Deep Convolutional Generative Adversarial Network

Deep Learning

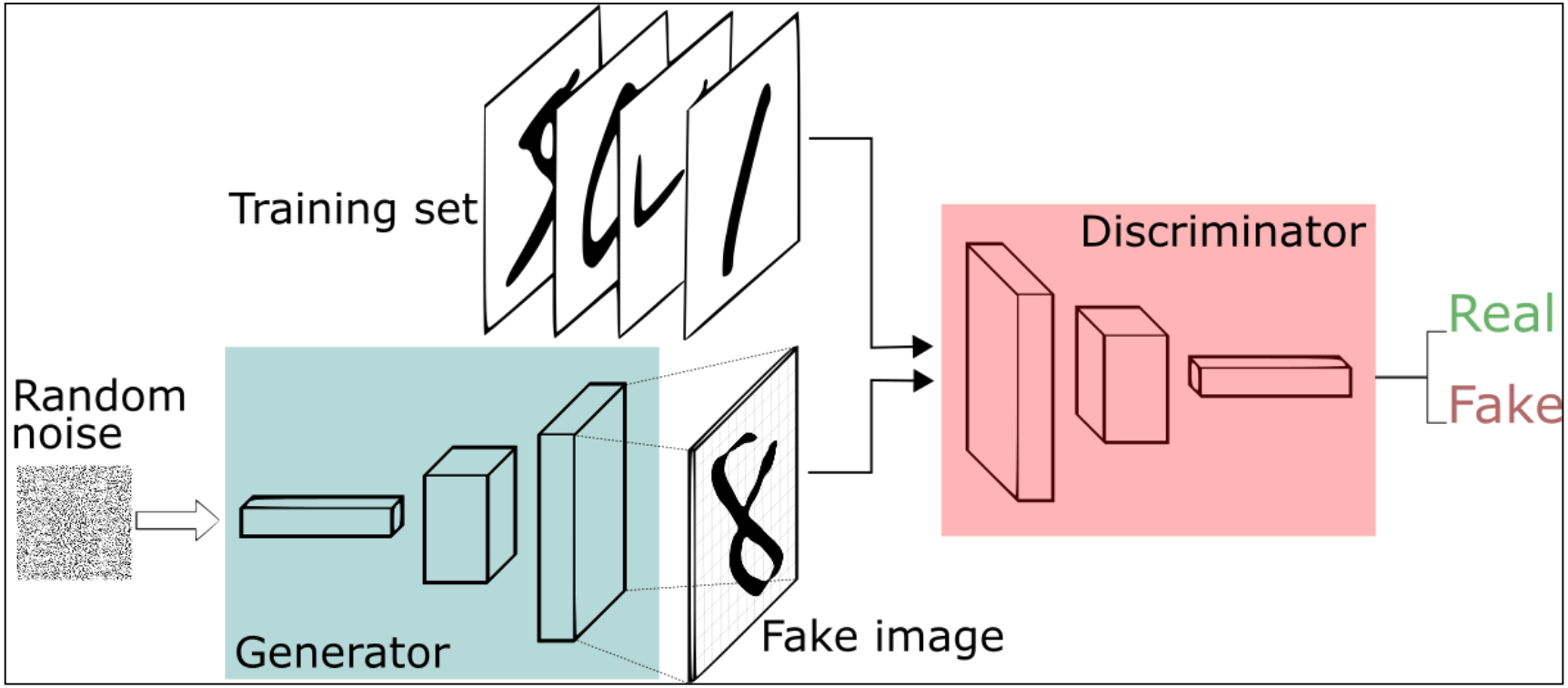
Agenda

- GAN
- DCGAN
- Experiment

GAN
Was ist GAN?

- Besteht aus 2 Neuronalen Netzen (CNN)
  - Diskriminator D
  - Generator G
- G -> Generiert Samples
- D -> Klassifiziert Samples als Fake oder Echt

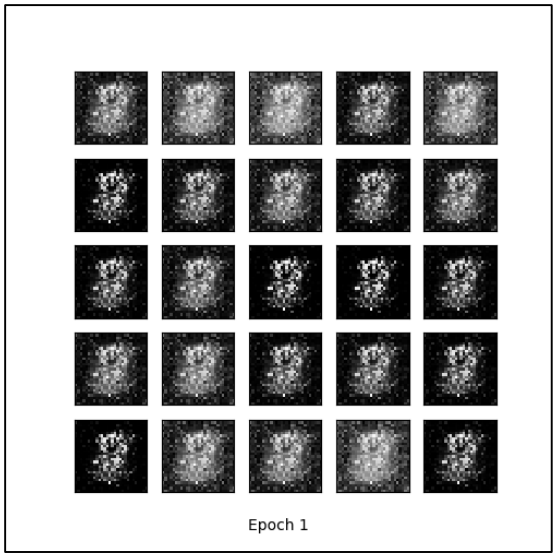
GAN
Was ist GAN?

