**# Exercise 3 - practical part: VAE & GAN**

On this exercise the code was splitted to VAE implementation on Deep\_ex\_3\_q3.ipynb and to GAN implementation on EX3\_section4\_GAN.ipynb.

**VAE:**

**## Dataset**

In this section VAE relies on the Fashion MNIST data set. After that we will train the SVM each time on a different amount of data for each class. [100, 600, 1000, 3000].

**## Model**

The code implements Variational AutoEncoder (VAE), from the paper: "Semi-supervised Learning with Deep Generative Models".

After the VAE we trained the SVM model from scikit-learn library.

**## Run**

To run this code go to the section

1. To run the code please first insert the right directory paths inside “For the instructor” section, according to your directories setup.
2. Then run the file cell by cell.
3. To train both the VAE and the SVM, please run the insert flag = 0, and for load trained model insert flag =1.
4. After that, pick the number of samples for each class. and run all the cells.

**## Results**

The results of M1 + SVM:

Number of samples : 100 || Accuracy: 79.0 [%]

Number of samples : 600 || Accuracy: 82.3 [%]

Number of samples : 1000 || Accuracy: 83.1 [%]

Number of samples : 3000 || Accuracy: 84.3 [%]

**GAN:**

**## Dataset**

The GAN models (DC GAN& WGAN) were trained on the Fashion MNIST dataset consisting of 70,000 grayscale images of fashion items, such as clothes, shoes, and accessories. The dataset is divided into 10 categories.

**## Model**

The code implements a Generative Adversarial Network with a Generator and a Discriminator. The Generator generates synthetic images using sequential blocks of linear and convolutional transpose layers. The Discriminator classifies input images as real or fake using convolutional layers with leaky ReLU activation. The GAN framework trains the Generator to produce realistic images that can deceive the Discriminator.

Differences of the GAN type can be seen in the loss calculations for each type. And on the optimizer parameters.

**## Run**

1. To run the code please first insert the right directory paths inside “For the instructor” section, according to your directories setup.
2. Then run the file cell by cell.
3. To train both the DCGAN and the WGAN, please run the cell of “Run training”.
4. To infer the saved models please run the last two cells under “Display”.