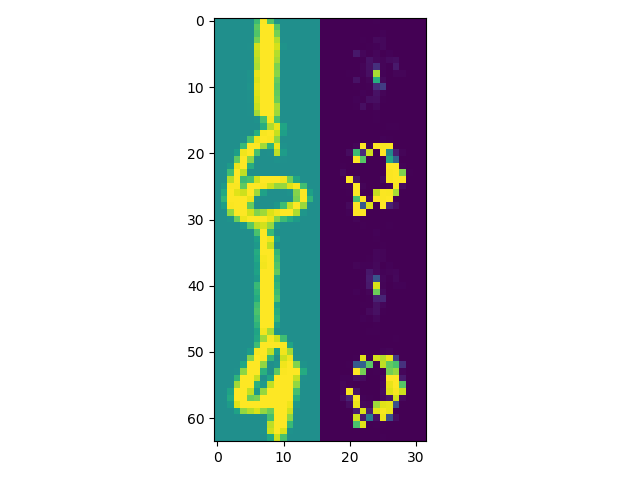
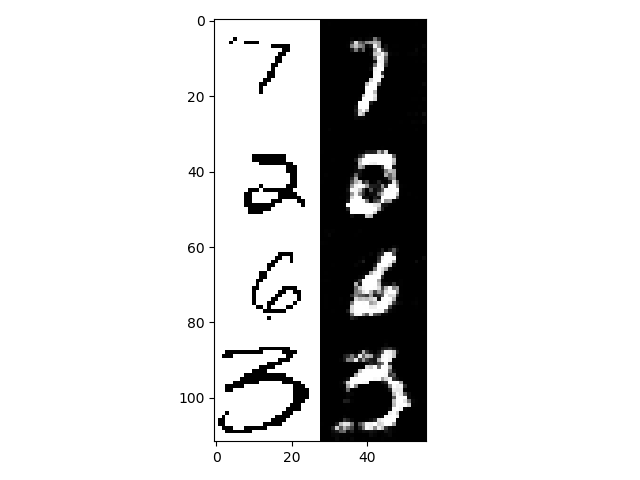
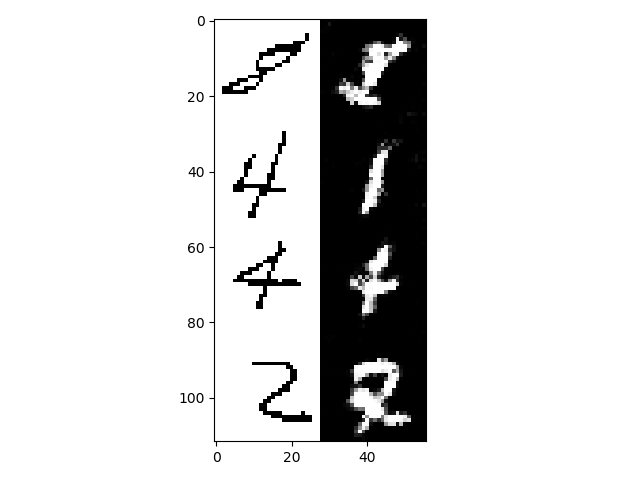
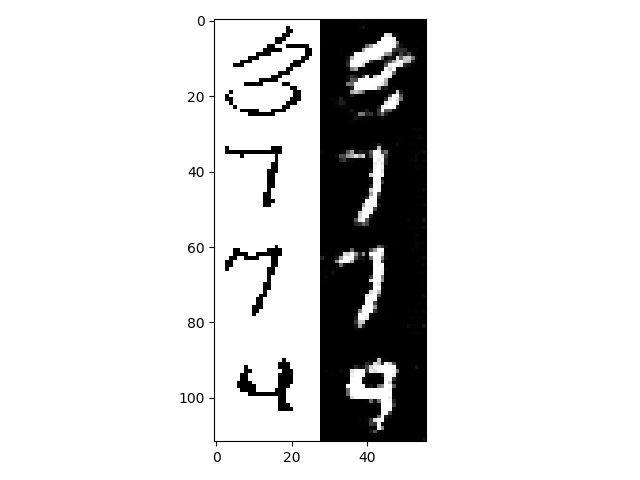
[1] 08/01: Vanilla GAN 16x16, g\_conv\_dim=64, d\_conv\_dim=64. Mode collapse to 2 outputs.



[2] 08/01: Vanilla GAN 28x28, g\_conv\_dim=64, d\_conv\_dim=64, niter=50, niter\_decay=400, batch\_size=64.

