HW 9 GAN

Colab link: https://colab.research.google.com/drive/1BBVA-pA9AoGY5TWCtvdJE5OQDjilchjp?usp=sharing

Baseline variation with epochs:

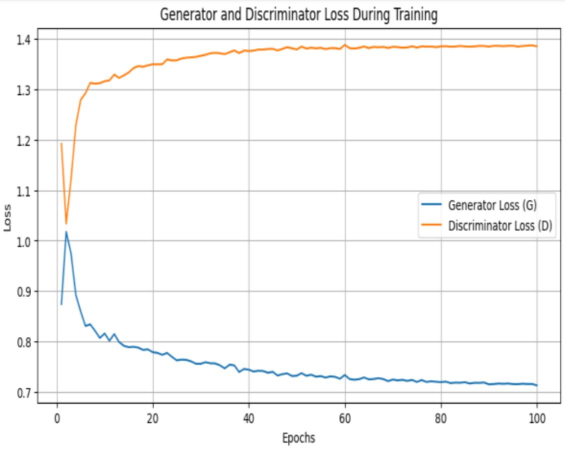
Generated Images at Epoch 20

Generated Images at Epoch 40

Generated Images at Epoch 60

Generated Images at Epoch 80

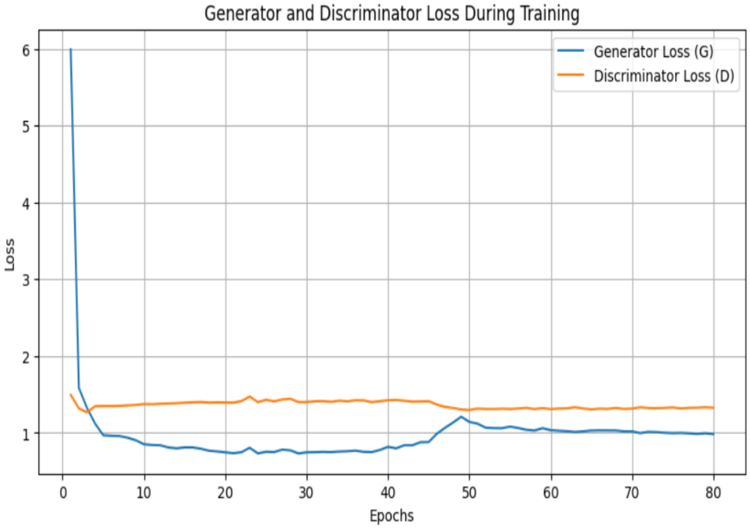
Generated Images at Epoch 100



Latent Space = 50:

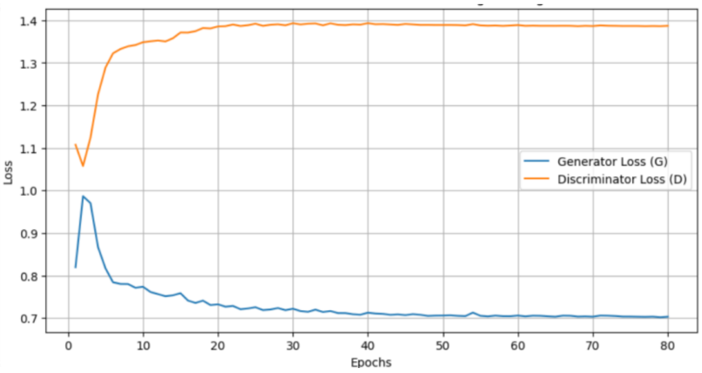
Latent Space = 25: Similar training curve but initial loss of D higher and G lower

LR = 2e-2:

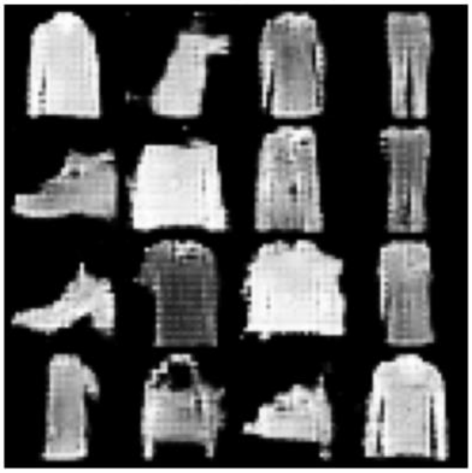


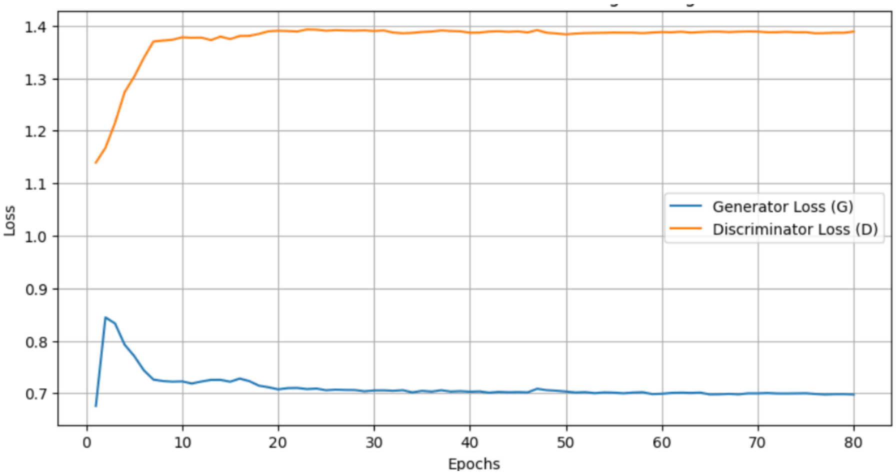
LR = 2e-1: Generator produces noise (black output) and discriminator performs perfectly with 0 loss-

Feature map size = 16:



Feature map size = 8:





Discussion:

1) High epochs do not give much improvement, most of useful training is in initial 20 epochs
2) Lowering feature maps slightly reduces quality of generated images but training time is reduced significantly. Also mode collapse starts occuring as can be seen in Feature map size = 8.
3) LR > 2e-4 results in inability of generator to be trained as well as mode collapse
4) Reducing latent space size significantly fastens training and doesn't hamper the quality much.

Modification using mobile net ideas:

In the discriminator replace conv2d (standard convolution) with depthwise + pointwise convolution. This allows us to increase size of feature map to 48 without increasing number of parameters (10k) . For Generator, since we want to upsample so reverse the order:

- **Pointwise Upsampling**: Use a `1x1 Conv2d` to increase the number of channels. This is the "combination" step.
- **Depthwise Upsampling**: Use a `ConvTranspose2d` with `groups=in_channels` to perform the spatial upsampling independently for each channel.

Making the generator deeper did not improve the results since model was difficult to train. The main parameter bulk in generator lies in linear block from latent variable to first hidden layer which can only be reduced by reducing latent space dimensions. Doing the above changes in generator reduces parameters from 364k to 326k. The following image is generated with reduced parameter model: