

Questions Answered

Q: TanH Activation and Scaling: Update the example to use the tanh activation function in the generator and scale all pixel values to the range [-1, 1].

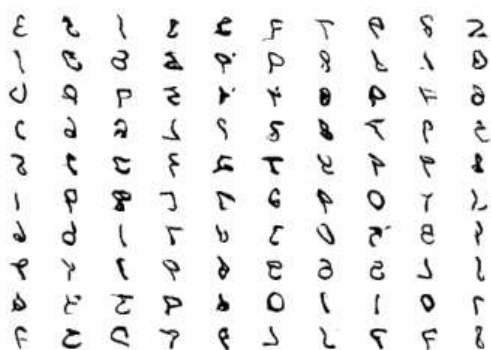
- 1) Changing the activation function inside of the `define_generator()` function from sigmoid from tanh shows that after 100 epochs, we see that the discriminator could evaluate 55% ‘real’ numbers, objectively, of the selected real samples. We also saw that the discriminator had a 65% accuracy in detecting fake images. This is a sign that the discriminator was trained decently but not very well, in terms of ability to detect which ‘fake’ images. Since ability to detect is objective in terms of the model, and the computer, for clarity assume ‘fake’ as in images that were generated plausible numbers. With that, we also see a weakness in the generator then, as it only was able to generate 11% of its data that was plausible to the discriminator, which has a great differentiation ability, of 93%,.

Q: Change Latent Space: Update the example to use a larger or smaller latent space and compare the quality of the results and speed of training

- 2) Two different trials were changed in this question. At first, I increased the latent space from 100, to 10,000 – this was done to observe the effects on accuracy and time it took to run. Rightly so, the time it took for this variation to run was roughly 120 minutes. Interestingly, there was a massive, and notable improvement with the

generator model's ability to create plausible images, since the discriminators model's posted an accuracy of detecting fake images to 27%. This could be because there are more options for the model to choose from in terms of points to develop, resulting in perhaps a 'creativity' of the GANs. The discriminator also detected real images at an accuracy of 91%, this is an interesting data piece to look at in conjunction with its low fake-detection accuracy. I infer that this means the discriminator, saw most of the generated images as real and can be reinforced since both samples after 100 epochs (pictured below) look relatively convincing.

Before, at 100



After, at 10000



Q: **Label Smoothing:** Update the example to use one-sided label smoothing when training the discriminator, specifically change the target label of real examples from 1.0 to 0.9, and review the effects on image quality and speed of training.

- 3) Very quickly, by 30 epochs, the discriminator detects the fake number pictures very well and also the real images at a 70%.

Q: A common issue in GANs is the following: if a generator produces an especially plausible output, the generator may learn to produce only that output. In fact, the generator is always trying to find the one output that seems most plausible to the discriminator. How can we make the generator broaden its scope?

- 4) As seen in the previous questions—a good way to approach this is to increase the latent space so that the generator has more variety of starting points to choose from. This can be taxing in terms of computer performance but ultimately the generator will perform very well as developing plausible images against the discriminator.

Q: GANs frequently fail to converge. What are some methods that can improve GAN convergence?

- 5) The problem with GANs and convergence is that they are constantly being trained together, causing the models to collapse or fail to converge—meaning as the generator improves with training, the discriminator worsens because it cannot tell the difference between real and fake. Therefore, it is imperative that both models have a variety of data samples and massive amounts of them but also data that is random/fake. This is ‘noise’ is so that it can keep the GANs from collapsing and keeps the generator and the discriminator in a tête à tête. Secondly, penalizing weights in the discriminator model can also help with convergence, if the discriminator misclassifies a real image as a fake image and vice versa—then the underlying distribution becomes more refined with each train—keeping the discriminator sharp and making the generator work harder.