Torch GAN Basics

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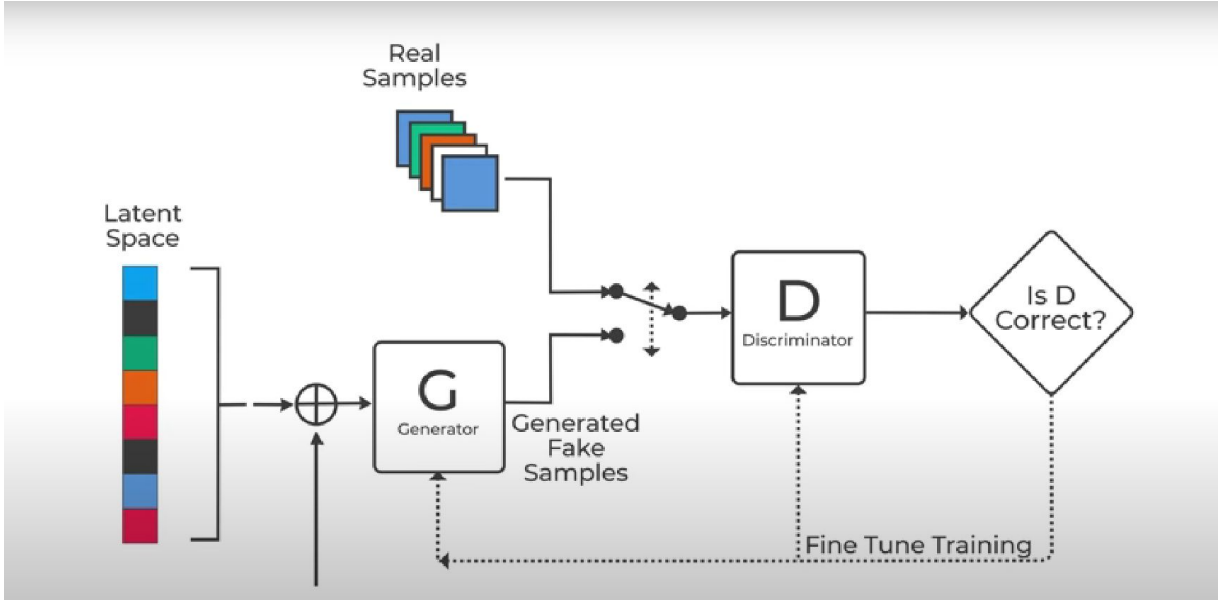
Session Structure

1. **What is Torch GAN for**
    a. **PyTorch vs Tensorflow**
    b. **PyTorch vs Torch GAN?**
    c. **What is a Generative Adversarial Network**
2. **How to setup environment for Torch GAN**
3. **Demo**

