



Objective

- To utilize GAN (Generative Adversarial Networks) as a form of denoising images
- We will study the process of denoising and how well it works on different severity of noise within an image
- PyTorch is a machine learning framework that is used within python for various machine learning and Artificial Intelligent algorithms
- Output images will be compared with the base image to then study how well the comparison is

Problem

- Create an array of images that are all from a singular base image, each one having different intensity of noise.
- Create a machine language script that has the ability to process images and utilize a Generative Adversarial Network to accomplish the denoising processes

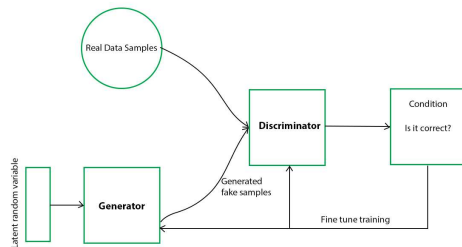


Figure 1: Generative Adversarial Network Model

Methodology

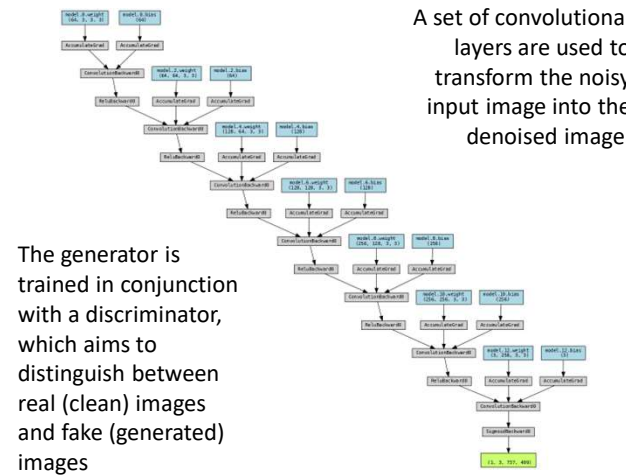


Figure 2: Generator Model

Results

While using a combination of different approaches to researching the ability of GAN or denoising images, We utilized the IUP archway photo as my base image. Noise was added to the image at three different attenuations, 10, 25, and 50 utilizing Laplacian noise. Then the images were passed through the GAN at 3 different times for each attenuation, each one at a different EPOCH amount (number of trials), and then studied for patters.



Figure 3: Denoised image 100 epochs and 50 attenuation noise

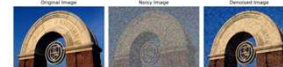


Figure 4: Denoised image 10000 epochs and 50 attenuation noise

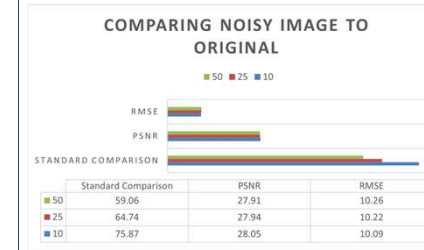


Figure 5: Comparing Noise to Original

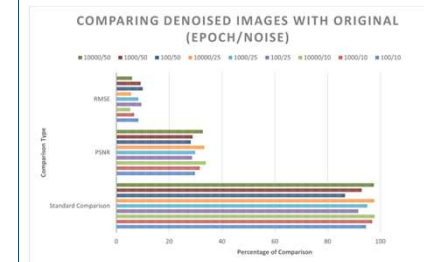


Figure 6: Comparing
Denoised to Original

We subjected the base image to many different noise levels with various trial run sizes and the final comparisons are very similar to the original image.



Denoising Charts

Conclusion

The tests demonstrate that utilizing Generative Adversarial Networks was a success, and that images can be denoised from mostly any state back to a high percentage of the original image.

References

- nVidia: <https://nvlabs.github.io/denoising-diffusion-gan/>
- Image Denoising: <https://www.mdpi.com/2079-9292/11/15/2445>