1 Learning about PyTorch

PyTorch is a Python library that is widely used for deep learning. PyTorch greatly simplifies the process of building deep learning models, training them via backpropagation and stochastic gradients, loading and processing data, and more. You will need to gain a working understanding of PyTorch in order to successfully complete the homework, and this understanding will quite possibly benefit you later on in your future machine learning endeavors.

For this discussion, you will use `https://pytorch.org/tutorials/beginner/deep_learning_60min_blitz.html` as a reference to answer the questions below, rather than lecture materials. If you are not yet familiar with PyTorch, it is strongly encouraged that you review this excellent tutorial in detail before diving into the homework assignment. For the purposes of today's discussion, do your best to skim through the tutorial and search for the answers to the questions. Some of these answers will not be directly provided in the text and will instead require you to read the code and infer the behavior of certain functions.

(a) Compare and contrast NumPy's `ndarray` with PyTorch's `tensor`. In what ways are these two types similar? In what ways are they different?

(b) What is the purpose of the `torch.nn.Module` class? What functionality does it provide?

(c) What function is required to make a `Module` callable? What does calling the `Module` do for neural networks?

(d) What PyTorch function is used when moving between convolution layers and fully connected layers in a neural network forward pass?

(e) How is backpropagation performed in PyTorch?

(f) What is the purpose of the `zero_grad` method? What happens if this method is not called?

(g) How are model updates (e.g., via stochastic gradients) performed in PyTorch?

(h) What PyTorch class is responsible for processing and providing batches of data for training and testing? Briefly describe how it is constructed and used.

(i) How does one take advantage of GPUs when training and testing PyTorch models?