EN4553 2020: Assignment 3 on Learning

December 20, 2020

This assignment is on learning and deep learning in vision. Please note that you must implement the Python functions and scripts that concern the intention of the question on your own. If you copy from the Internet or others, you will not get the learning experience intended through this assignment. This exercise will help you to confidently face the final examination too.

1. Implement a two-layer fully-connected network for CIFAR10 with single batch (GD) backpropagation implemented on your own.   [2 marks]

2. Repeat 1 with automatic gradient computation, e.g., using GradientTape() in TensorFlow. Verify that the gradients are the same as in 1 with a known weight initialization.

3. Plot the value of the loss function for weights $\theta_t^\alpha = (1-\alpha)\theta_t + \alpha\theta_{t+1}$ for 10 values of $\alpha \in [0,1]$ for 30 epochs. Here θ_t is the set of weights at epoch t. Comment on the observation.

4. Construct a CNN for MNIST (10 classes) with the following configuration:

$$C32, C64, C64, F64, D10.$$

   All convolutions are 3×3 convolutions with no padding and 2×2 pooling (stride 2) follows convolutions layers. Activation: ReLU, except for the last layer (softmax). Optimizer: Adam with default parameters. Loss: sparse categorical cross entropy.

   (a) Train this for two epochs with a batch size of 32.

   (b) Save the model (the structure and weights).

   (c) Loading this saved model, transfer learn for MNIST with two classes (class 1: digit 0 to digit 4, class 2: digit 5 to digit 9). Run 3 epochs.

   (d) Do fine tuning. Run 2 epochs.

   For each of the above items, report the test loss and the accuracy.

   Upload a report named as your_index_a03.pdf. The report must include important parts of code, and comparison of results. The interpretation of results and the discussion are important in the report. The report must be six pages or less. Extra-page penalty is 2 marks per page.

References