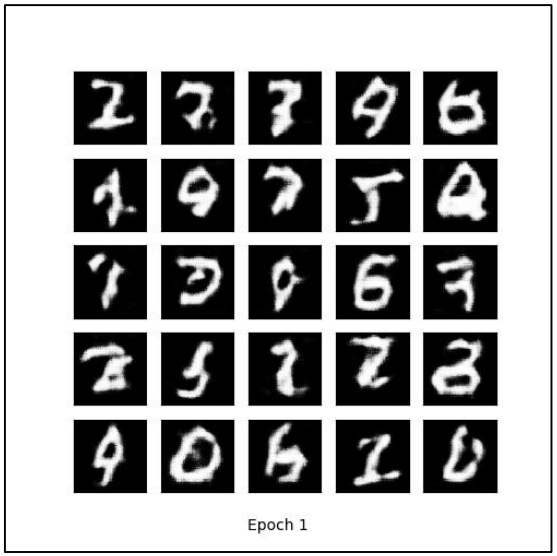


DCGAN
Was ist DCGAN ?

- Erweiterung bzw. Verbesserung des GAN

- Mehrere Convolution Layers

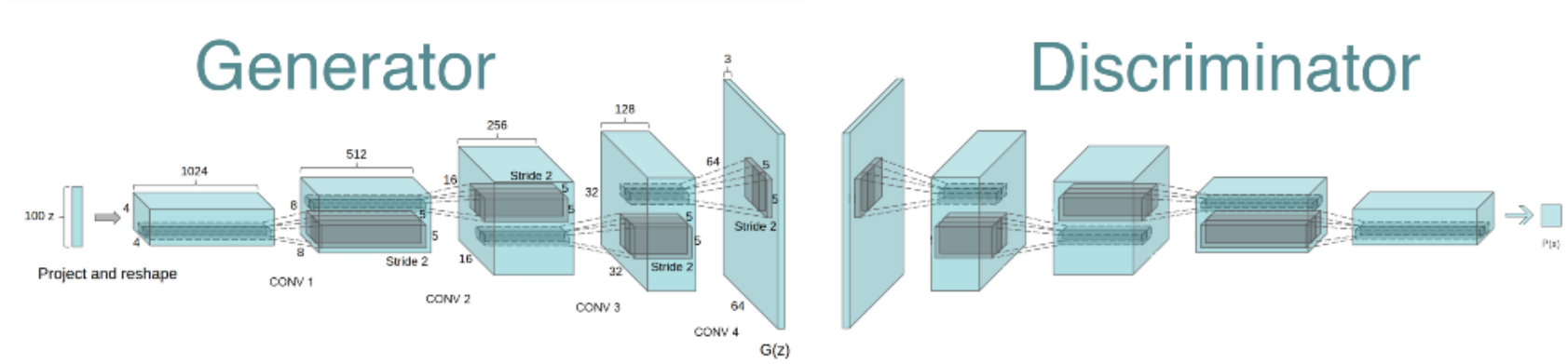




DCGAN
Guidelines

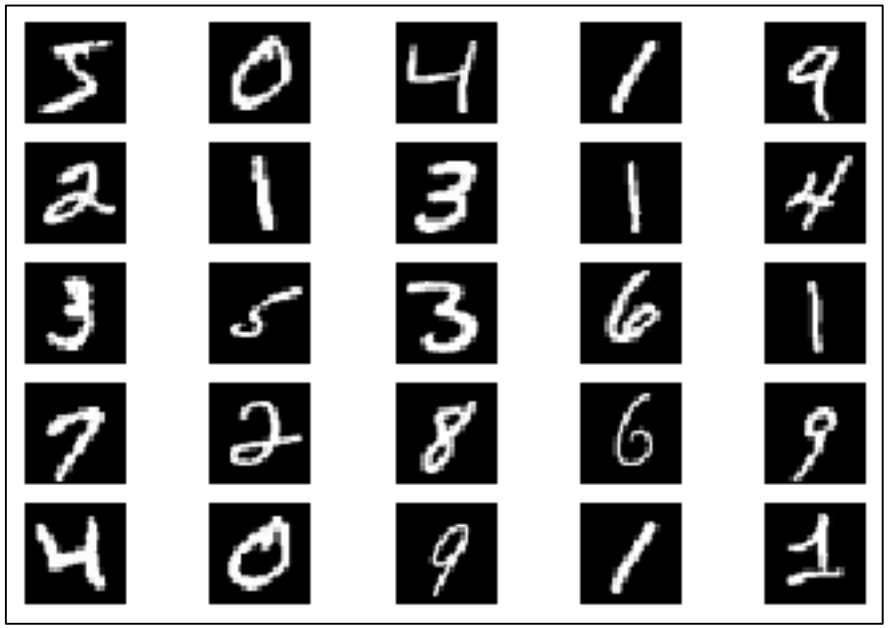
- Ersetze Pooling Layers mit strided convolution/fractionally-strided conv.
- Benutze Batch normalization für Generator und Diskriminator
- Entferne alle fully connected layers
- Benutze ReLu für alle Layers und Tanh für den Output im Generator
- Benutze LeakyRelu für alle Layers im Diskriminator

DCGAN
Generator und Diskriminator



Experiment

- Colab
- Keras
- MNIST
  - Training: 60.000
  - Test: 10.000



Experiment
Model

Model: "Generator"

Layer (type)	Output Shape	Param #
dense_1 (Dense)	(None, 12544)	1254400
batch_normalization (BatchNo	(None, 12544)	50176
leaky_re_lu_2 (LeakyReLU)	(None, 12544)	0
