# Homework 06

The UCI ML hand-written digits datasets contains 8x8 images of digits belonging to 10 different classes:

```
In [18]: import sklearn
         from sklearn.datasets import load_digits
         dataset = load_digits()

         x, y = dataset.data, dataset.target
         print("predictors shape =", x.shape)
         print("labels shape =", y.shape)
         print("n. unique labels =", len(np.unique(y)))
```

```
predictors shape = (1797, 64)
labels shape = (1797,)
n. unique labels = 10
```

```
In [21]: import numpy as np
         import matplotlib.pyplot as plt
         plt.figure(figsize=(8,3))
         for index, (image, label) in enumerate(zip(x[0:5], y[0:5])):
             plt.subplot(1, 5, index + 1)
             plt.imshow(np.reshape(image, (8,8)), cmap=plt.cm.gray)
             plt.title('Label: %i\n' % label, fontsize = 10)
```
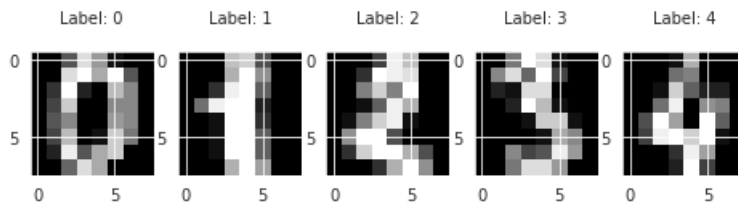

1. Normalize the matrix of predictors and perform a train/test split using `train_test_split` from `sklearn` library.
2. Use pyro to write a multinomial bayesian logistic regression model[1]. You should define both a `guide()` function and a `model()` function. Use a Categorical distributions on the outcomes to solve this multiclass classification problem.
3. Run SVI inference using pyro `Adam` optimizer and plot the ELBO loss using `matplotlib.plot` function.
4. Evaluate your model on the test data: compute the overall test accuracy and the class-wise accuracy for the 10 categories.

[1] Section "Bayesian logistic regression" in notebook 07.