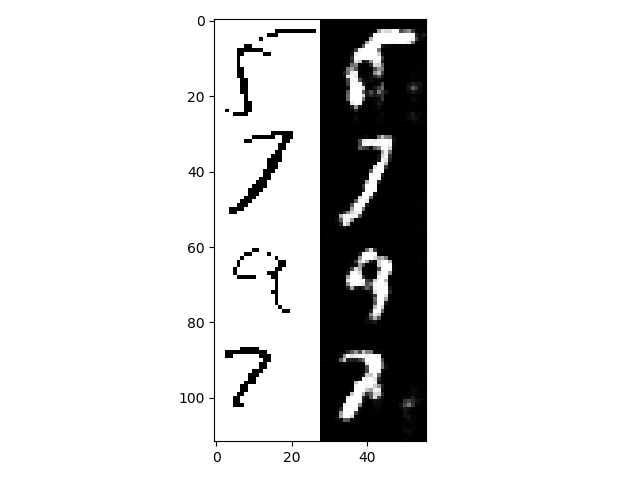
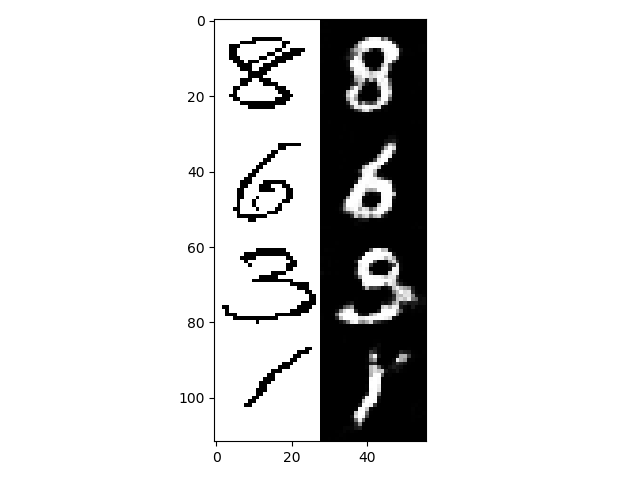
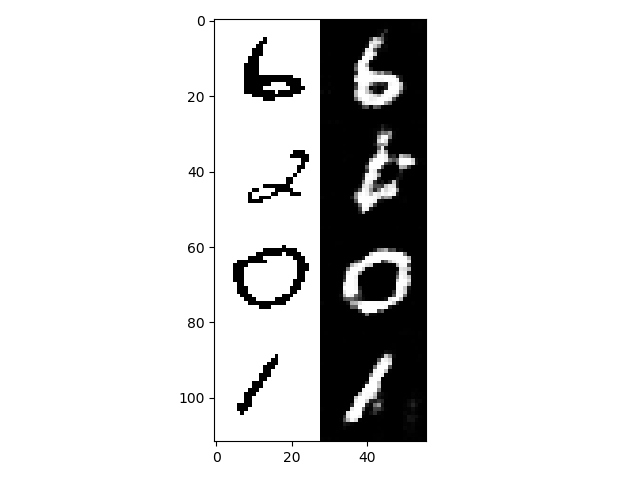
Observation: loss\_D is already close to 0.5 from the first few iterations onwards. The more iterations, the less noisy the output but eventually ends up favouring certain digits (e.g. 8 -> 3, 7 -> 1)



Maybe try tweaking g\_conv\_dim and d\_conv\_dim to find levels of sophistication of D and G that encourage fairer competition. Seeing that loss\_D ~ 0.5 early on (it already cannot tell the difference between real and fake), try making it more sophisticated by setting d\_conv\_dim > g\_conv\_dim

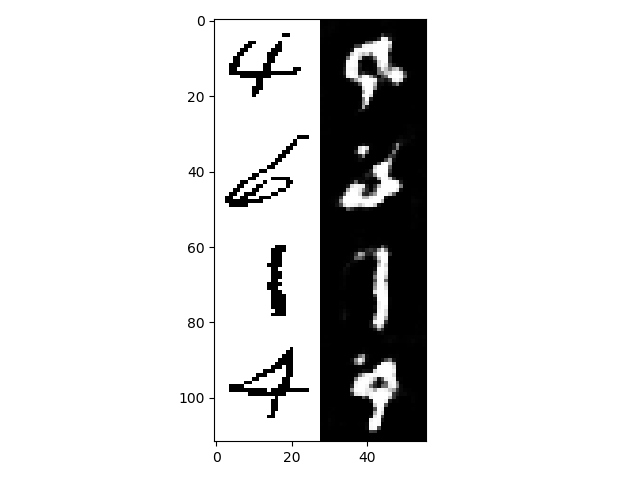
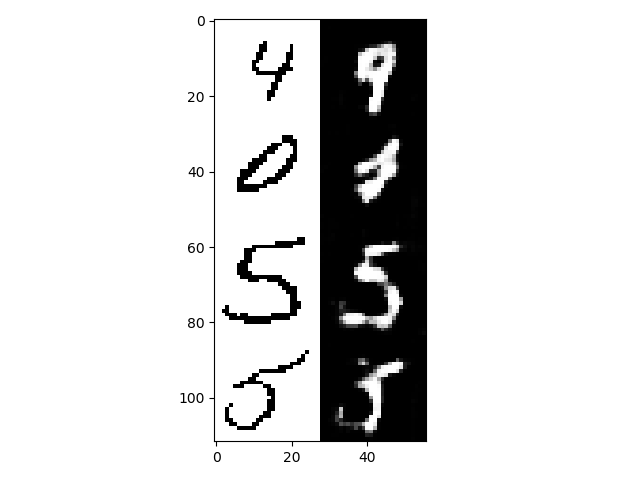
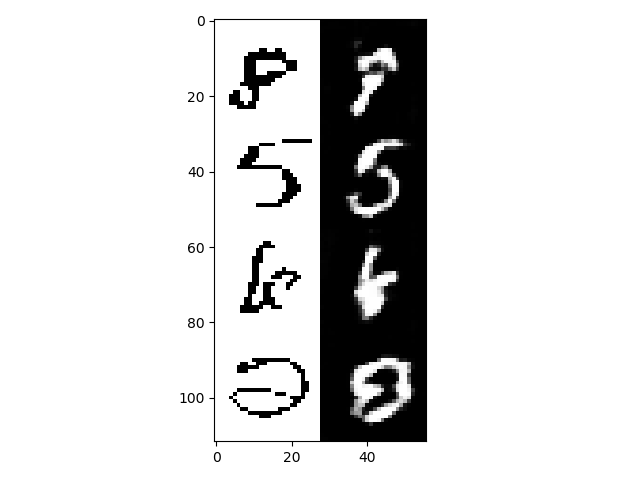
[3] 09/01: Vanilla GAN 28x28, g\_conv\_dim=32, d\_conv\_dim=64, niter=50, niter\_decay=400, batch\_size=64.