reshape (Reshape)	(None, 7, 7, 256)	0
conv2d_transpose (Conv2DTran	(None, 7, 7, 128)	819200
batch_normalization_1 (Batch	(None, 7, 7, 128)	512
leaky_re_lu_3 (LeakyReLU)	(None, 7, 7, 128)	0
conv2d_transpose_1 (Conv2DTr	(None, 14, 14, 64)	204800
batch_normalization_2 (Batch	(None, 14, 14, 64)	256
leaky_re_lu_4 (LeakyReLU)	(None, 14, 14, 64)	0
conv2d_transpose_2 (Conv2DTr	(None, 28, 28, 1)	1600

Total params: 2,330,944
Trainable params: 2,305,472
Non-trainable params: 25,472

Model: "Discriminator"

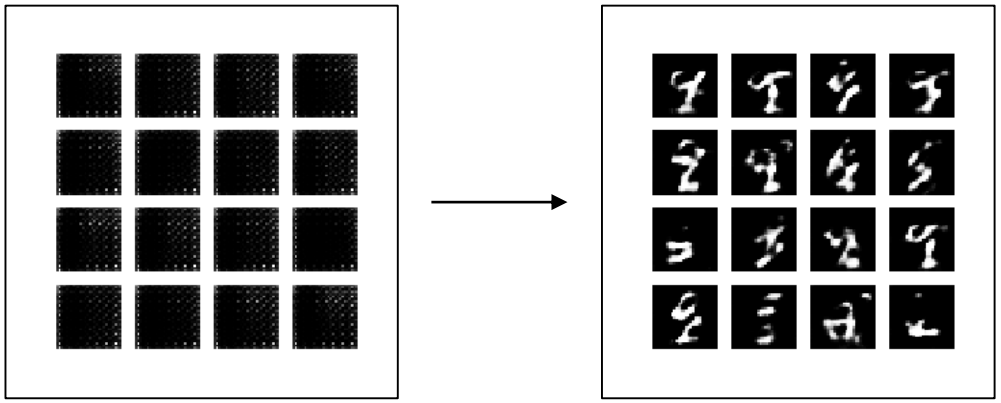
Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 14, 14, 64)	1664
leaky_re_lu (LeakyReLU)	(None, 14, 14, 64)	0
dropout (Dropout)	(None, 14, 14, 64)	0
conv2d_1 (Conv2D)	(None, 7, 7, 128)	204928
leaky_re_lu_1 (LeakyReLU)	(None, 7, 7, 128)	0
dropout_1 (Dropout)	(None, 7, 7, 128)	0
flatten (Flatten)	(None, 6272)	0
dense (Dense)	(None, 1)	6273

