RunwayML Project - AI Architecture, Generative Design Modern Japanese architecture

Introduction

Architecture has also been an appealing art form to me, it reflects significant events, styles, technologies, and cultural adaptations but what makes it so intriguing is the involvement of logic & strategy.

In order to make a worthy architecture concept; structure, purpose, relevant societal and physical systems are all factors that need to be considered. Making it, one of the most promising art forms that will rely on artificial intelligence in the future. Research is being developed by the Architects Registration Board (ARB) to provide genuine AI design assistance, through genetic algorithms, design optimisation will result in the most suitable & strongest designs to be implemented. AI will also be able to provide ways of forming new aesthetics in architecture. So, I thought an interesting concept would be to generate new architecture designs/aesthetics images on a small scale with the use of AI.

The Project - Concept

Generate new AI architectural projects using a dataset containing images from three architects with similar but unique styles. The result should display new buildings/styles. The style I've decided to work with is Modern Japanese designs as they seem to be one of the most progressive architectural styles at the moment, the architects I've chosen have all been huge contributors to modern Tokyo & the Tokyo 2020 Olympics. Below are the architects whose work I've chosen for the project.

Akihisa Hirata - Born in Osaka, Japan in 1971, Hirata completed his studies at Kyoto University in 1997 receiving a MA in Engineering. He opened his own studio in Akihisa Hirata Architecture Office in 2005 and is also currently a professor at Kyoto University. Major works include Masuya (2006), sarugaku (2008), Bloomberg Pavilion (2011), kotoriku, (2014). His style can be described as Japanese modernist with a flair of natural elements.

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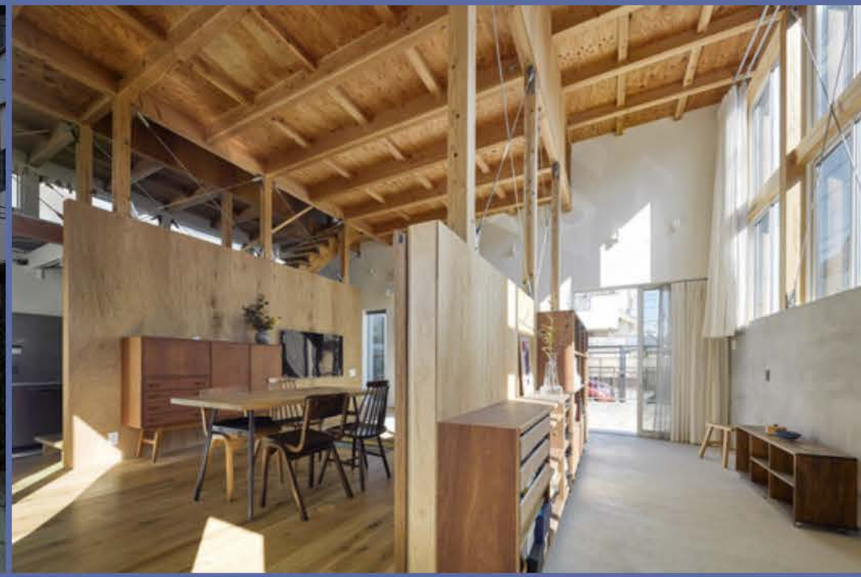
Kazuyo Sejima - Born in Hitachi, Japan in 1956, Sejima is known for her amazing breath-taking buildings such as the New Museum in New York City and the Glass Pavilion in Toledo, Ohio. She is now the first woman to have taken on the directorship of the Architecture Biennale in Venice, Italy. Her style is a creative take on on minimalism, designs that quietly commune with nature or slip gently into a city street.



The Project - Final Results

Documentation

Background and Research

I investigated the ways that AI has been influencing the architectural industry to gain some insight & prepare for the project. Some key effects of AI in architecture include concept designs that use AI are becoming a practice norm, parametric architecture is becoming more prevalent; parametric architecture uses geometric programming, with complex algorithms so that architects can meld & reshape a building to fit their needs. There is also an increase in project efficiency due to genetic algorithms that are making design & building time shorter.