Much better



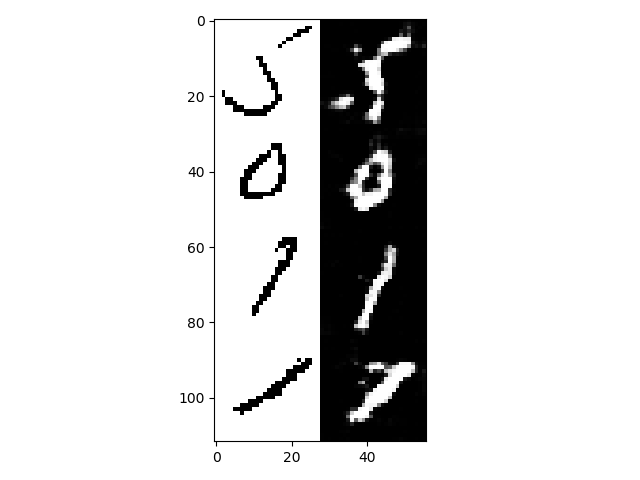
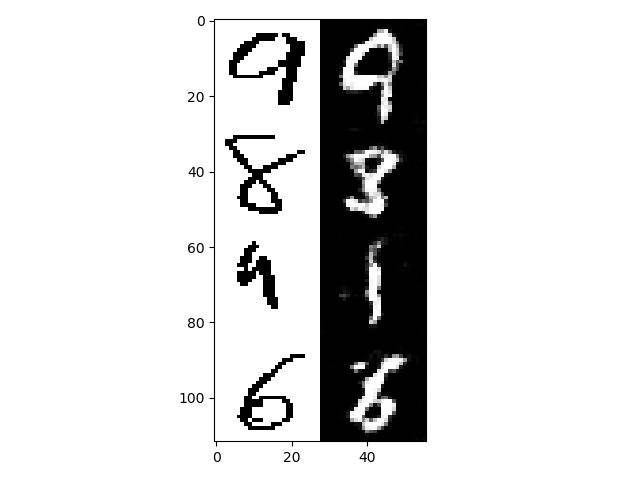
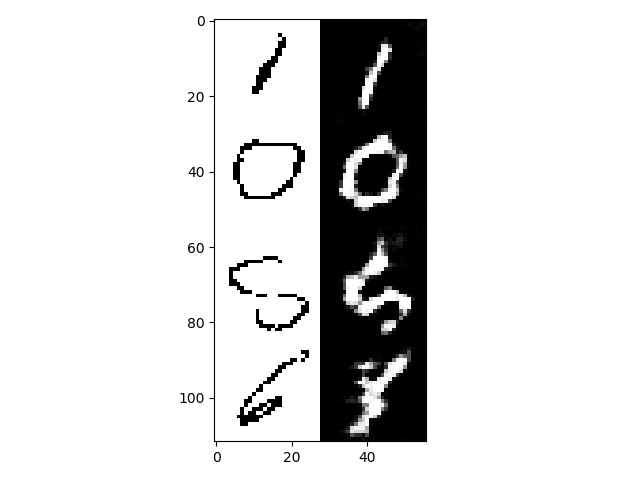
[4] 09/01: Vanilla GAN 28x28, g\_conv\_dim=20, d\_conv\_dim=64, niter=50, niter\_decay=400, batch\_size=64.

Poorer results possibly because G is not sophisticated enough to handle the variations in input



Still need d\_conv\_dim > g\_conv\_dim for the reason in [3] but concern about the network getting too large to train. Try decreasing d\_conv\_dim

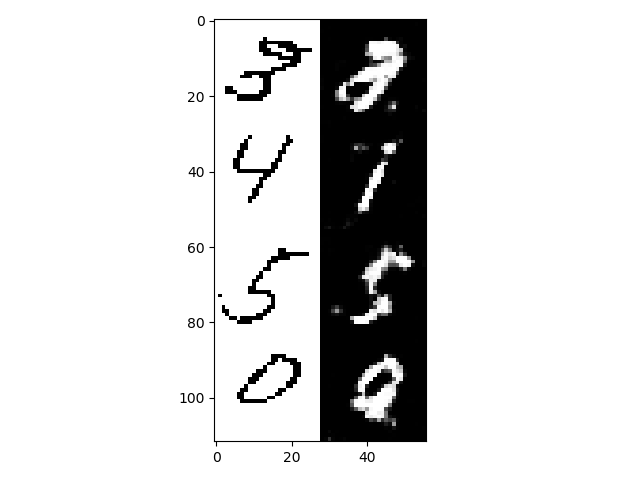
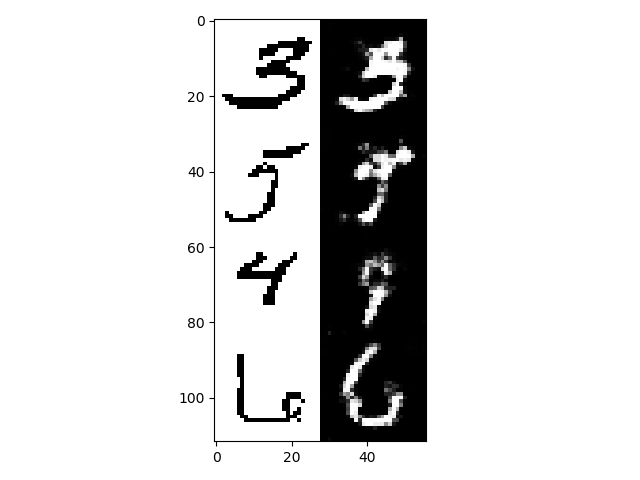
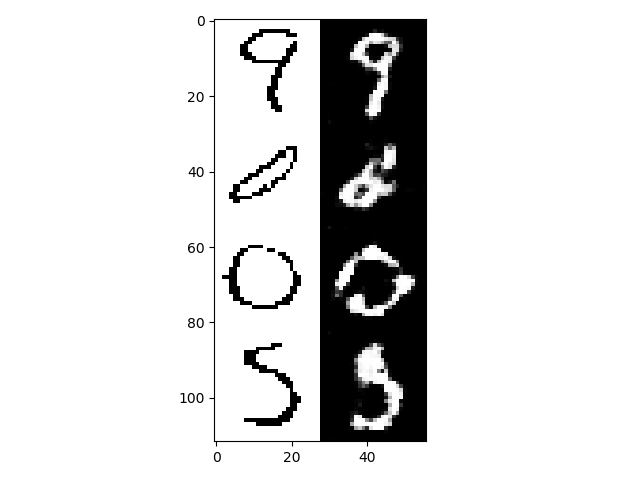
[5] 09/01: Vanilla GAN 28x28, g\_conv\_dim=32, d\_conv\_dim=48, niter=50, niter\_decay=400, batch\_size=64.