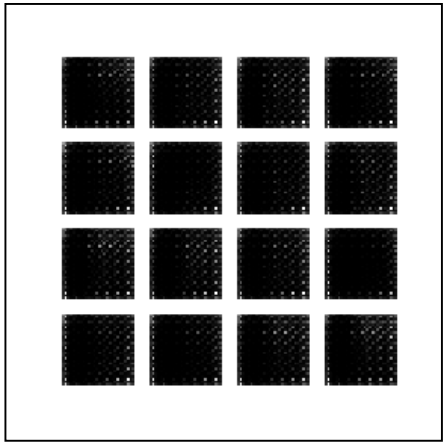
Total params: 212,865
Trainable params: 212,865
Non-trainable params: 0

Experiment
Test #1

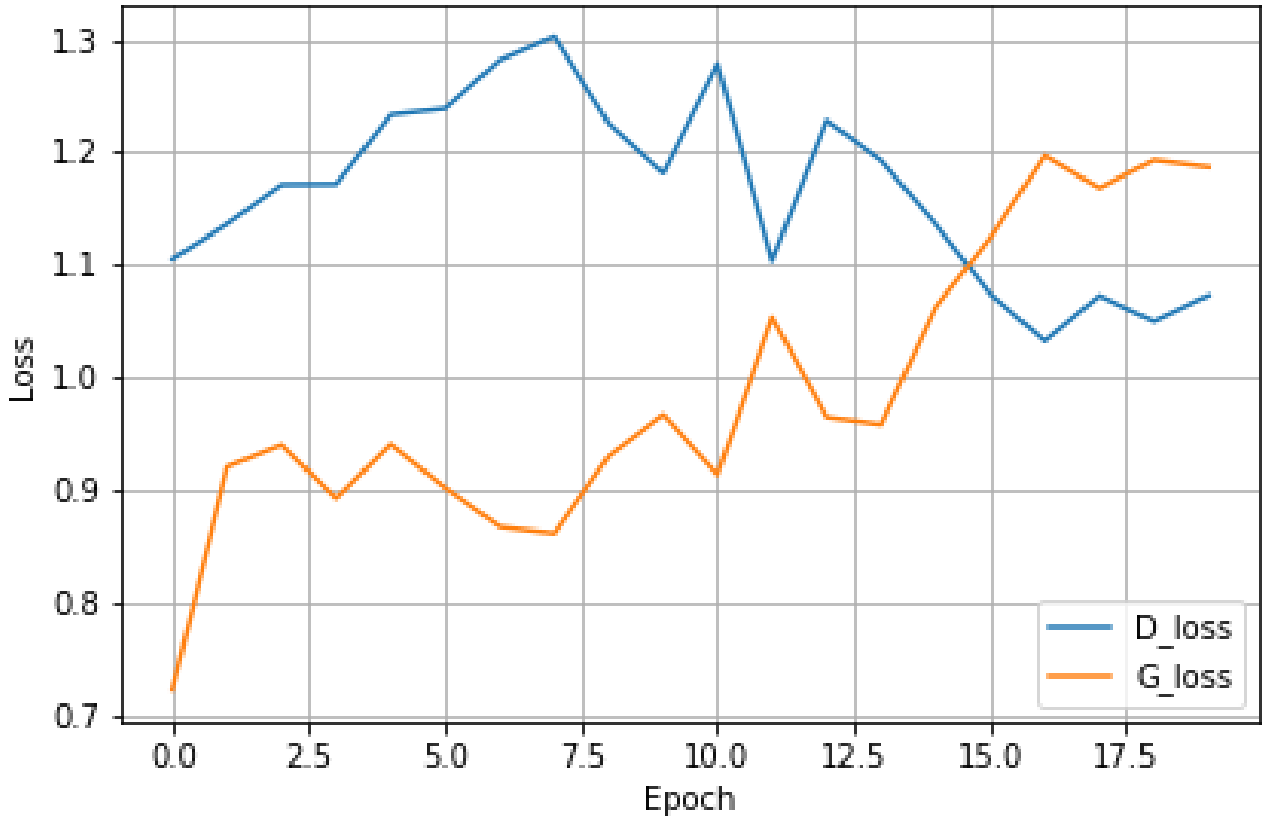
Hyperparameter

- Batch size: 256
- Learning rate: 0.0001
- β1: 0.9
- LeakyReLu: 0.3





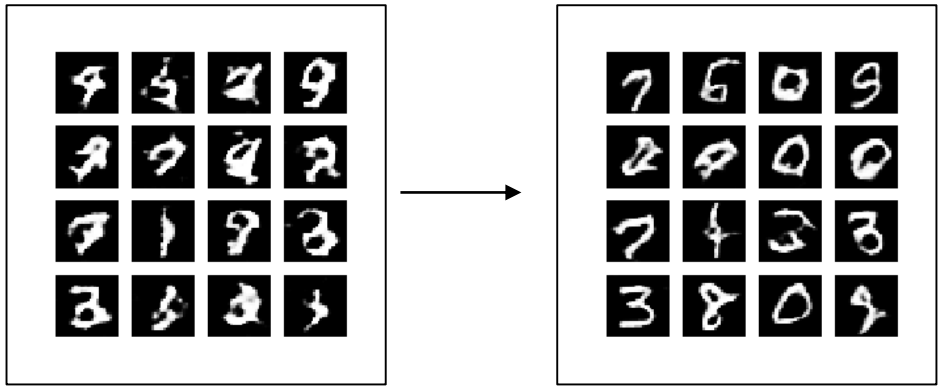
Experiment
Test #1

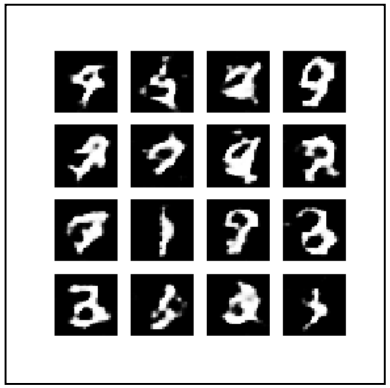


Experiment
Test #2

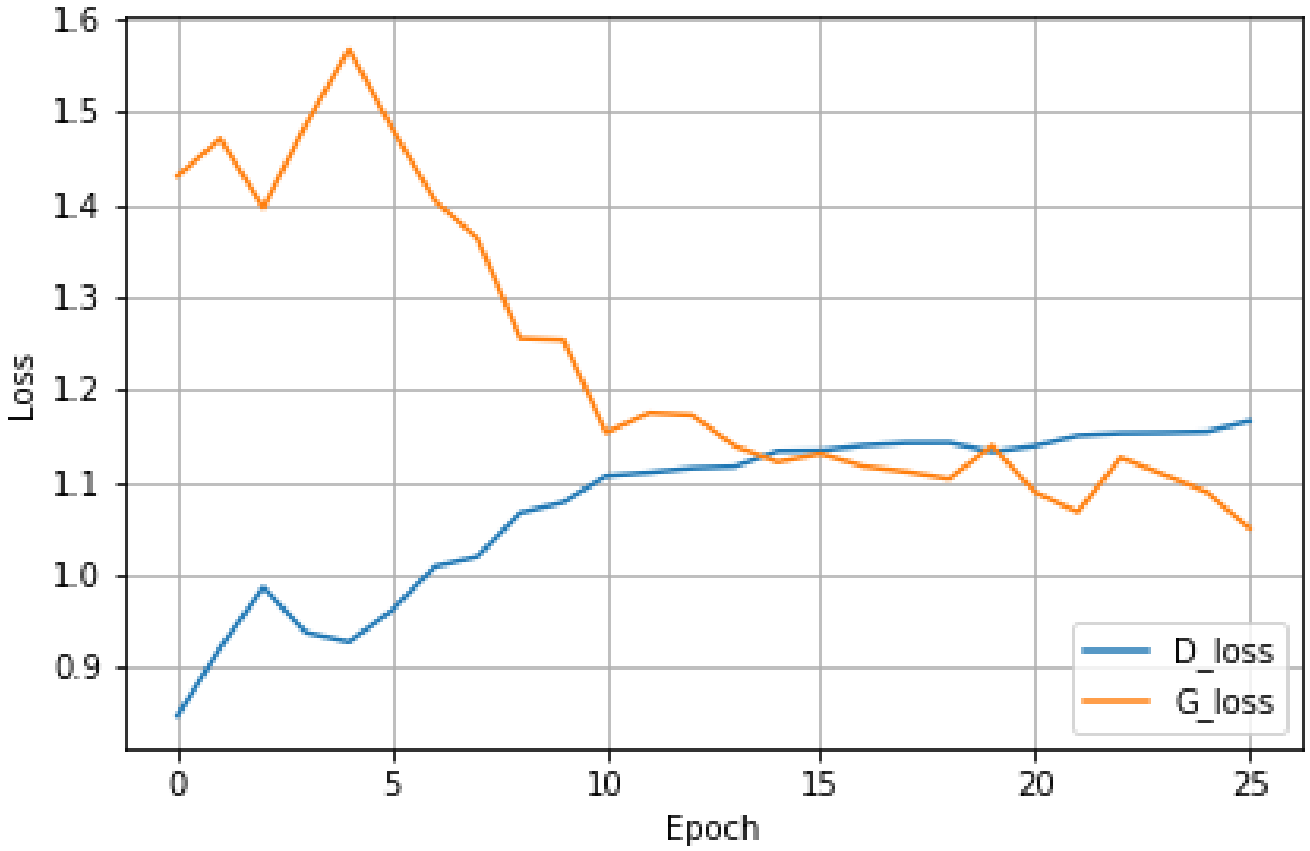
Hyperparameter

- Batch size: **100**
- Learning rate: **0.0002**
- β1: 0.9
- LeakyReLu: 0.3





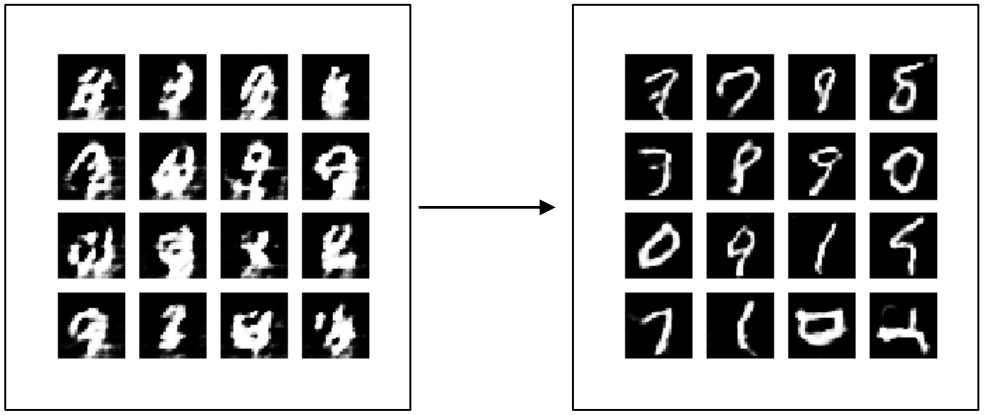
Experiment
