

# Image Classification using CNN

**(a) Dataloader** Download the MNIST dataset and get the dataloader in PyTorch.

**(b) Data Exploration** Pick one example from each digit and visualize them. Count the number of samples per digit in the original training data.

**(c) Modeling** Implement a Convolutional Neural Network model using Convolution layers to classify the digits in the MNIST dataset.

**(1)** Split original training data (60000 datapoints) into training and validation datasets. We also have a test dataset (10000 datapoints).

**(2)** Visualize the filter in each layer.

**(3)** Monitor the loss on the training dataset across the epochs of the CNN training. Report the overall classification accuracy on validation dataset.

**(4)** Use validation dataset to tune the hyper-parameters of the model. You may experiment on the validation set with different CNN hyper-parameters, e.g. num of layers, filter size, stride, activation function, dropout, weight regularization, etc. You may also try different loss functions and optimization methods.

**(5)** Use the best fine-tuned model for inference on test dataset. Compare the classification accuracy result with the model you had in **step 3** above.