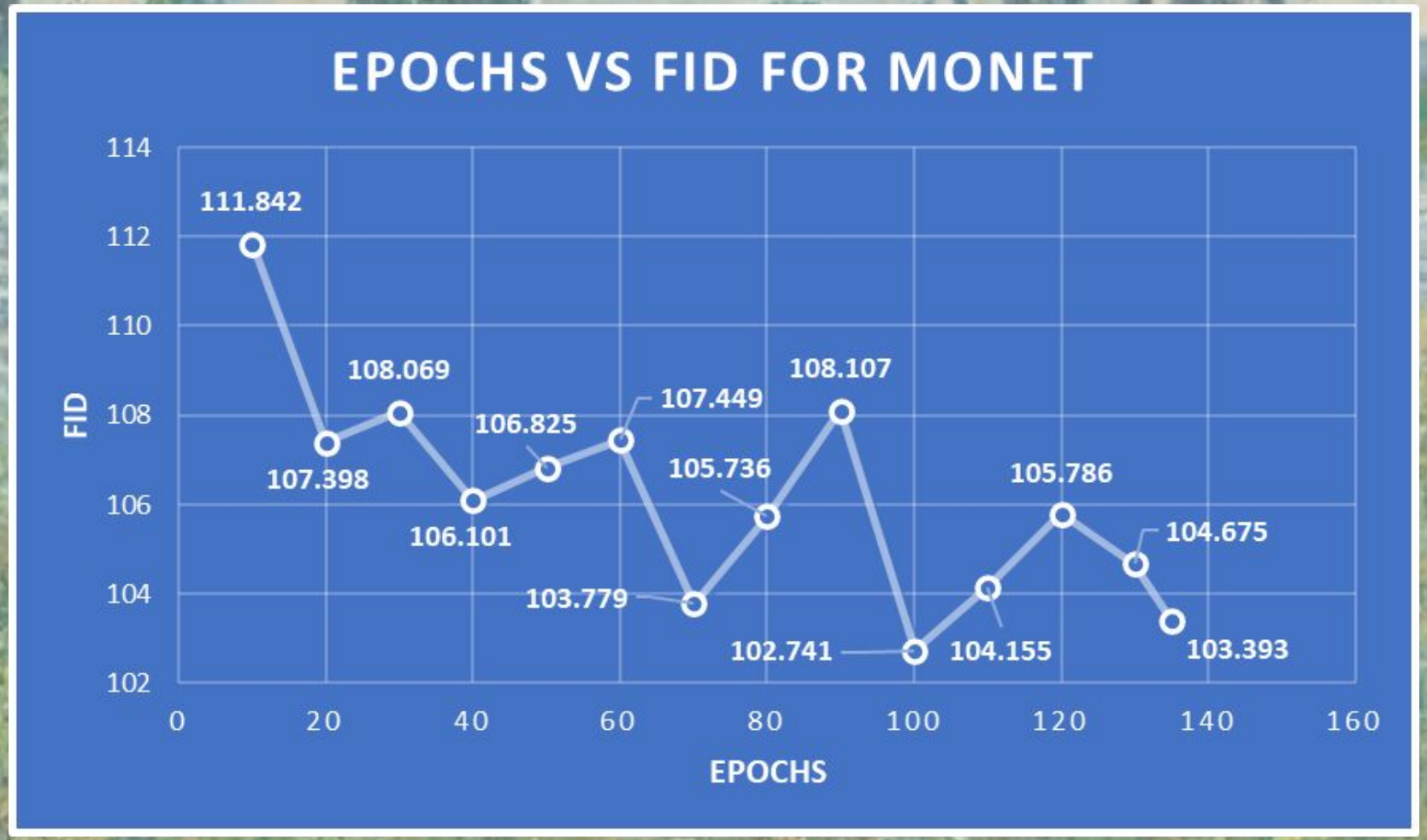
Line Graph Displaying Scores for Learning Rates Tested at 30 Epochs

All Artists Performance Comparison



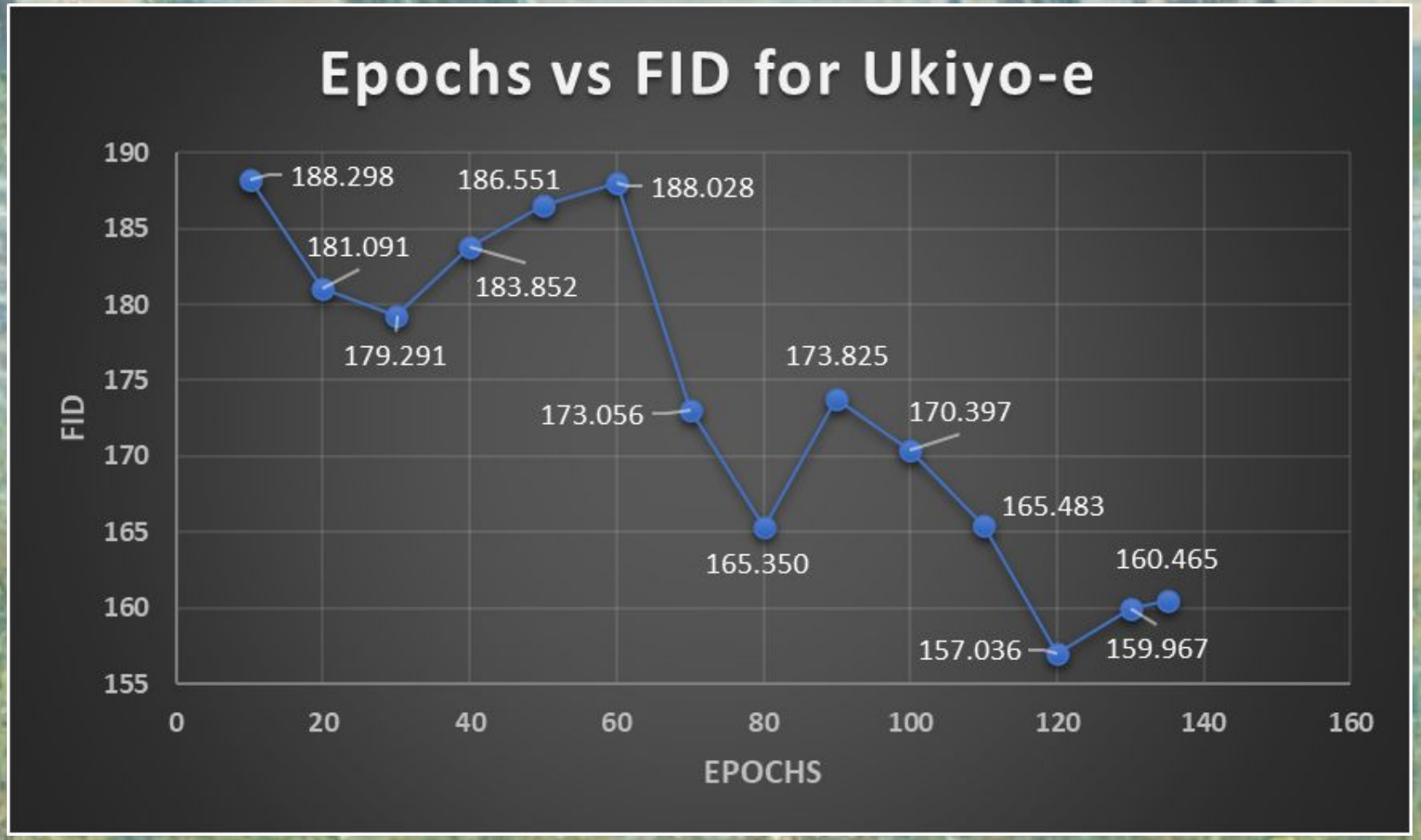
Line Graph Displaying Scores for Epochs Tested

