## Deep Learning, Winter 2019

Assignment # 4 (Unsupervised learning and autoencoders)

This assignment is designed to gain a better understanding of unsupervised learning and autoencoders. Your work will be carried out using the MNIST dataset. You will do the followings:

* Perform PCA on MNIST data and visualize first 8 eigen images resulting from PCA.
* Generate 10 reconstructed images, one for each digit. This will be done by using the top 8 eigen values/vectors.
* Using t-SNE, visualize the MNIST data in the original space and in the PCA space consisting of top 8 eigen images.
* Next, implement a simple linear encoder with one hidden layer of 8 neurons and compare the reconstructed images with those done using PCA. Provide comments on your results.
* Visualize the input weight matrix again in the form of 8 images. Compare these with 8 PCA based eigen images and give your comments.
* Using t-SNE, visualize the MNIST data in the autoencoder’s hidden space.
* Repeat the autoencoder steps with a nonlinear autoencoder and compare the results against PCA and linear encoder.

Submission should be a pdf file of your jupyter notebook.