

# Implementation Report

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For this project, we wanted to implement a system where humans and our system could collaborate to create different types of artwork. As humans, we sometimes spend a lot of time to colour our black and white sketches. It might be interesting if the number of tasks is small, but when it comes to hundreds of sketches a day, maybe we need some help. What if we could build a system that could colour these black and white sketches for us? In order to achieve this idea, we implemented a system that would take these black and white images and give us images coloured in a similar way to oil paintings.

## Architecture

We have created our system using Generative Adversarial Network, or GAN, that consists of a generator for outputting new possible images and a discriminator that classifies images as real (from the dataset) or fake (generated). Our generator and discriminator are trained simultaneously in an adversarial process where the generator seeks to fool the discriminator and the discriminator seeks to better identify the counterfeit images. The discriminator is provided both with a source image and the target image and must determine whether the target is a reasonable transformation of the source image. Our generator combines an encoder and a decoder where our encoder breaks down our input image into smaller pieces and our decoder combines and scales up these smaller pieces to generate a final new oil painting image. Our generator is also updated via binary cross-entropy loss measured between the generated image and the expected output image. This additional loss encourages the generator model to create reasonable translations of the source image. The discriminator model is updated directly, whereas the generator model is updated via the discriminator. Our network takes an input a black and white sketch and outputs a coloured oil painting image. We also save our final generator and discriminator models into 2 separate h5 files.

# Experimentation

## City Landscapes

At first, we trained our model with training data sets of city landscapes and buildings. This data set had only around 400 images in the training set which gave us good results on similar test images of buildings and city landscapes. However, when we tried to test it to create oil paintings from human sketches, it gave us bad results for our test set. We used 100 epochs to train our model but it was not able to detect borders for the test human sketches since it was not trained with sketch images. When our input test sketch was building sketches or sketches of city landscapes, it was able to oil paint the images in a much better way.

## Structured Objects and Characters

Similarly, we again tried to train our model with a different dataset with sketch images of shoes and handbags, we got better results than our last experimental setup for our GAN model with 100 epochs. It was able to detect borders better. Finally, we trained our model with a dataset of human sketches with borders that contained 3546 human sketch images. Using 100 epochs, we were able to generate the desired output for our test set using this dataset as our training data. Due to this reason, it took us a really long time to train our system on such a large dataset and subsequently test it.

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