Same issues as [3] and arguably more pronounced. Will more iterations help?

[6] 09/01: Vanilla GAN 28x28, g\_conv\_dim=32, d\_conv\_dim=48, niter=70, niter\_decay=700, batch\_size=64.

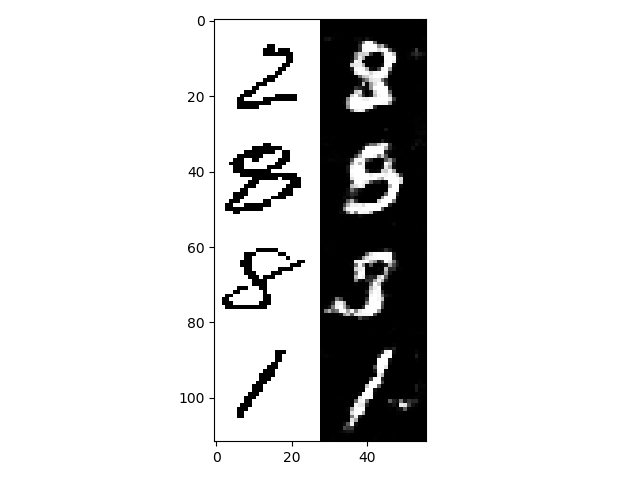
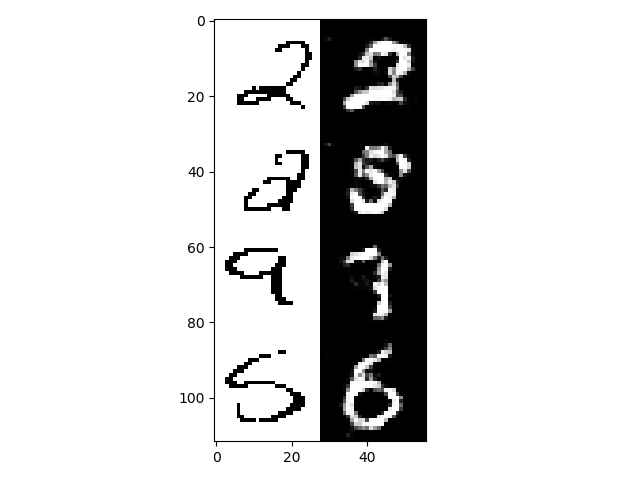
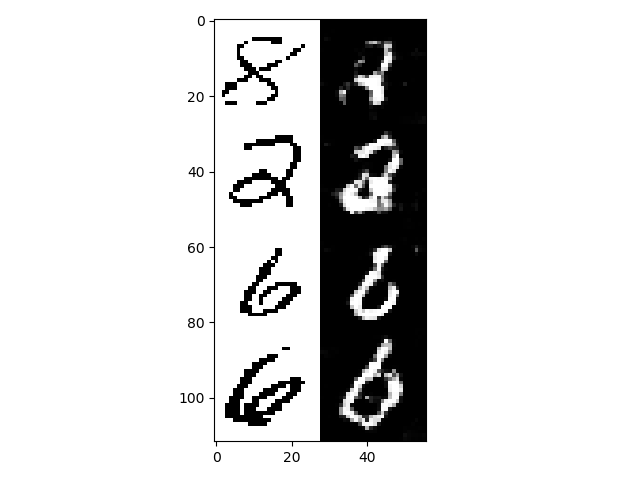
Marginal improvements only. Also the images are noisy compared to [3]. Visually, [3] is still the best result.



Let d\_conv\_dim remain at 64. Given that in [3] some numbers still fail to be rendered convincingly, try increase g\_conv\_dim to enable G to capture finer details in the image.

[7] 09/01: Vanilla GAN 28x28, g\_conv\_dim=36, d\_conv\_dim=64, niter=70, niter\_decay=700, batch\_size=64.

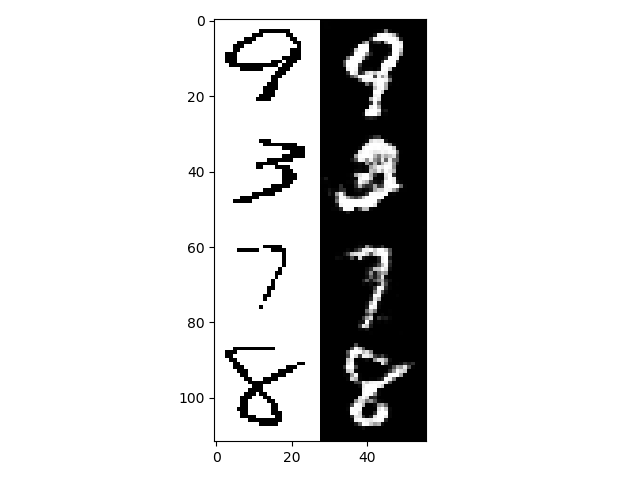
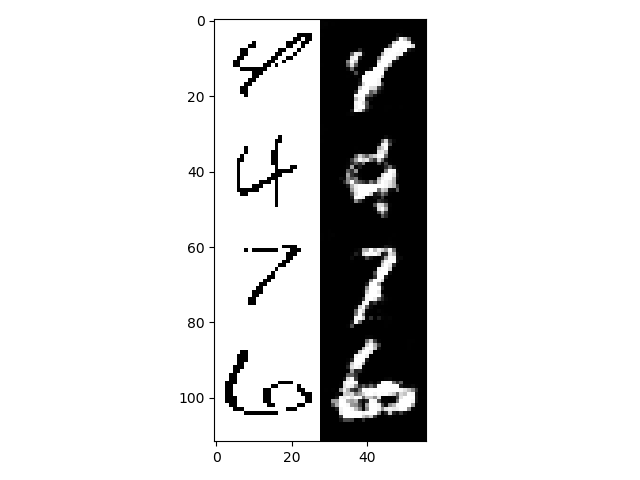
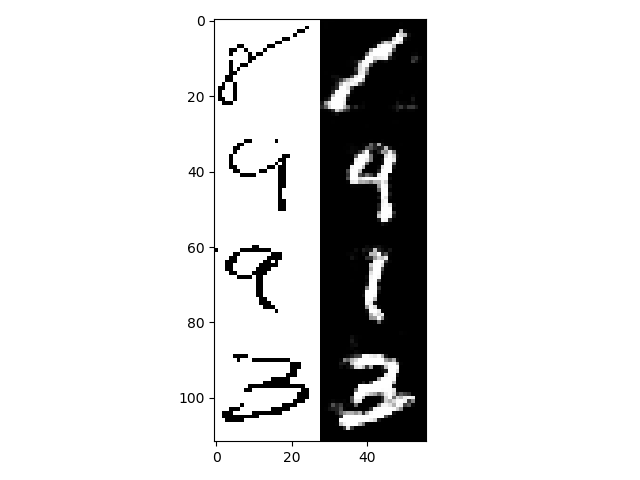
Same issues.



