

[Return to Assessments page](#)

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## Worksheet 10 - VAE and CVAE

### Part 1: VAE and CVAE

Given is a collection of 20000 labelled images from the MNIST dataset (images: `data_x`, labels: `data_y`).

Your task is to train a variational autoencoder (VAE) with two latent dimensions and a conditional variational autoencoder (CVAE) with one latent dimension. Then, use your VAE and CVAE models to visualise which latent representation the model has learned, i.e., show where images are located by the encoder and which images can be generated given a position (VAE) or position + label (CVAE).

Example: you can show the latent encoding of the dataset by passing it through the VAE encoder stage and plotting the  $\mu$ s while using the label information to color your plot.

To visualise the decoding part, span a two-dimensional grid over the entire latent representation and decode an image for each grid point; then, show all generated images in a plot matrix.

#### Attachments

vae-cvae-challenge.npz

Completing this challenge can earn you up to 10 bonus points.

Your submission must consist of a single jupyter notebook including the implementation of your models, the training process, visualisations, and explanatory text. Do not clear the figures/outputs before submitting.

You should first reproduce the VAE example plots using your own model and then adapt the visualisation for the CVAE case; with CVAE, you have only one latent dimension but also the label information.

Using your visualisations, briefly explain the difference between the latent representations of VAE and CVAE.

To ensure that we can run your submitted notebook, please restrict yourself to Python 3.5 (or later) and the packages numpy, matplotlib, keras, tensorflow, pytorch (in recent versions).

Click "Browse" to locate your file and then click "Upload" to upload your file.

File:

## Part 2