Test #2

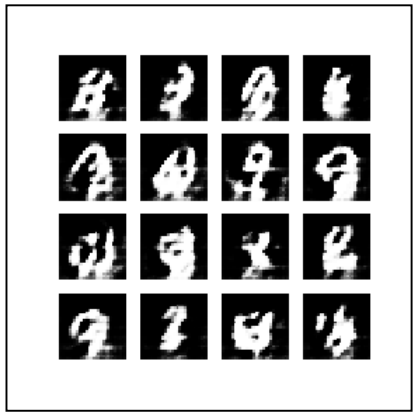


Experiment
Test #3

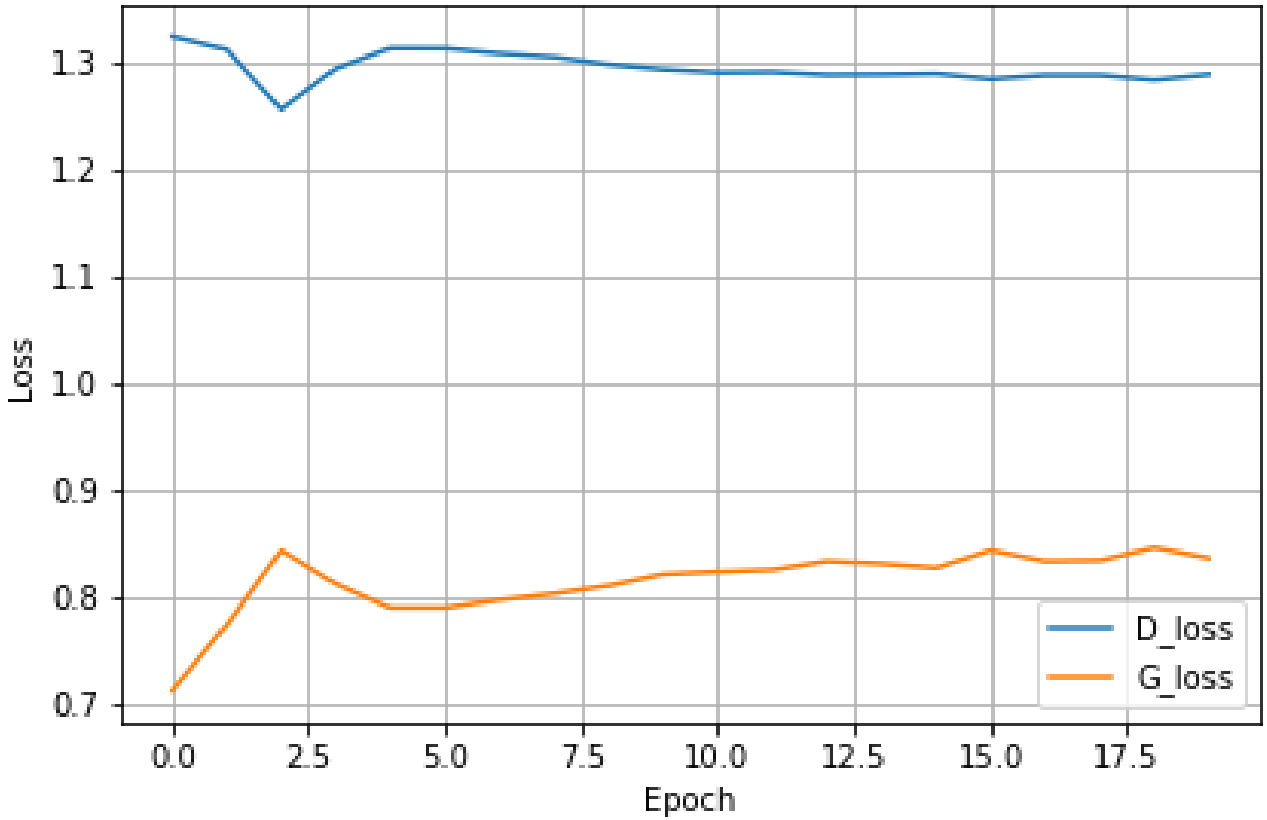
Hyperparameter

- Batch size: 100
- Learning rate: 0.0002
- β1: **0.5**
- LeakyReLu: 0.3





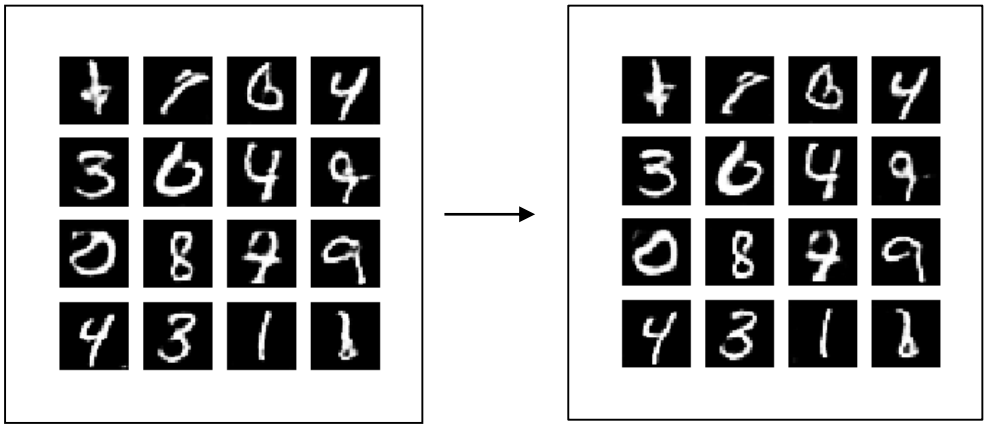
Experiment
Test #3

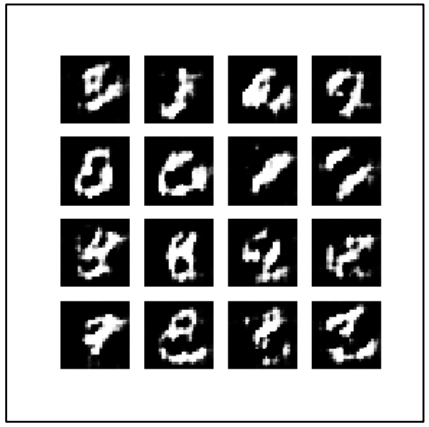