Even more iterations?

[8] 09/01: Vanilla GAN 28x28, g\_conv\_dim=36, d\_conv\_dim=64, niter=100, niter\_decay=1200, batch\_size=64.

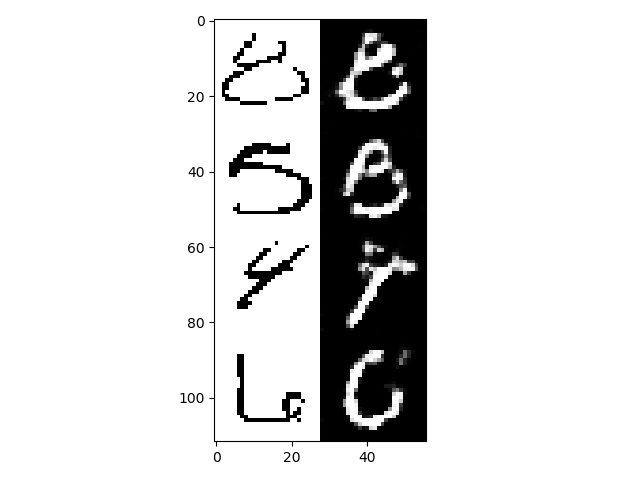
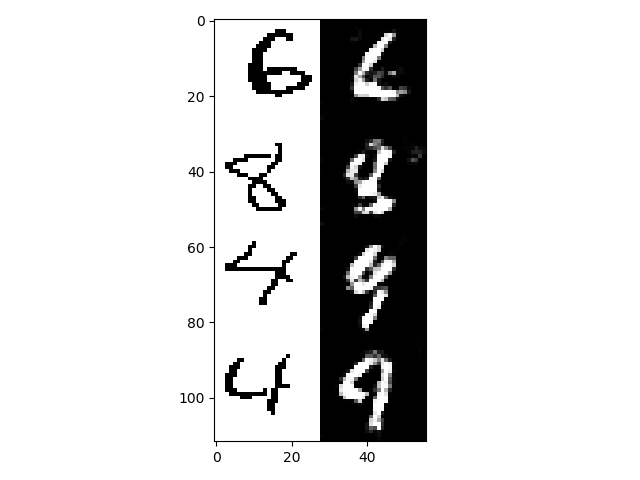
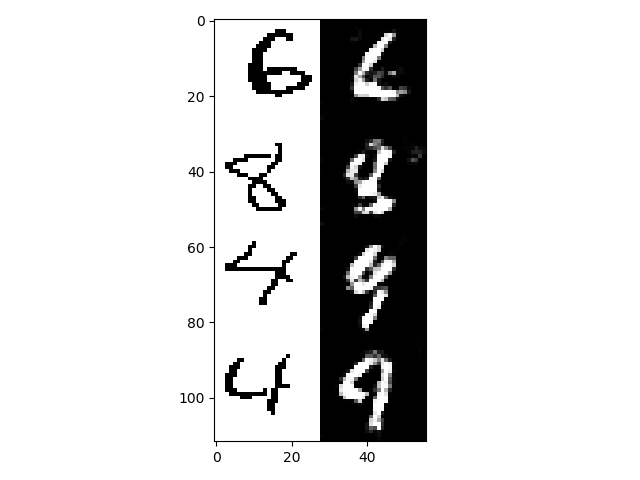
Slightly better, but still suffers the same pitfalls of generating the wrong number as well as some noisiness.



Everything above used 6 residual blocks as the network behind G. Try using which\_model\_netG=resnet\_9blocks

[9] 09/01: Vanilla GAN 28x28, g\_conv\_dim=36, d\_conv\_dim=64, niter=60, niter\_decay=600, batch\_size=64, which\_model\_netG=resnet\_9blocks.