Monet General Performance Comparison



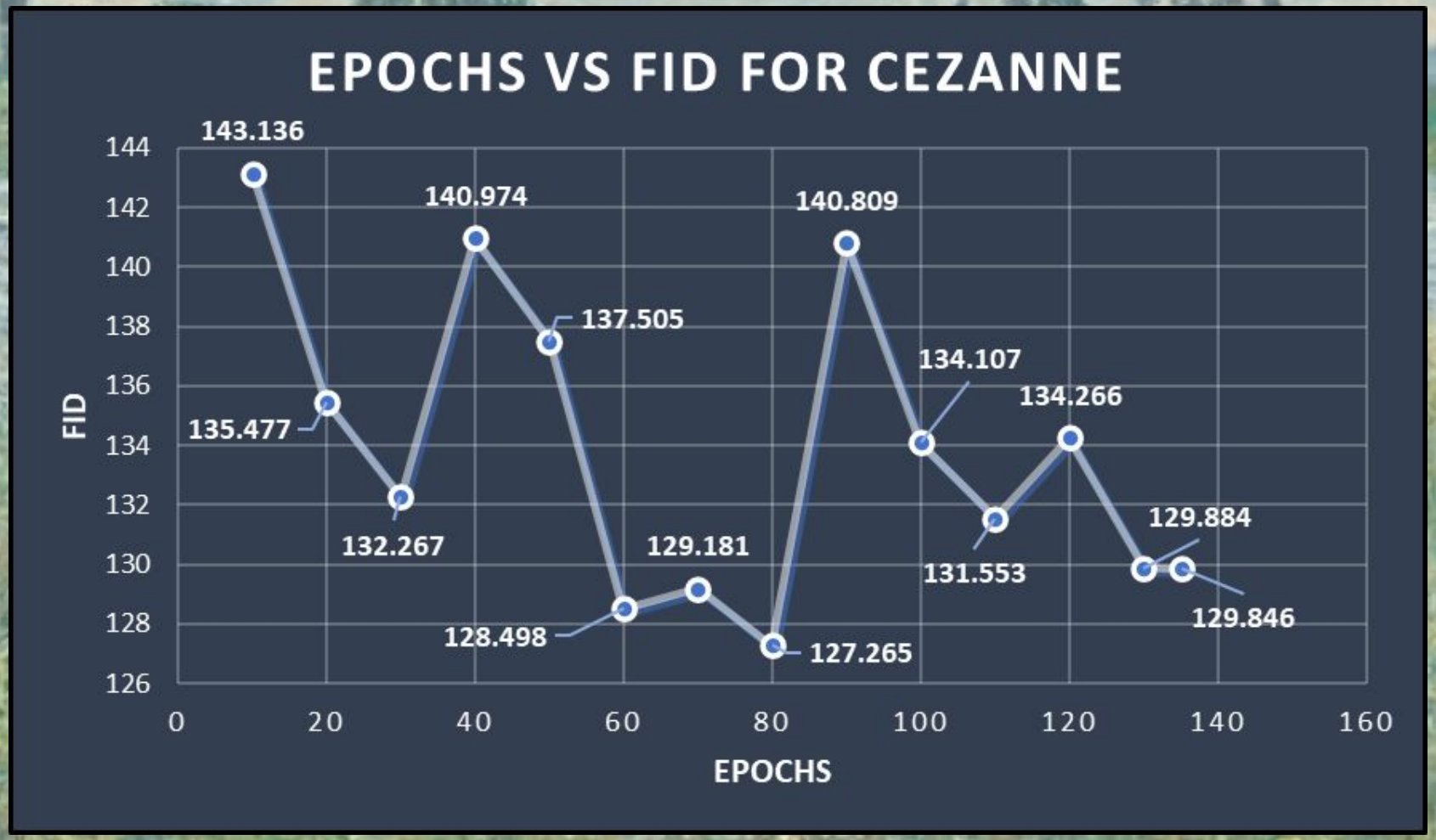
Line Graph Displaying Scores for Epochs Tested

Ukiyo-e Performance Comparison



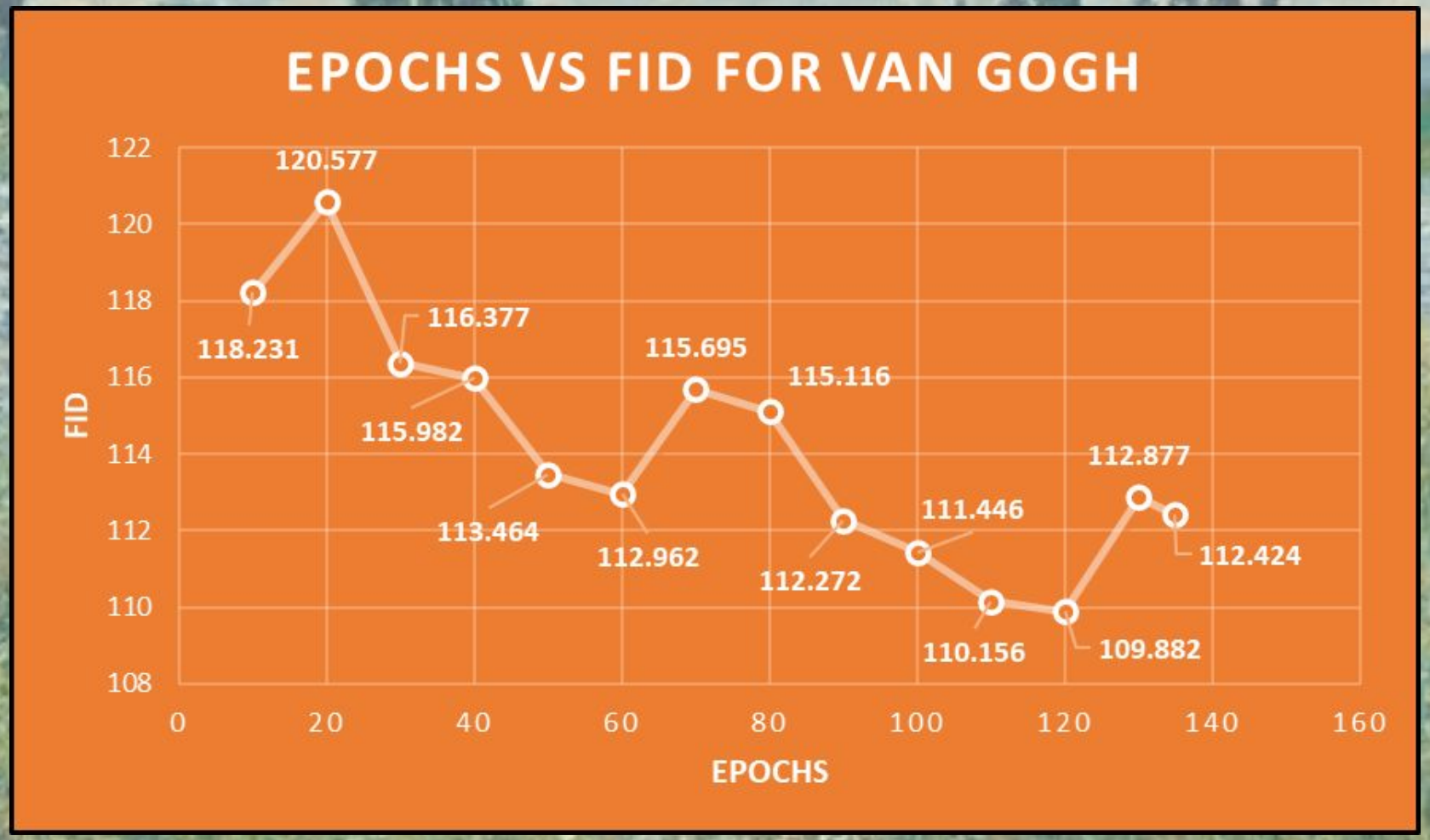
Line Graph Displaying Scores for Epochs Tested

Cezanne Performance Comparison



Line Graph Displaying Scores for Epochs Tested

Van Gogh Performance Comparison



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

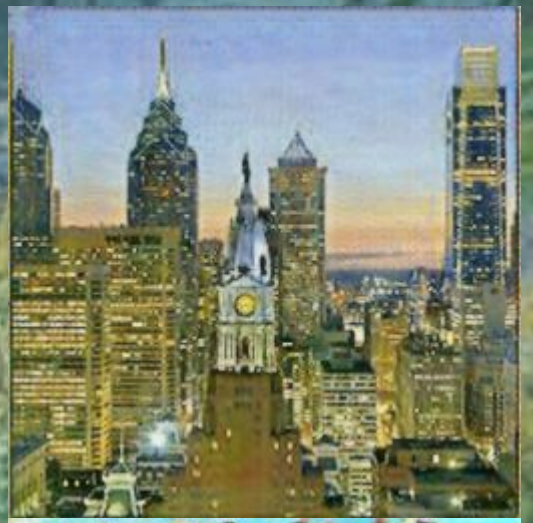
Input	Final competition model	Author's model
		
		

Bad Example Outputs (Competition)

