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GAN and LSGAN MNIST

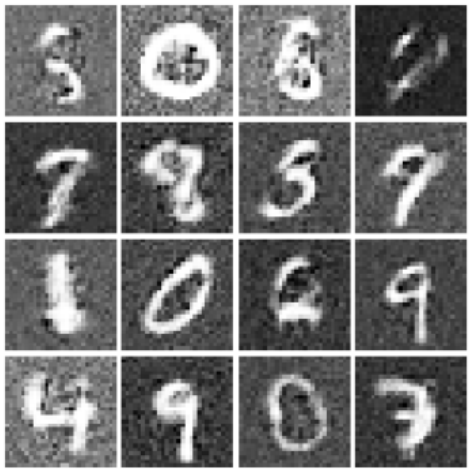
Show final results from training both your GAN and LSGAN (4x4 grid of images for both):
GAN -

```
EPOCH:  12
Iter: 5250, D: 0.73, G:2.342
```

```
EPOCH:  30
Iter: 13750, D: 0.5034, G:3.894
```

LSGAN -

```
Iter: 14000, D: 0.2977, G:0.7566
```



```
EPOCH:  30
Iter: 13750, D: 0.2399, G:0.7865
```

GAN and LSGAN Cats

Show final results from training both your GAN and LSGAN (4x4 grid of images for both):
DCGAN -

```
EPOCH:  50
Iter: 24250, D: 0.001153, G:9.901
```

LSGAN -

```
EPOCH:  50
Iter: 24250, D: 0.03836, G:0.908
```

Discuss any differences you observed in quality of output or behavior during training of the two GAN models.

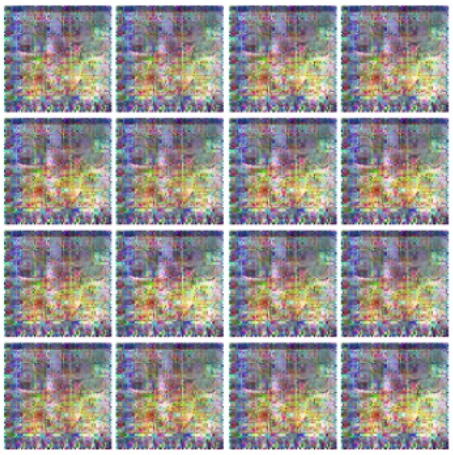
1. The DCGAN gets into mode collapse very easily while the LSGAN does not. This is consistent with what we learned in the class.
2. The LSGAN performs way more consistently as compared to DCGAN. DCGAN collapsed completely in the middle of the training two times, while LSGAN didn't.
3. The overall results of LSGAN were far more precise and diverse as compared to DCGAN.
4. Both the models had similar performance in early epochs, until about 15 epoch.

Do you notice any instances of mode collapse in your GAN training? Show some instances of mode collapse from your training output.

1. DCGAN -

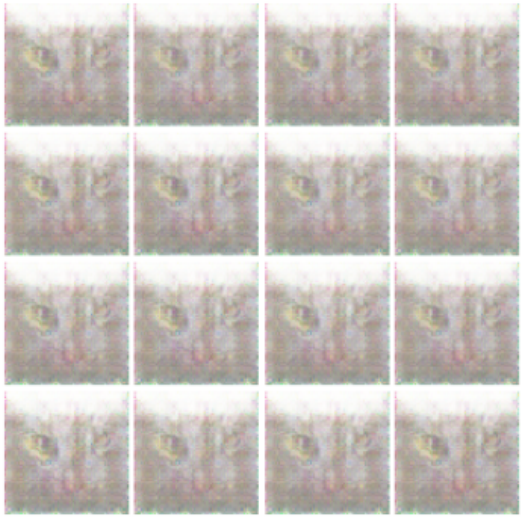
2. An image one, the discriminator achieved very low error but the generator loss is very high.
3. In Image 2 , plot 4,7, 14, 8 look very much similar.
4. In Image 3, the model completely collapsed to make only one kind of cat.
5. In Image 4, plot 5,9,2 looks the same, plot 7,12,16,15 looks the same.

EPOCH: 17
Iter: 8000, D: 1.976e-05, G:15.48



Iter: 3750, D: 0.2513, G:2.74

Iter: 8250, D: 0.0001648, G:39.14



Iter: 9250, D: 0.1047, G:8.315

LSGAN -

1. In Image 1, the cat at 5,7,9 looks very much similar , but it doesn't have to be an error since the random noise selected at beginning could actually be same for both of these.

```
EPOCH:  39
Iter: 18750, D: 0.04385, G:1.244
```

Mode collapse was mainly observed in DCGAN and not in LSGAN. This is consistent from what we learnt in the model.

Extra Credit - Alternative GAN Formulation

Explain what you did (describing all model changes and hyperparameter settings) and provide output images.