Sequence 7 exercises

Autoencoders

N.B: For any NN development, we are going to use the Keras library from Tensorflow. Help and description about Keras can be founded at www.keras.io.

1. A vanilla AutoEncoder for image denoising (homework)

In this exercise, we are going to use the MNIST fashion dataset. It is made of 70k grey level images of size 28x28 pixels of fashion articles (60k images for the training set and 10k images for the testing set). The ten following classes are equally represented in the dataset:

- 0: T-shirt/top
- 1: Trouser
- 2: Pullover
- 3: Dress
- 4: Coat
- 5: Sandal
- 6: Shirt
- 7: Sneaker
- 8: Bag
- 9: Ankle boot

1.1 Training the AE for image reconstruction

The file *Vanilla-AE.py* gives the code of a simple convolutional AutoEncoder in the coder and the decoder. Note that the *UpSampling2D()* function is the opposite of the *MaxPooling2D()* function. It is used for interpolation during the decoding step.

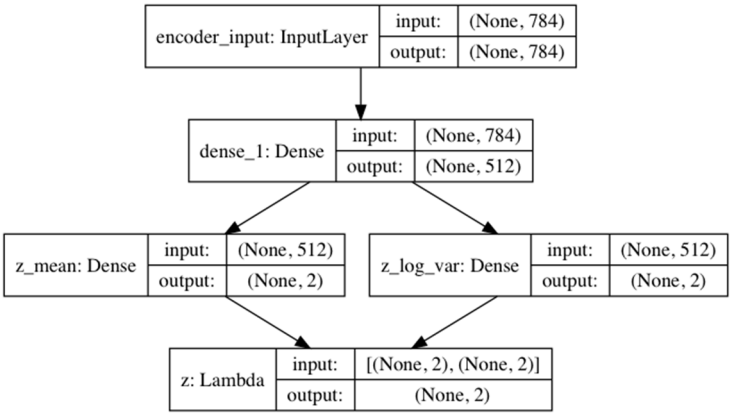
Run the proposed code in order to learn the autoencoder parameters. Compare some original and reconstructed images.

1.2 Using the trained AE for image denoising

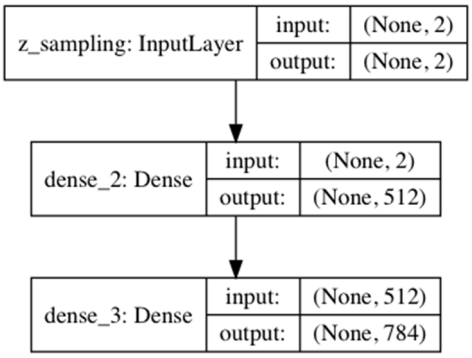
The function *add_noise()* proposes a way to add some noise on the dataset. Use that function in order to add noise on the images of the test set. Then use the previously trained autoencoder in order to predict the output of some noisy images. Comment the obtained images.

2. Variational AE for digit image generation (Classwork)

Let us go back to the MNIST dataset made of 70k images of handwritten digits (60k images for the training set and 10k images for the testing set).
The file *vae.py* gives an implementation of a VAE designed to deal with the MNIST dataset. The architecture of the considered VAE is the following:



Encoder architecture



Decoder architecture

Describe the kind of architecture we have in this case. What is the dimension of the feature data in the latent space?

Run the code. Comment the data distribution in the latent space.

The proposed code shows how to generate some new digit images. Modify the proposed code in order to generate the digit image corresponding to the following coordinates in the latent space: (-0.8, 0.9) ; (0.9, -0.9). In each case, what is the digit that is supposed to be generated? Comment the obtained results.

Which digit will be generated if using the following latent space coordinates: (0.9, 1.5) ; (0.4, -2) ; (-0.3, 0.5) ? Display the generated images and comment the results by looking at the position of the chosen points in the latent space.