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HW5 — Conv Neural Network

Please submit your solutions in the jupyter notebook file (i.e., ipynb)

1 Programming Assignment

1. Take the "MNIST-CNN.ipynb" and "MNIST-ResNet.ipynb" as your start point:
   (a) Build a customized data set, $\mathcal{D}$, with labels of only two digits (e.g., images with labels of only 1 and 3). Pick a data set size that aligns with your computational capability. Show me your code. Plot a subset of your customized data set.
   (b) Train a CNN model with $\mathcal{D}$. Sweep the data set once (i.e., with 1 epoch) with your choice of batch size, optimizer, and other configurations. Show me your code.
   (c) Using the same data loader and train-test split, train a ResNet model with $\mathcal{D}$. Sweep the data set once (i.e., with 1 epoch) with your choice of batch size, optimizer, and other configurations. Show me your code.
   (d) Using the same data loader and train-test split, train a Feedforward Neural Network (NN) model with $\mathcal{D}$. Sweep the data set once (i.e., with 1 epoch) with your choice of batch size, optimizer, and other configurations. Show me your code.

2 Definitions & Concepts

You **must** create a "Markdown" block for this part in your jupyter notebook

1. Consider a CNN layer with the following characteristics:
   - Input volume size: 32x32x3 (where 32x32 is the spatial dimension of the input, and 3 is the number of input channels, e.g., RGB image)
   - Number of conv kernels: 10
   - Kernel size: 5×5
   - Stride: 1
   - Padding: 0

   (a) How many parameters does the above model have?
   (b) What is the minimum size of the image that still allows the above model to remain functional and compatible?
2. What is the key problem that ResNet aims to address in deep neural networks?
3. What is the key problem that dropout aims to address in deep neural networks?

Submitted by Bowen Weng on .