GAN

Components

1. **Generator Network**
2. **Discriminator Network**

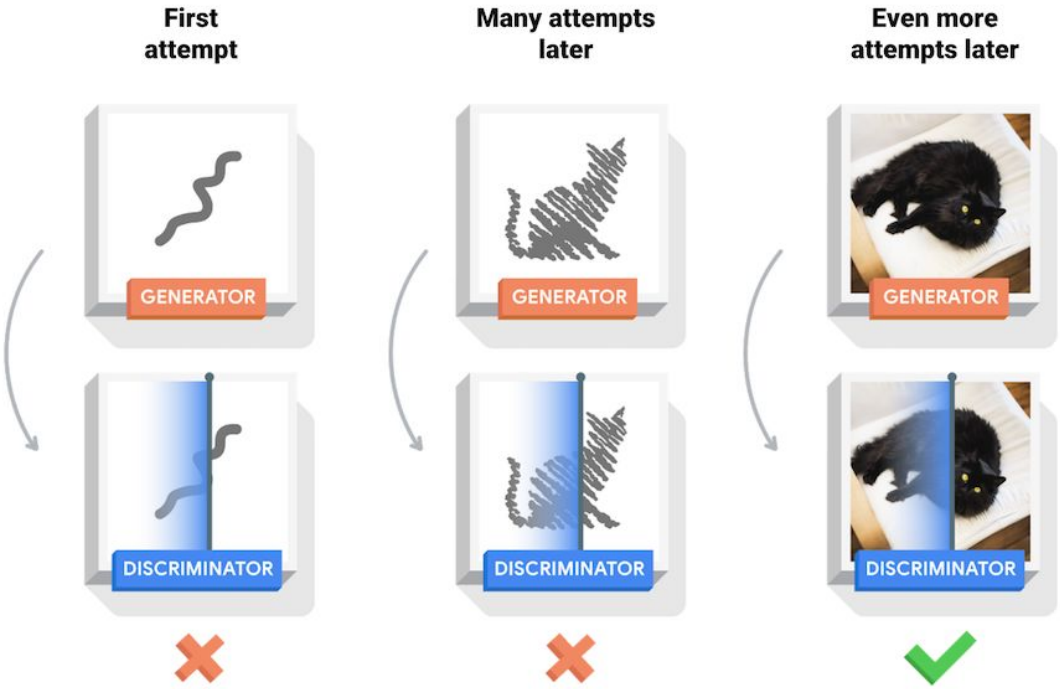


MNIST Dataset

DCGAN

Components

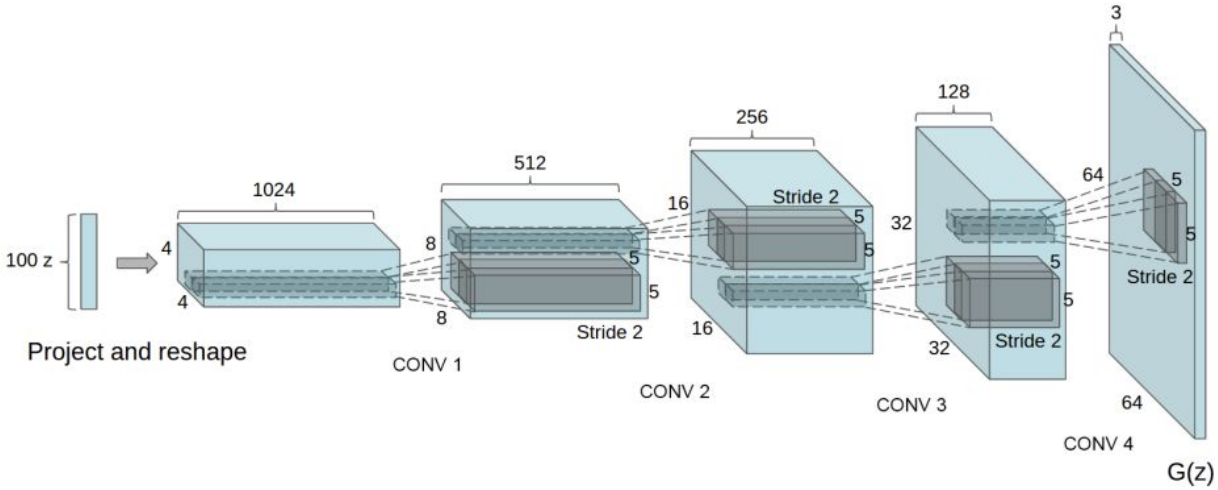
1. **Variant of GAN primarily used for image data**
2. **Uses convolution layers**



DCGAN

Architecture

1. **Variant of GAN primarily used for image data**
2. **Uses convolution layers**



DCGAN

Generator Network

$batch\ size \times encoding\ dims.$

1. **Channel Dimension**: $encoding\ dims \to d \to \frac{d}{2} \to \frac{d}{4} \to 1.$
2. **Image size**: $(1 \times 1) \to (4 \times 4) \to (8 \times 8) \to (16 \times 16) \to (32 \times 32).$

$batch\ size \times 1 \times 32 \times 32$

Discriminator Network

$batch\ size \times 1 \times 32 \times 32$

1. **Channel Dimension**: $1 \to d \to 2 \times d \to 4 \times d \to 1.$
2. **Image size**: $(32 \times 32) \to (16 \times 16) \to (8 \times 8) \to (4 \times 4) \to (1 \times 1).$

Minimax Loss

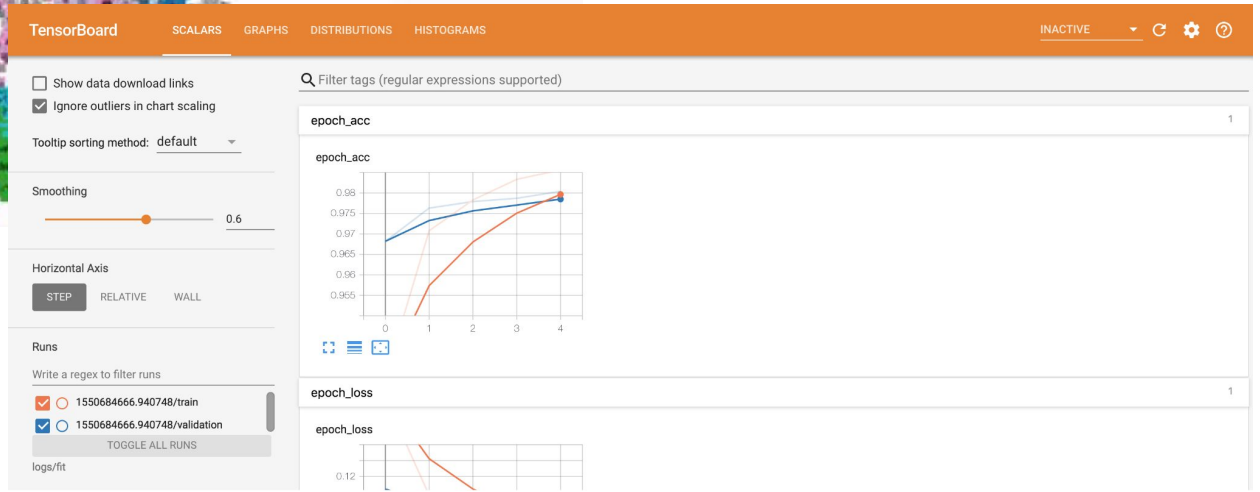
In the paper that introduced GANs, the generator tries to minimize the following function while the discriminator tries to maximize it:

$$E_x[log(D(x))] + E_z[log(1 - D(G(z)))]$$

In this function:

- `D(x)` is the discriminator's estimate of the probability that real data instance x is real.
- E_x is the expected value over all real data instances.
- `G(z)` is the generator's output when given noise z.
- `D(G(z))` is the discriminator's estimate of the probability that a fake instance is real.
- E_z is the expected value over all random inputs to the generator (in effect, the expected value over all generated fake instances G(z)).
- The formula derives from the cross-entropy between the real and generated distributions.

Tensorboard



Useful Links

Torch GAN Docs

https://github.com/torchgan/torchgan

DCGAN Tutorial (Tf)

https://www.tensorflow.org/tutorials/generative/dcgan

Torch GAN Docs

https://github.com/torchgan/torchgan

Reproducibility

https://pytorch.org/docs/stable/notes/randomness.html