COMP 449 Final Project

Team Members:
- Chen Si
- Ding Zhang
- Dong Shu
- Yuchen Wang

Task Description

Objective:

- Develop an “Art generator”: given a list of paintings of famous artists (e.g. Davinci, Van Gogh), aim to generate pictures that mimics the styles of the artists.

Methodology:

- Perform web scraping on the given website and form the image dataset
- Data pre-processing
- Train GAN on the dataset and evaluate performance

Dataset Description

- The art catalog csv from WGA (Web Gallery of Art)

- Consists of 30000+ entries of web url containing the image itself, and its art form, type, school, and its timeframe

	AUTHOR	BORN-DIED	TITLE	DATE	TECHNIQUE	LOCATION	URL	FORM	TYPE	SCHOOL	TIMEFRAME	id
0	AACHEN, Hans von	(b. 1552, Köln, d. 1615, Praha)	Venus and Adonis	1574-88	Oil on canvas, 68 x 95 cm	Fogg Art Museum, Harvard University, Cambridge	https://www.wga.hu/html/a/aachen/adonis.html	painting	mythological	German	1601-1650	5ea8c230-e28a-482b-a916-d563681b1b94
1	AACHEN, Hans von	(b. 1552, Köln, d. 1615, Praha)	Allegory	1598	Oil on copper, 56 x 47 cm	Alte Pinakothek, Munich	https://www.wga.hu/html/a/aachen/allegory.html	painting	mythological	German	1601-1650	433cdbe6-f3ac-454f-90b6-216f46dd643a
2	AACHEN, Hans von	(b. 1552, Köln, d. 1615, Praha)	Allegory of Peace, Art and Abundance	1602	Oil on canvas, 197 x 142 cm	The Hermitage, St. Petersburg	https://www.wga.hu/html/a/aachen/allegorz.html	painting	mythological	German	1601-1650	7687ba68-8eb6-4dbe-ae1c-88bdb4b6b2ca
3	AACHEN, Hans von	(b. 1552, Köln, d. 1615, Praha)	Jupiter, Antiope and Cupid	1595-98	Oil on copper, 31 x 21 cm	Kunsthistorisches Museum, Vienna	https://www.wga.hu/html/a/aachen/antiope.html	painting	mythological	German	1601-1650	7f243ff6-868f-4f56-bfce-66f9c9e69f4b
4	AACHEN, Hans von	(b. 1552, Köln, d. 1615, Praha)	Pallas Athena, Venus and Juno	1593	Oil on canvas, 54 x 67 cm	Museum of Fine Arts, Boston	https://www.wga.hu/html/a/aachen/athena.html	painting	mythological	German	1601-1650	1c3e34cd-f940-42b8-9b80-4fca4c28ceb1

Web Scraping

- Retrieve image viewing urls from WGA Catalog file
- Filtered out images that were not paintings (like architecture, ceramics, glassware, …)
- Uses BeautifulSoup for finding correct web components and save images in local folder

Example

- Example Entry:
  - https://www.wga.hu/html/v/vermeer/03a/19woman.html, painting, portrait, Dutch, 1651-1700

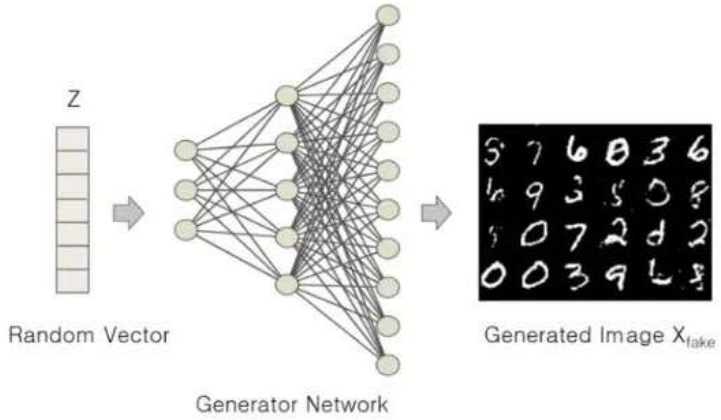
Pre-processing Phase

- Resize, center, and crop all images to ensure consistency of sizes
- Convert the images into tensors and normalize them
- Create the Data Loader and form batches of image