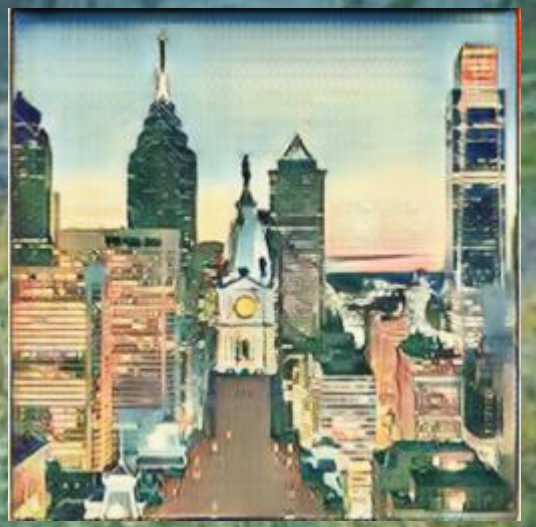
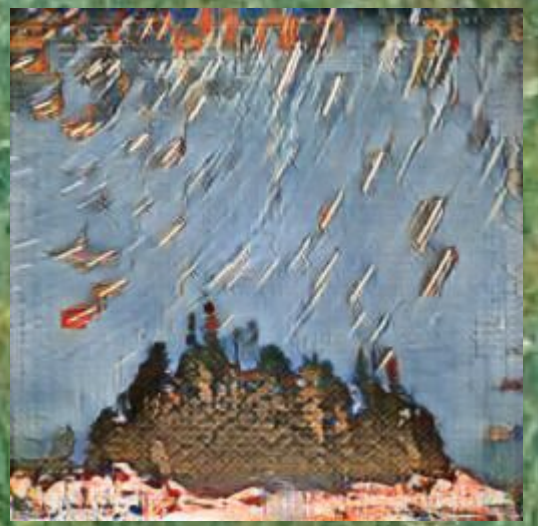
Input	Our competition model	Author's model
		
		

Monet General Output Good/Bad Examples

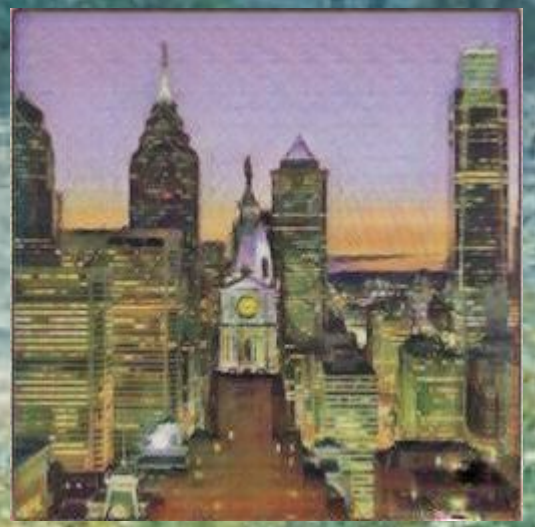
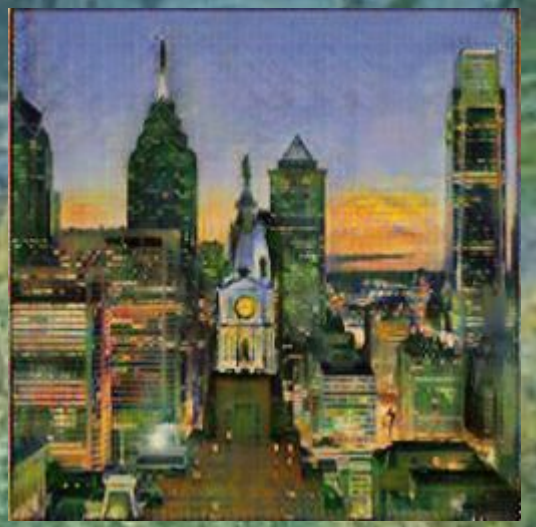
Input	General Model	Author's model



Ukiyo-e General Output Good/Bad Examples

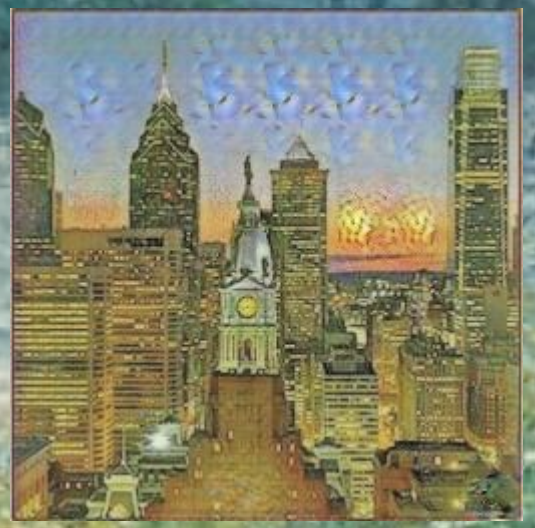
Input	General Model	Author's model
		
		