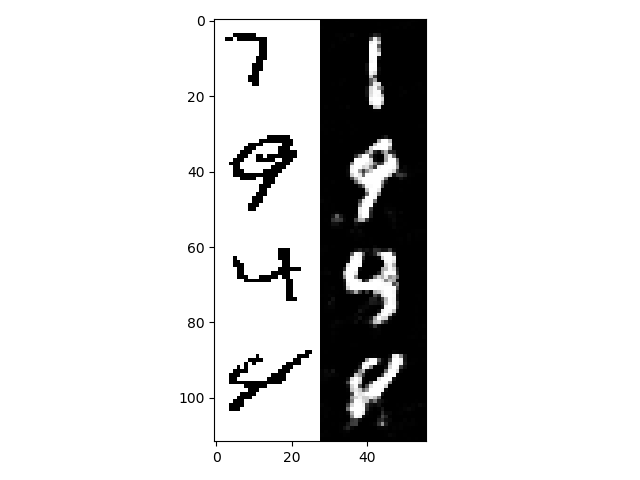
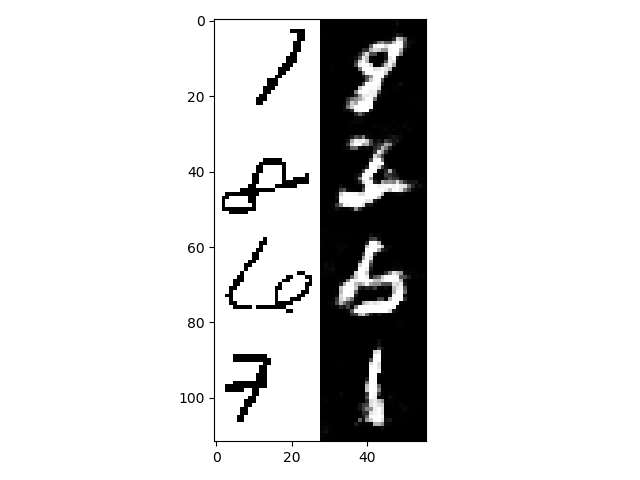
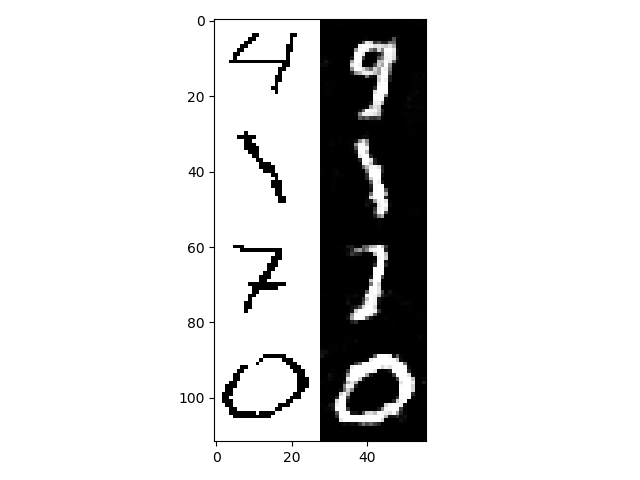
Bad.



D is still too dumb.

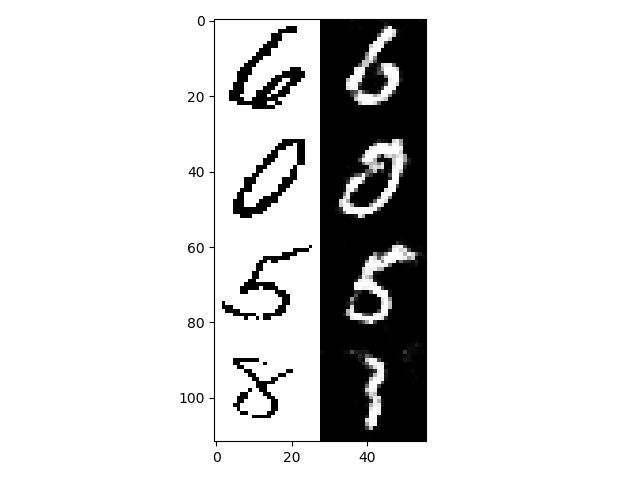
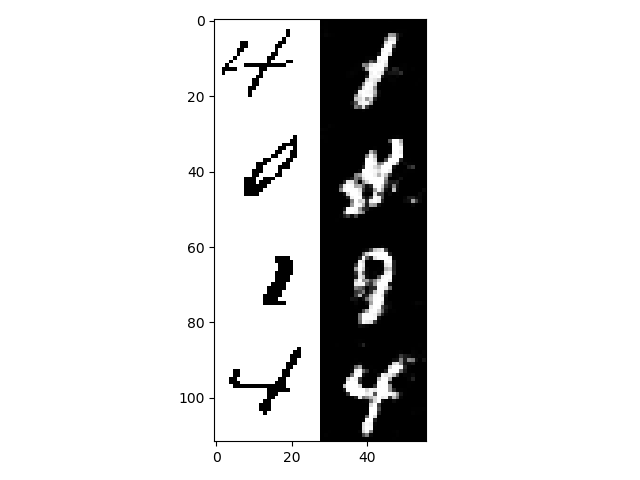
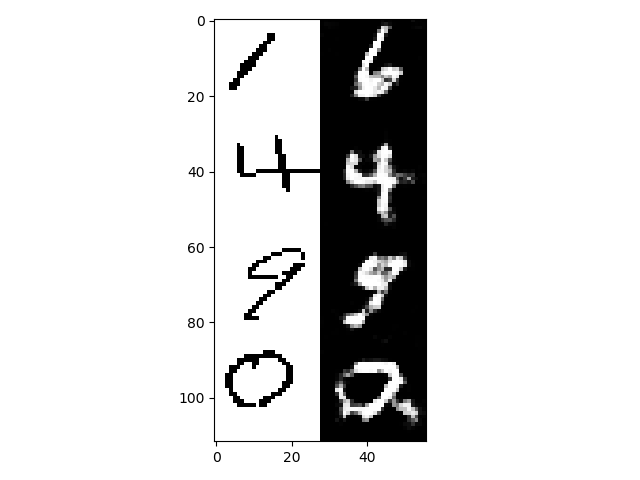
[10] 09/01: Vanilla GAN 28x28, g\_conv\_dim=36, d\_conv\_dim=64, niter=60, niter\_decay=600, batch\_size=64, which\_model\_netG=resnet\_9blocks

When the discriminator is not outsmarted by the generator, we see some rather good learning results. The output is quite convincing in some cases; however it is unstable in others.