Model Specification

Generator

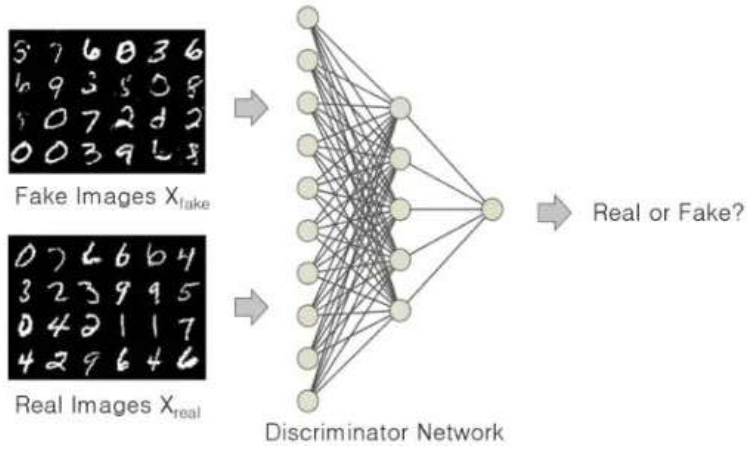
- Generate or produce new and synthetic samples of a certain input, which could be a random set of values or noise.
- Does its best to produce a new fake image with the hope that the discriminator would consider the image to be authentic.



Model Specification

Discriminator

- Process the images from the generator and classify them as either real or fake.
- Works as a binary classifier by taking two inputs: the first being a real image (from training data), and the other being the image the generator produced.



Model Specification

Full Training Loop shown on the right

Image_size: 64

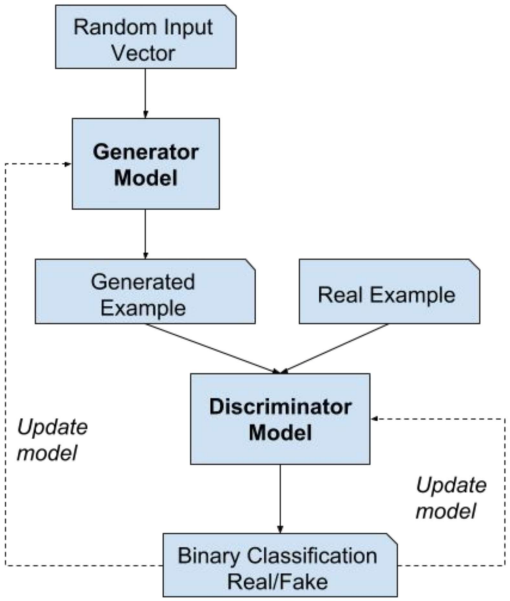
Batch_size: 64

Num_epochs: 300

Learning rate (lr): 0.0002

Optimizer: torch.optim.Adam

Loss_function: binary_cross_entropy



Model Specification

Generator Layers:

128 (latent_size) x 1 x 1

512 x 4 x 4

256 x 8 x 8

128 x 16 x 16

64 x 32 x 32

3 x 64 x 64

Discriminator Layers:

3 x 64 x 64

64 x 32 x 32

128 x 16 x 16

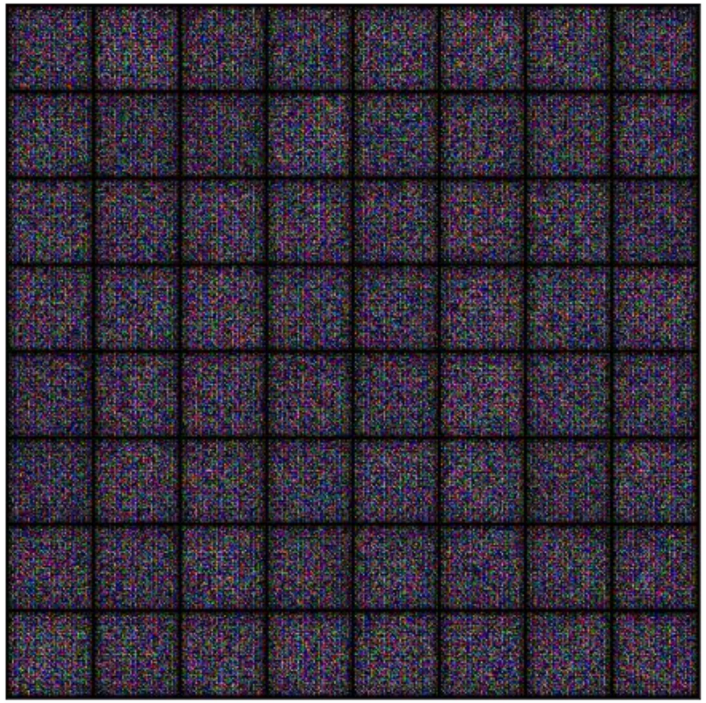
256 x 8 x 8

512 x 4 x 4

1 x 1 x 1

Baseline

- The baseline we are comparing is when the epoch is equal to 0.
- As we can see on the right, the model is generating random noise, with real scores equal to 0.



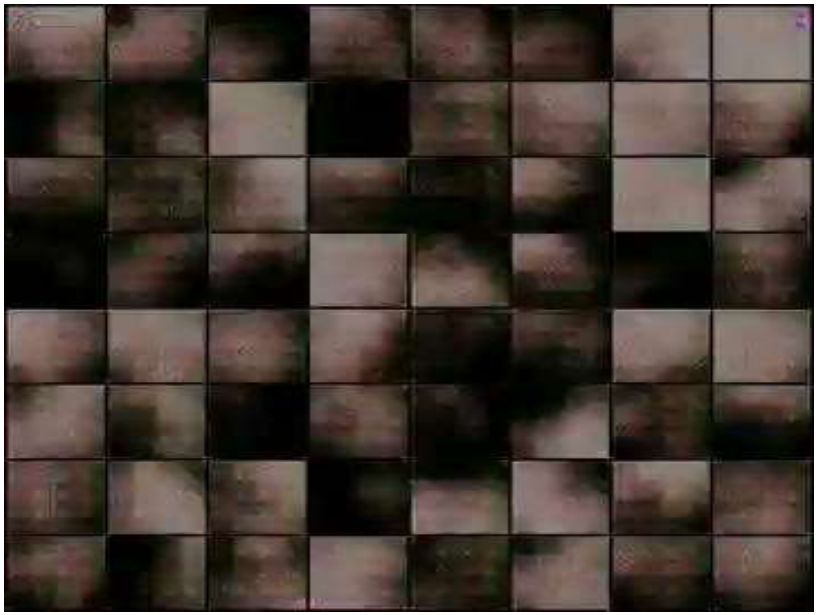
Results

Epoch 40:

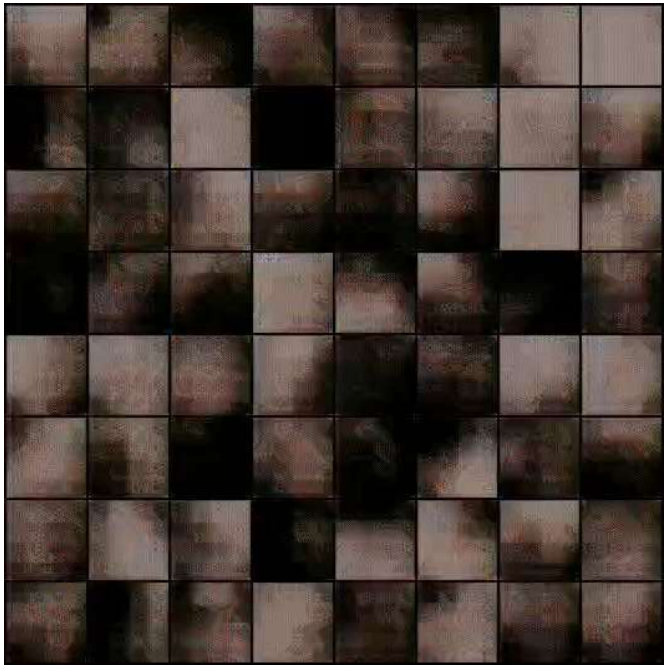
Epoch 150:

Epoch 270:

Result Timelapse



Result Timelapse

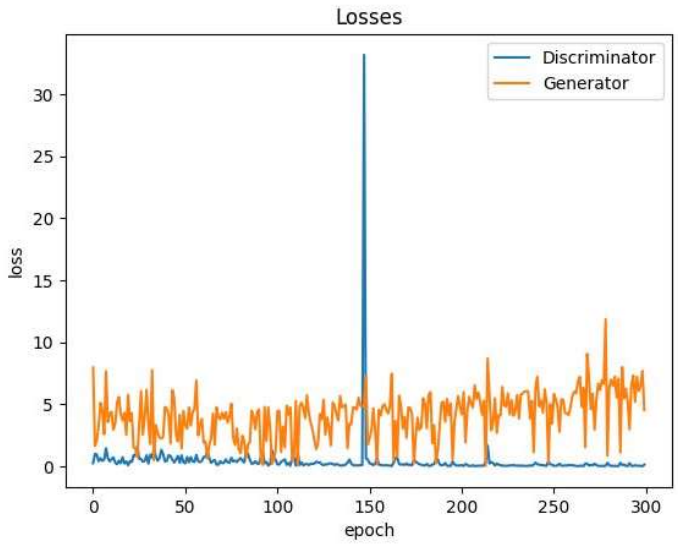


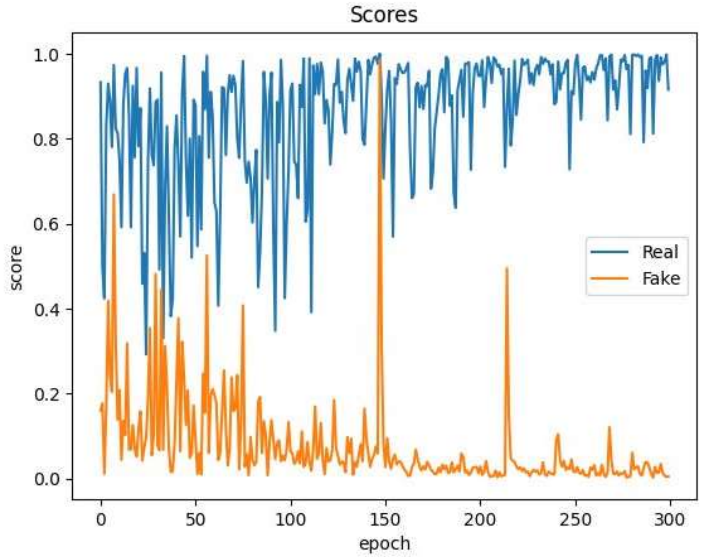
Result: epoch 300

Some generated paintings are the same: discarded

Analysis of Results

- graph of Losses / scores





Limitations and Key Assumptions

- Due to the limit of computational resources, we weren't able to use the entire image dataset with all artists
    - keep only artists who have the number of art works greater or equal to 250.
- The dataset contains paintings in a realistic style, whereas our generator is currently limited to producing paintings in a more abstract style.
- In order for our model to generate a painting that specific to a particular author, it requires more epochs (much greater than 300 epochs).

THANK YOU!

References:

- https://algoscale.com/blog/how-to-use-gan-to-generate-images/
- https://github.com/soham2707/ARTGAN/blob/master/ARTGAN.ipynb