Coloring Black & White Images Using Generative Adversarial Networks (GAN)

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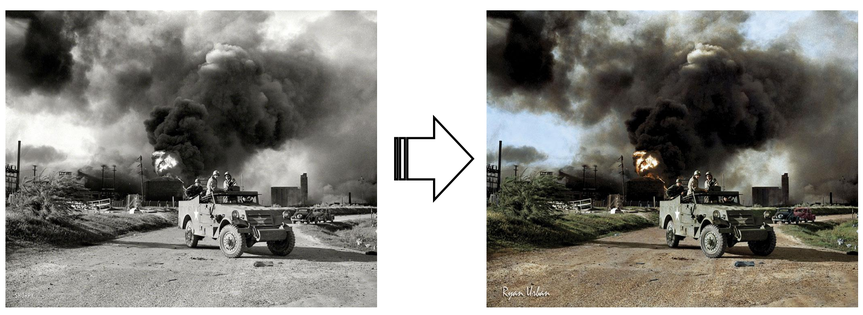
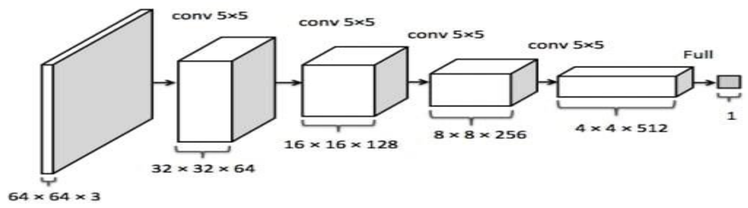
Motivation

Image colorization is a field that has been explored since the invention of media capture devices. From the mid-1800s till this day, image coloring was and still is done either the traditional way of hand coloring or via computer applications; in both cases the process is done by expert artists. These old methods are both expensive and time-consuming. In addition, artists can manipulate images in ways that could alter their historical significance. The aim of this project is to develop a fully automated system that is fast, scalable, and requires no human intervention to color grayscale images.

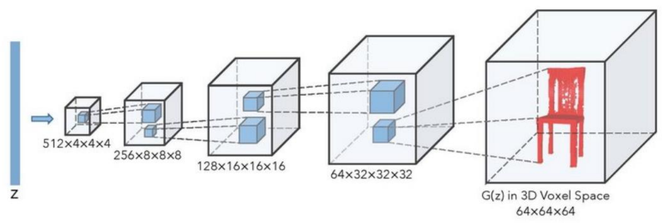


Background

- GANs are made up of two parts: Generator and Discriminator both parts compete against each other making them better at their tasks.
- Discriminators are used to classify whether images are real or fake



- Generators creates fake images from noisy input (latent vectors z)



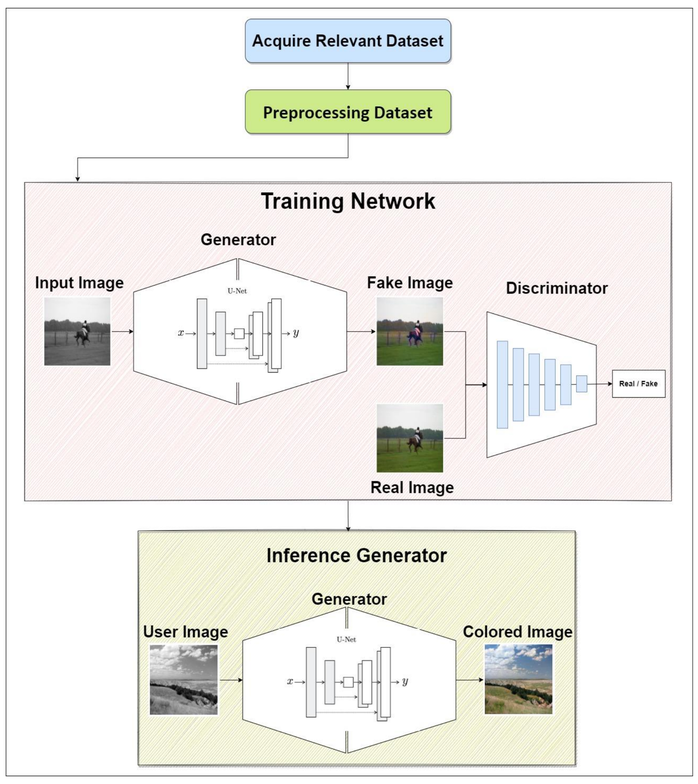
Methodology

Our system uses techniques based on the state-of-the-art general solution for image-to-image tasks proposed by Berkeley AI Research [1]. The system consists of four steps:

1. Acquiring relevant dataset (8000 images minimum)
2. Data preprocessing and format conversion
3. Training the model
4. Detaching the generator network for inference

Preprocessing Methods

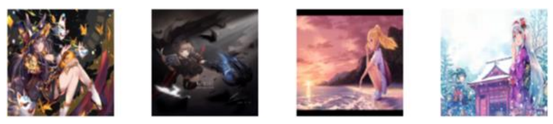
1. RGB to L*a*b conversion
2. Image resizing
3. Image rescaling
4. Image augmentation
5. Image batching



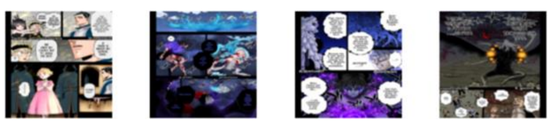
Datasets

- Places365

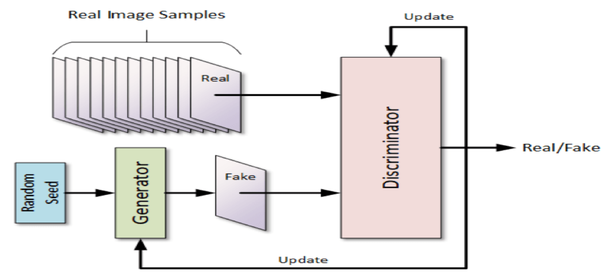
- Annotated Anime



- Black Clover Manga



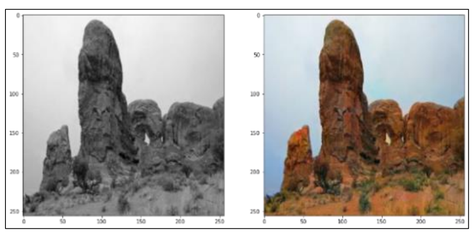
Model



Results

After training the model on the three datasets for 100 epochs each:

Places365



Annotated Anime

Black Clover Manga

To determine the accuracy of the model two participants were asked to distinguish between real and fake colored images by our model. They were both presented 9 fake and 1 real image:

- Person 1: had an accuracy of **50%** equivalent to randomly guessing
- Person 2: had an accuracy of **40%** worse than randomly guessing

Conclusion

Concluding from the results we obtained, our system looked very reliable even on the small scale we trained on. And detaching the generator network provided us with a small and fast network that could potentially be used in real-time applications like real time coloring of camera feed from space or in mines and caves.

Scaling Potential

1. Increasing training data
2. Using pretrained network as the feature extractor parts of the model

References

[1] J.-Y. Z. T. Z. A. A. E. Phillip Isola, "Image-to-Image Translation with Conditional Adversarial Networks," 2022.

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