

Assignment Description

Select and download one of the following image datasets:

- MNIST Fashion
- MNIST Handwritten Digits

(2 POINTS): Create a well-formatted panel of plots that illustrate 1 random example of each image class (i.e., each digit, or each clothing item).

(3 POINTS): Pick 2 classes. For each class, select 10 random images. Create a panel of 2 plots, where each plot is a histogram of the grayscale values of the 10 images for a given class (i.e., each histogram will illustrate $28 \times 28 \times 10 = 7,840$ grayscale values). Do the histograms look significantly different between the two classes?

(3 POINTS): Instantiate and train a neural network that uses the grayscale value of each pixel to predict the image class. Describe the architecture (number of layers, neurons per layer, activation functions, loss function, and optimization algorithm) of your network. Compute the total number of learnable parameters “by hand”, and compare this to the value you get by calling `model.summary()`.

(3 POINTS): Plot the model performance (loss value and accuracy) as a function of the number of training epochs. What number of training epochs do you recommend, and does the plot show any signs of overfitting?

Hint: The lecture slides, as well as Chapter 3 of Michelucci’s 2nd edition, contain code that you can use if you’d like:

- Michelucci, U. (2022). *Applied deep learning with TensorFlow 2* (p. 99). 2nd Edition. Springer, Berlin, Germany.
- https://adl.toelt.ai/FFNN/Multiclass_classification_with_fully_connected_networks.html

Deliverable

(2 POINTS): Turn in a clean, well-formatted short report describing your process and results, along with code snippets for important steps, and your own interpretations of the modeling exercise.

(2 POINTS): Include a short section (at least one paragraph) describing your initial ideas for a semester project. What type of AI task are you interested in exploring (e.g., image classification, artistic image alteration, text generation, AI safety, AI uncertainty analysis, time-series analysis, traditional regression/classification, or something else)? What might your research question be? Do you have any ideas on a dataset (for example those available in TensorFlow, or something on Kaggle)?