Tutorial 10: Generative Adversarial Networks (15P + 8P)

Please submit your code/answers by 14th Jan 23:59 to thomas.wiest@informatik.uni-augsburg.de and manuel.milling@informatik.uni-augsburg.de. You can submit your solutions alone or in teams of 2 (please indicate all names with the submission).

1 Get familiar with GANs (0P)

A short introduction to GANs will be given in the tutorial on 8th Jan. The details can be found in the paper of Ian Goodfellow et al. (link). There are also various online resources available that explain how they work.

2 Use a GAN to generate a Ring (15P)

The target distribution for the GAN of this exercise will be represented by a two dimensional point cloud in the shape of a ring. Our target ring will have its center at 0/0, inner circle radius 0.9 and outer circle radius 1.1. The points for representation should be sampled uniformly between the boundaries. As input noise, use random two-dimensional points with each coordinate sampled from a normal distribution with mean 0 and standard deviation 1.

The goal of this exercise is to implement a GAN that is able to generate new samples that lie within the boundaries of the target ring. Create a fixed test set of 1000 samples from the input noise distribution and check that the generator transforms **at least 80%** of them inside the target ring. (Goal function and code for plotting is provided in the exercise template). An example implementation of the generator is also provided, feel free to further adjust it if needed.

Hints:

- Use `model/layer.trainable` to exclude parameters from training (does not affect already compiled models)
- Use `model.train_on_batch` to train your model on random generated samples

See https://keras.io/models/model/ for more details.

3 Optional: Use a GAN to generate MNIST (8P)

Similar to Exercise 2 create a GAN that generates images from MNIST. A similar template to Exercise 2 is provided. The task is considered solved when the outputs of the generator sort of look like numbers. (Unfortunately, there is no precise metric to use here - plot at least 10 results to check if the outputs come close to the target dataset)

Note: This exercise is a bonus, i.e., it is not necessary to solve this exercise to obtain 100 % on the sheet.