I also took influence & knowledge from our previous in-class lessons such as Irti's lecture on generative design and HCI and explored the work of our guest speaker Tobias Revell who contributed to the Z33 Studio time essay 'Future Thinking in Art and Design', which goes over envisioning the future of art, design and architecture tackling topics such as imagination in creative practices, future literacy, and future ethics. I also read over some articles, for example, David Newtons Generative Deep Learning in Architectural Design which goes over how machine learning has great potential to analyse designs at less cost.

I thought it would be useful to search to see if there were any similar projects in which I found a pre-made model on RunwayML which generates brutalist architecture buildings, which gave me some insight to what the results of my model will look like. And lastly, I researched data preparation tips so that the images datasets could produce the best results in which I discovered normalising images by subtracting the datasets image mean can produce create a better outcome.

Plan

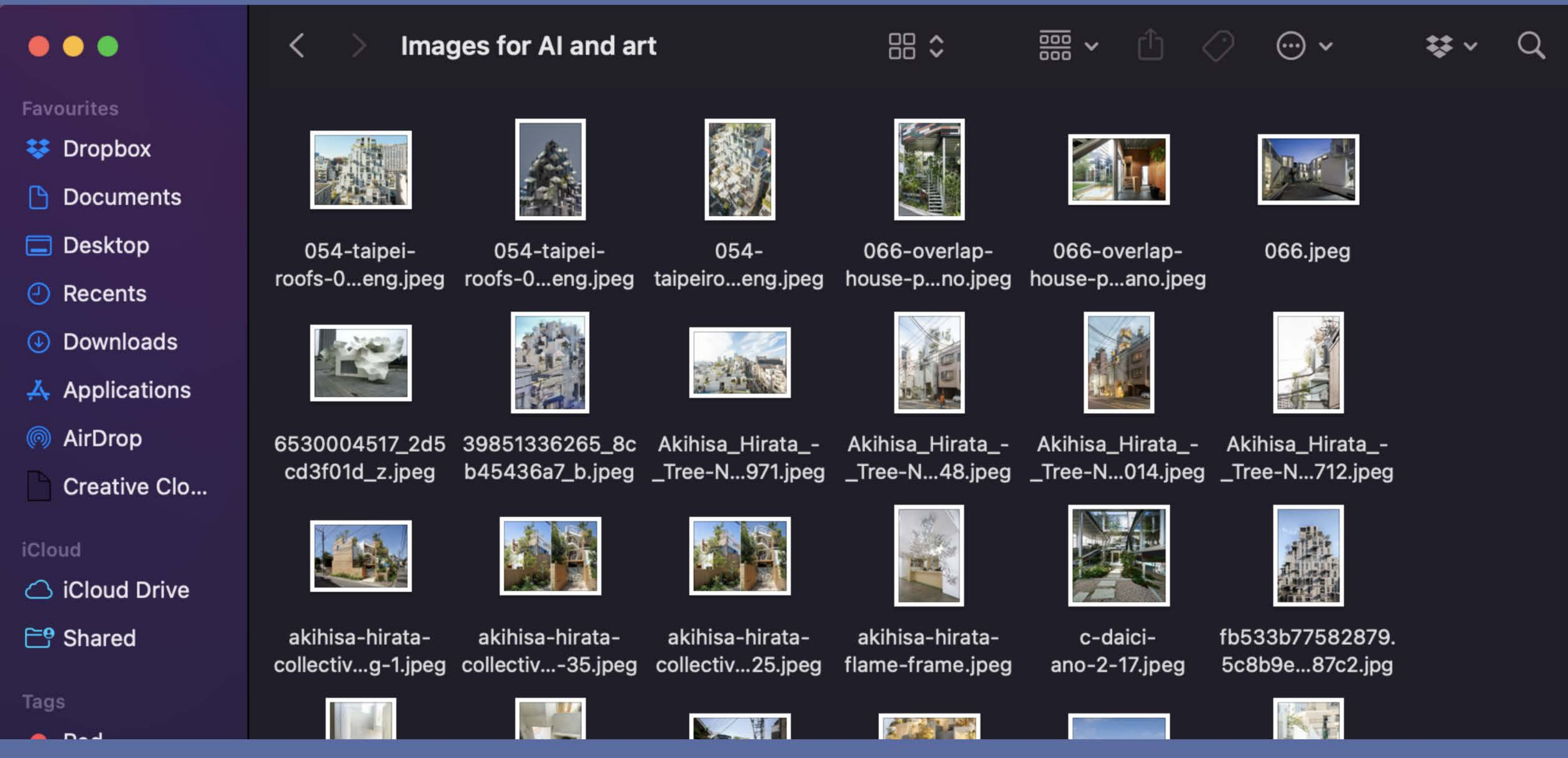
To prepare for the project, I'm going to download 200 – 500 pictures of the chosen architectures work. And resize all the images to 245 x 245 so that the data is easier to process.