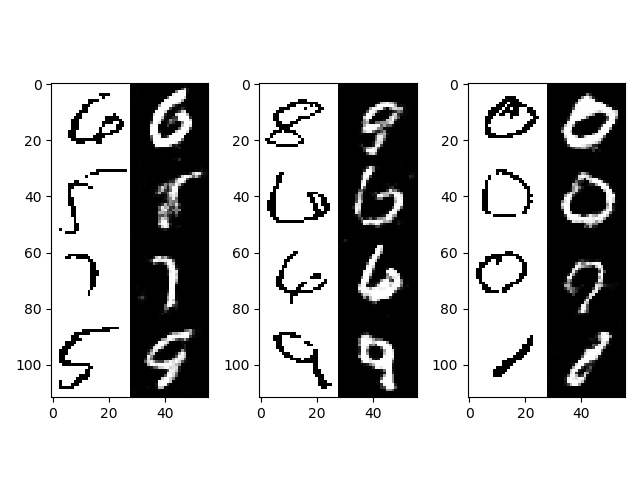


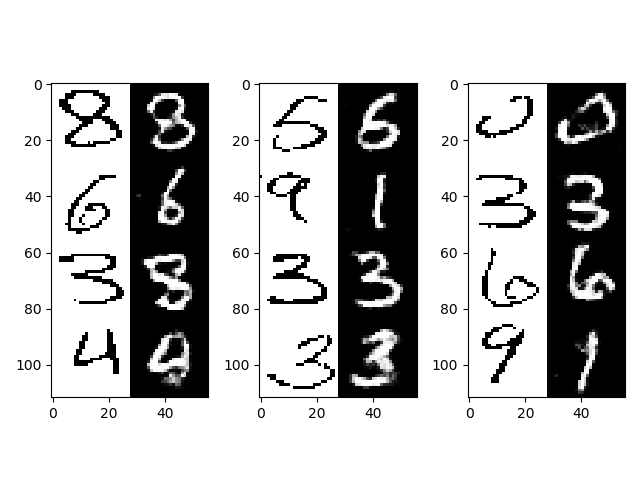
[11] 09/01: Vanilla GAN 28x28, g\_conv\_dim=64, d\_conv\_dim=64, niter=60, niter\_decay=600, batch\_size=32, which\_model\_netG=resnet\_9blocks, D.use\_sigmoid=True

Outputs are generally good but G is not mapping correct digits



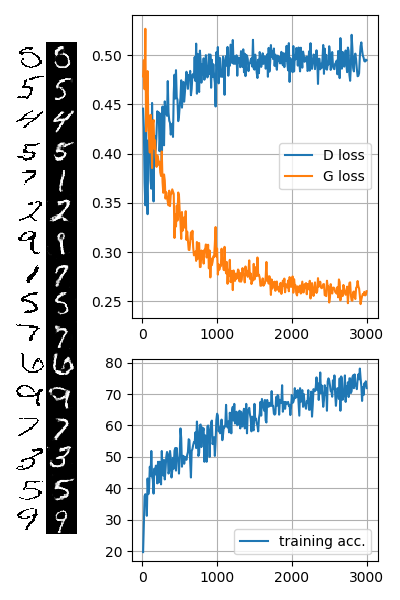
[12] 09/01: Vanilla GAN 28x28, g\_conv\_dim=64, d\_conv\_dim=64, niter=100, niter\_decay=1400, batch\_size=32, which\_model\_netG=resnet\_9blocks, D.use\_sigmoid=True, train G once every 2 iterations.





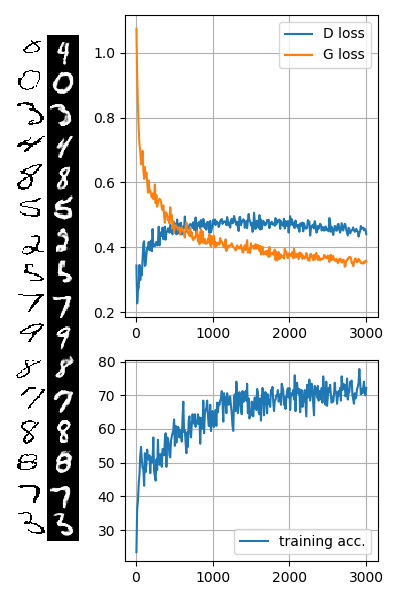
[13] 19/01: vanilla GAN. g\_conv\_dim=64, d\_conv\_dim=64, niter=1500, niter\_decay=1500, batch\_size=32, lr=0.0002, betas=(0.5, 0.999).

Result: 72.4% of test set classified correctly



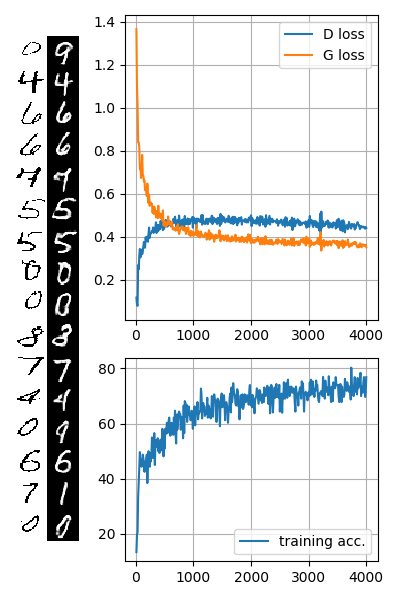
[14] 19/01: GcGAN. config same as [13] but with lambda\_gc=1.0.

Result: 69.8%



[15] 19/01: GcGAN. Same as [14] but with n\_iter = n\_iter\_decay = 2000 to observe if performance plateaued

Result: 70.2%



**Default settings**

Which\_model\_netD = ‘resnet\_6blocks’

Which\_model\_netG = ‘basic’

G\_conv\_dim = d\_conv\_dim = 64

Niter = n\_iter\_decay = 1500

Batch\_size = 32

Num\_workers = 4

Lr = 0.0002

Beta1 = 0.5

Beta2 = 0.999

Lr\_policy = ‘lambda’