Cezanne General Output Good/Bad Examples

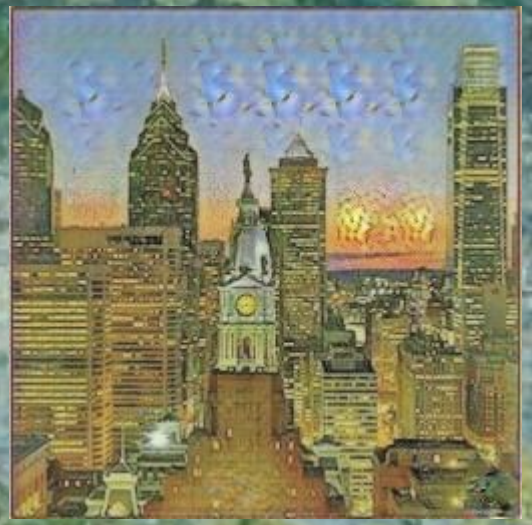
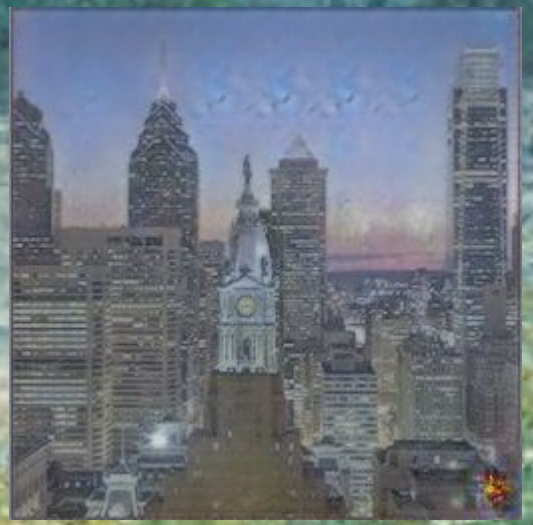
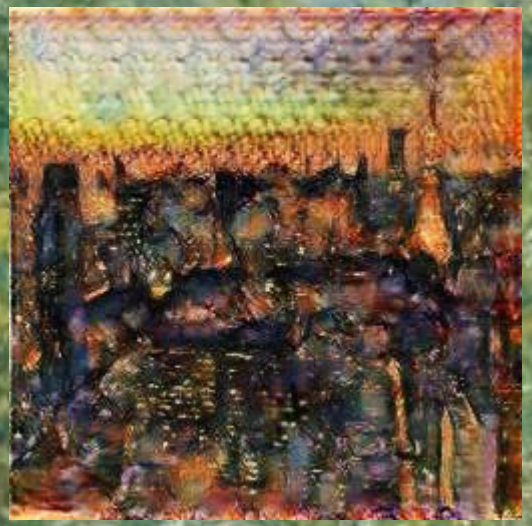
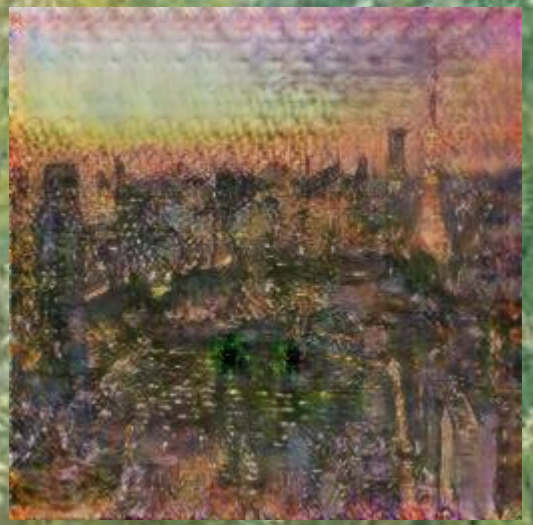
Input	General Model	Author's model
		
		

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 general 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)
Blog not found (wallpapers-xs.blogspot.com)
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
https://archello.com/story/91136/attachments/photos-videos/2
Question Marks Animation - ClipArt Best
Next steps concept stock image. Image of guide, next - 46566849 (dreamstime.com)