The photos are mostly going to be of exteriors architecture buildings, I will then go through the photos, deleting any that might negatively affect the results.

After watching a few videos on RunwayML, I decided that i'll be setting the training model to 3000 steps (The number of steps the algorithm takes to learn the feature in the dataset) as this should be enough for a small-scale dataset and anything higher might delay the process.

Development / iteration process

Download a range of images from the architects, then resized and sorted the images to prepare for the insertion into RunwayML



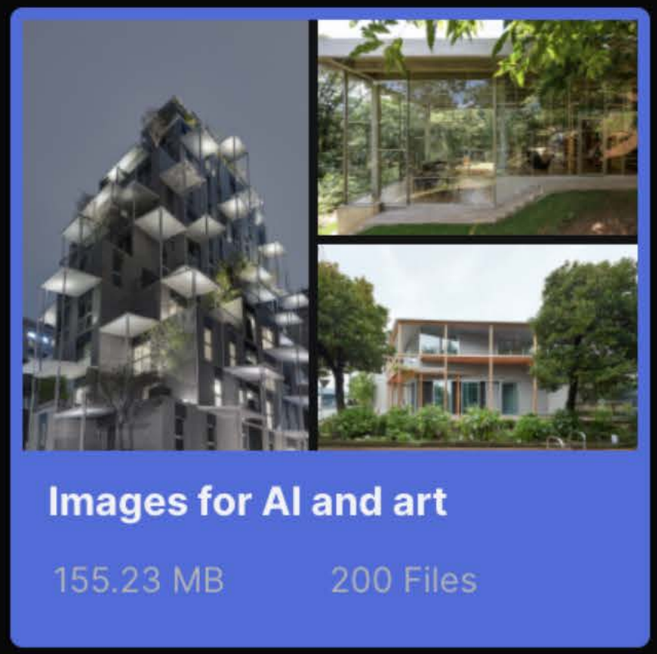
Went to the training options to make a new one & chose image generation and scenery

1

Select a Dataset

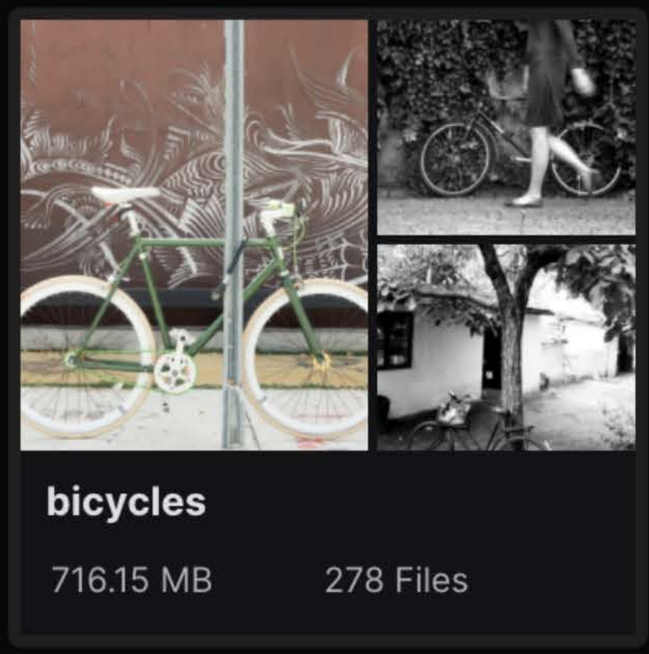
Choose an existing public dataset or upload your own (500 - 5000 images recommended)

Search for datasets...



Images for AI and art

155.23 MB 200 Files



bicycles

716.15 MB 278 Files

Training process.....

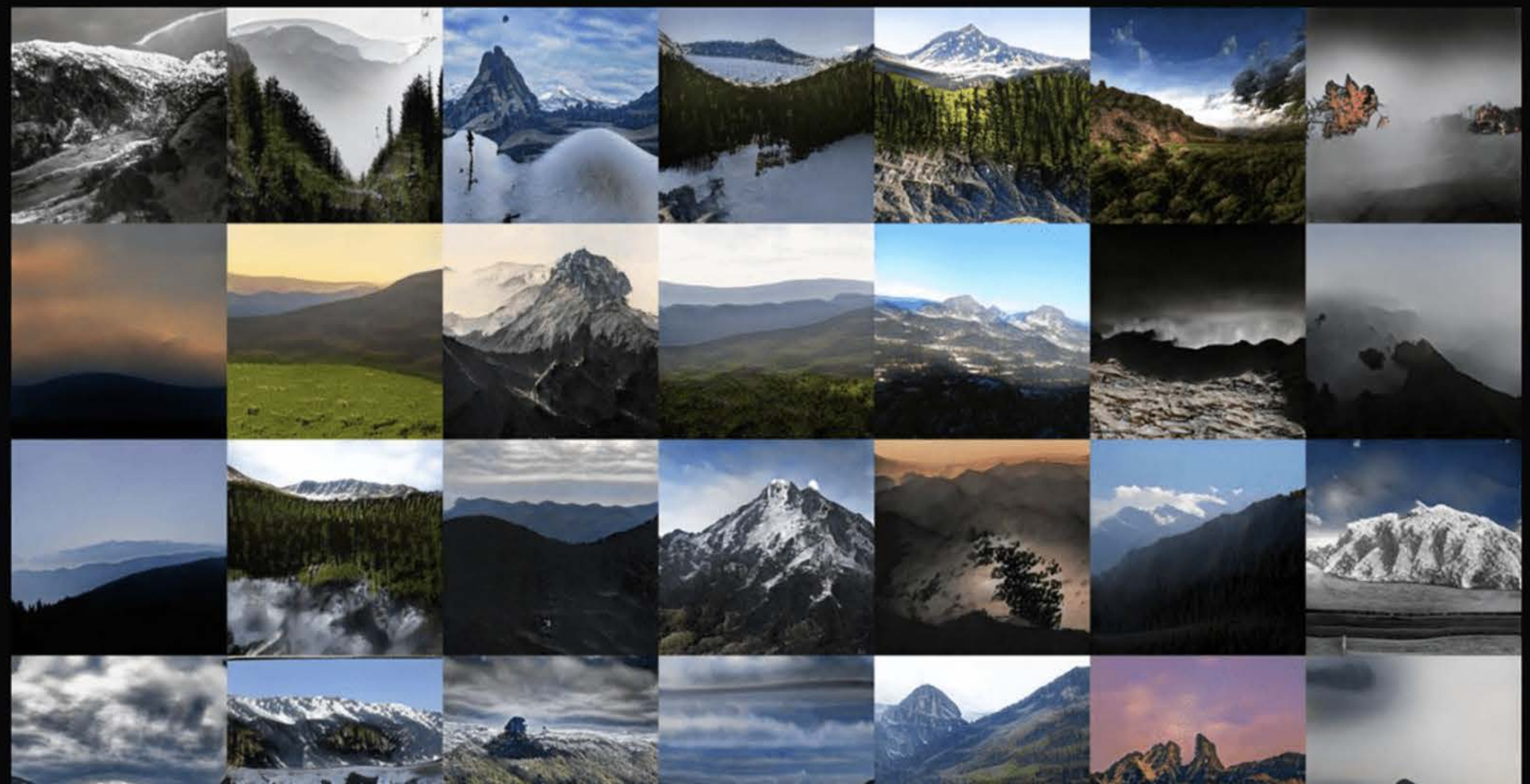
AI and art project ···

1 Dataset — 2 Setup — Training — Review

3

Training in progress!

See samples of your training progress.



TRAINING STATUS

Started 21 minutes ago

Status

Training

FID Score

257.39

Steps

13 / 3000

ETA Approx.

Calculating ETA

ML Lab

- Train 1
- Workspaces
- Models
- My Models
- Quick Actions
- Hosted
- Assets
- Help

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AI and art project ···

1 Dataset — 2 Setup — Training — Review

3

Training in progress!

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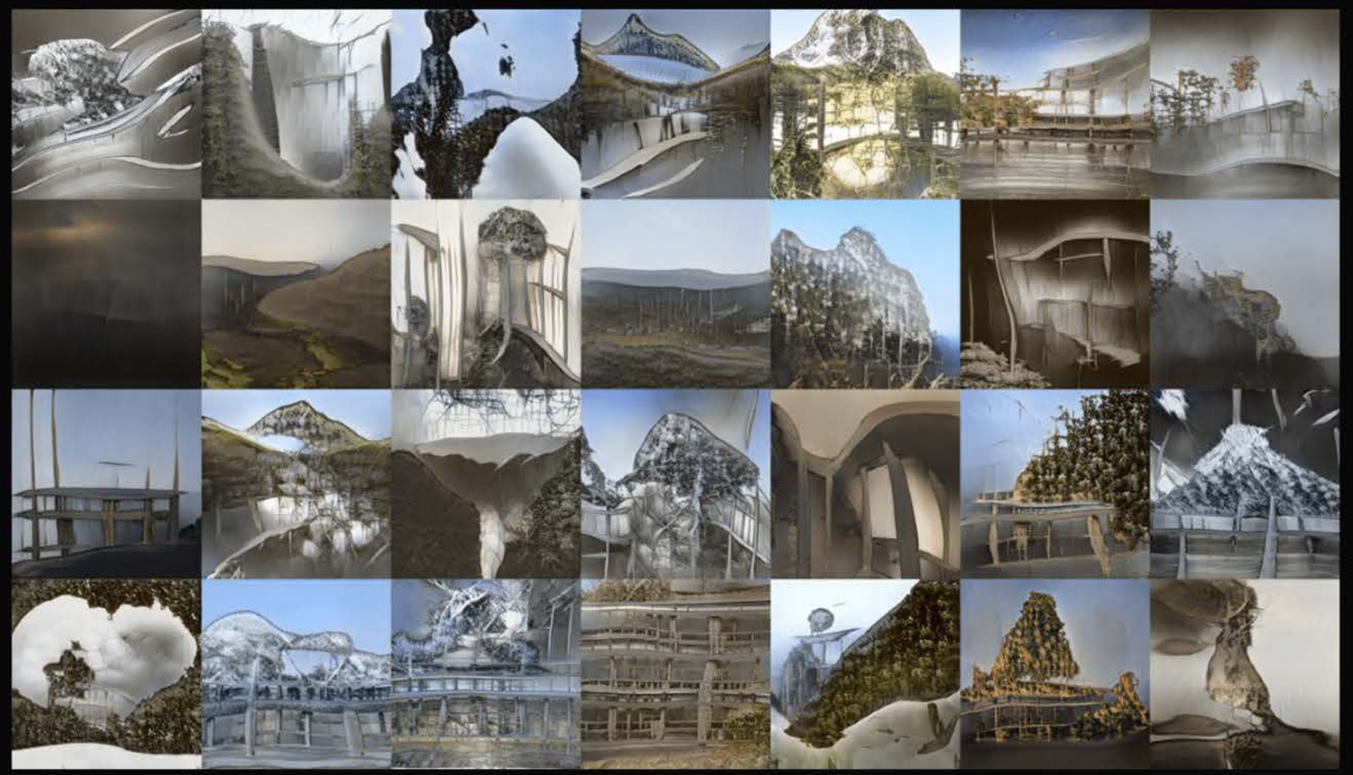

0 Step — 3000 Steps

1430

Save Sample Image | Create Progress Video

TRAINING STATUS

Started 2 hours ago

Status

Training

FID Score

197.17

Steps

1438 / 3000

ETA Approx.

2 hours remaining

Stop

Results & Reflection

Given the results, I achieved the base of my project, but in the future to create results that are very distinctive, I could perhaps add more images this would have resulted in the FID (fréchet inception distance, how close the generative images are to the original) increasing. Also to generate new aesthetics, a suggestion could be to add more images to the dataset from different architectural styles. Through the project, I've discovered a lot of ways AI can stretch the imagination to places, a humans can't. AI is providing the world with new ways and aspects to approach art mediums which is great. I hope to keep working on providing training for my model and perhaps work on different styles in AI architecture.