Lambda\_gan = 1.0

Use\_lsgan = True

Lambda\_cycle = 0.0

Lambda\_gc = 0.0

Lambda\_reconst = 0.0

Lambda\_dist = 0.0

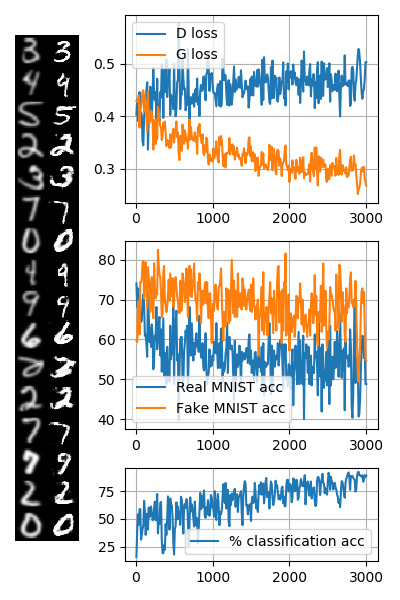
Begin\_train = True

Geometry = 1

Pretrained\_mnist\_model = ‘models/MNISTClassifier/200115-172045-MNISTClassifier.pth’

[16] 25/01: default settings. (Vanilla GAN; lambda\_gan = 1.0, all other criteria 0.0)

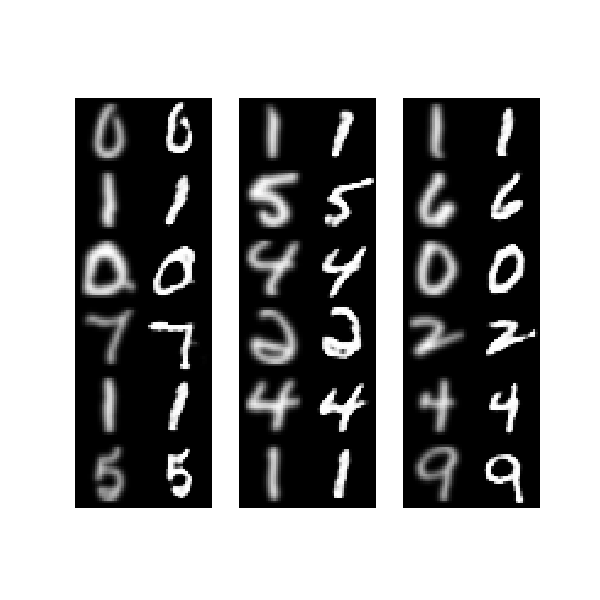
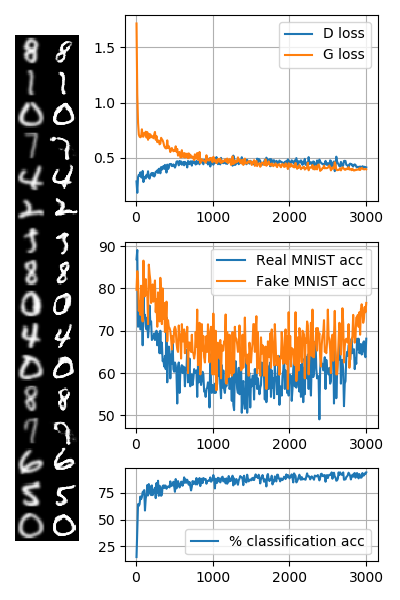
Result: 89.06% accuracy



[17] 25/01: lambda\_gan = 1.0, lambda\_gc = 1.7

(model breaks when lambda\_gc = 1.8. The highest it can go is 1.7. Even at 1.7 it occasionally fails)

Result: 94.06%



[18] 26/01: lambda\_gan = 1.0, lambda\_cycle = 20.0

Result:

Peak performance reached very quickly (after only about 200 iterations)

The transformation appears to be producing near-identity mappings, defeating the purpose of stylistic transfer. May be due to a large weighting given to the cycle consistency constraint

* Why is the discriminator so strong?

[19] 31/01: list of GcGAN tests to carry out

|  |  |  |  |
| --- | --- | --- | --- |
| Rule | Lambda\_gc | Result | Notes |
| Identity, one G (i.e. Vanilla GAN) | N/A | 89.06% (above) | Unstable performance during training |
| Identity, separate G | 2.3 | 88.44% |  |
| Rot90, one G | 1.7 | 94.06% (above) |  |
| Rot90, separate G | 1.7 | 88.13% |  |
| Rot180, one G | 1.7 | 87.19% |  |
| Rot180, separate G | 1.7 | 88.75% |  |
| Identity + noise (var 0.1), one G | 1.7 | 68.13% |  |
| Identity + noise (var 0.1), separate G | 1.7 | 85.31% |  |
| Rot90 + noise (var 0.1), one G | 1.7 | 82.81% |  |
| Rot90 + noise (var 0.1), separate G | 1.7 |  |  |
| Rot180 + noise (var 0.1), one G | 1.7 | 90.94% |  |
| Rot180 + noise (var 0.1), separate G | 1.7 | 90.0% |  |

[20] 02/02: again

|  |  |  |  |
| --- | --- | --- | --- |
| Rule | Lambda\_gc | Result | Notes |
| Identity, one G (i.e. Vanilla GAN) | N/A |  |  |
| Identity, separate G | 1.7 | 86.25% |  |
| Rot90, one G | 1.7 | 88.44% |  |
| Rot90, separate G | 1.7 | 82.81% |  |
| Rot180, one G | 1.7 | 90.63% |  |
| Rot180, separate G | 1.7 | 91.88% |  |
| Identity + noise (var 0.1), one G | 1.7 | 86.25% |  |
| Identity + noise (var 0.1), separate G | 1.7 | 86.25% |  |
| Rot90 + noise (var 0.1), one G | 1.7 | 91.25% |  |
| Rot90 + noise (var 0.1), separate G | 1.7 | 88.44% |  |
| Rot180 + noise (var 0.1), one G | 1.7 | 90.94% |  |
| Rot180 + noise (var 0.1), separate G | 1.7 | 79.06% |  |
| Identity + noise (var 0.05), one G | 1.7 | 88.44% |  |
| Identity + noise (var 0.05), separate G | 1.7 | 87.19% |  |
| Rot90 + noise (var 0.05), one G | 1.7 | 88.44% |  |
| Rot90 + noise (var 0.05), separate G | 1.7 | 88.44% |  |
| Rot180 + noise (var 0.05), one G | 1.7 | 88.75% |  |
| Rot180 + noise (var 0.05), separate G | 1.7 |  |  |