Experiment
Test #4

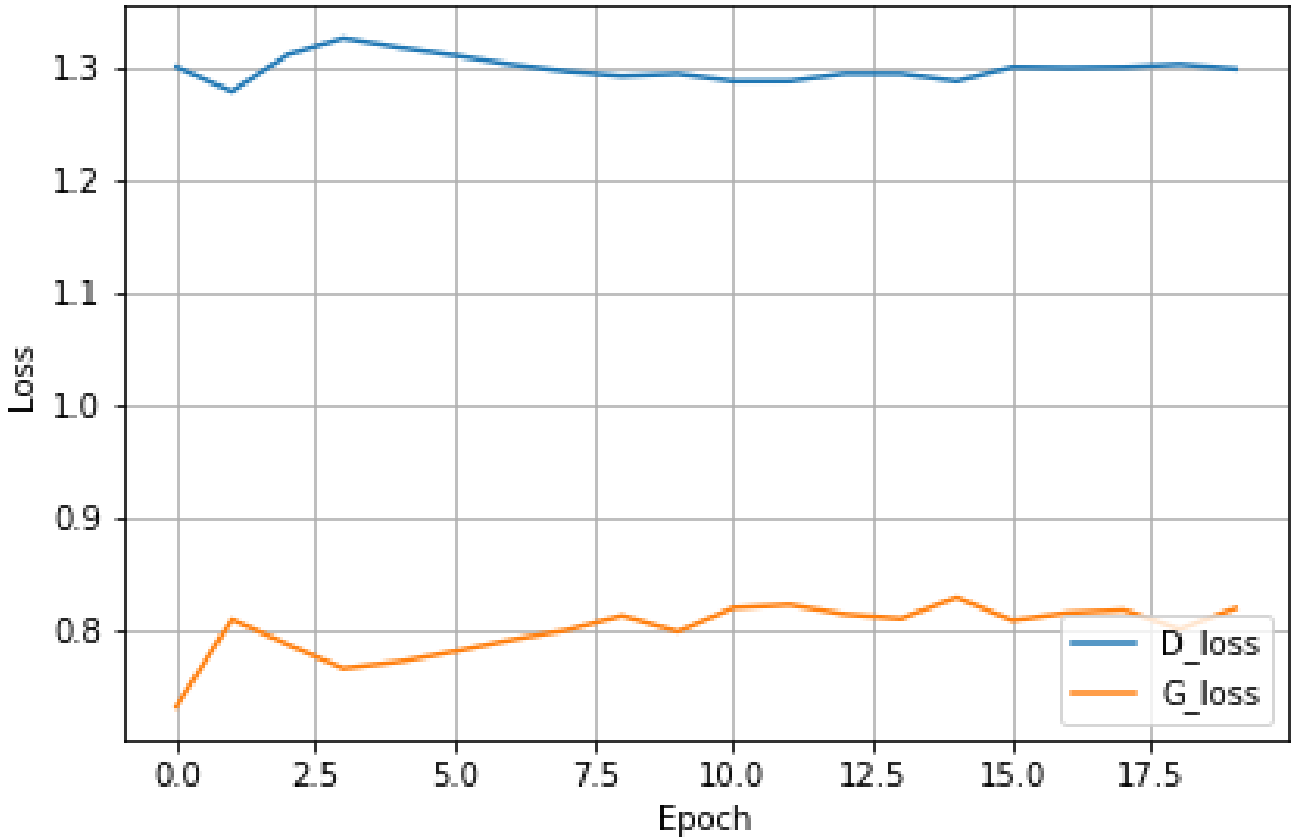
Hyperparameter

- Batch size: 100
- Learning rate: 0.0002
- β1: 0.5
- LeakyReLu: **0.2**





Experiment
Test #4



Literatur

- Github: https://github.com/dnguyen2211/DCGAN
- Creswell A. et. al. 2018. **Generative Adversarial Networks: An Overview**. IEEE
- Radford, Metz and Chintala 2016. **Unsupervised Representation Learning with Deep Convolutional Generative Adversarial Networks**
- https://github.com/znxlwm/tensorflow-MNIST-GAN-DCGAN
- https://pathmind.com/wiki/generative-adversarial-network-gan