

ECE/CS/ME 539 – Fall 2024 — Homework 10

Instructions

The following problems explore different transfer learning techniques using the VGG11 model. For each problem, use the provided starter code to load data, define the model, and train according to the specified method.

Problem 1: Full Fine-Tuning with VGG11

In this problem, you will perform full fine-tuning on a VGG11 model. Full fine-tuning allows all layers of the pre-trained model to be updated during training, helping it adapt entirely to the target dataset.

Instructions

- Use the VGG11 model pre-trained on ImageNet.
- Replace the final fully connected layer to match the number of classes in your target dataset.
- Fine-tune all layers of the model on DTD dataset.
- Use the provided code snippets to assist with loading the data, defining the model, and training.

Problem 2: Linear Probing with VGG11

In this problem, you will use linear probing to adapt a VGG11 model to a new dataset. Linear probing freezes the pre-trained weights in all layers except the final layer, which will be trained from scratch. This approach often requires less computation than full fine-tuning and can help avoid overfitting when data is limited.

Instructions

- Use the VGG11 model pre-trained on ImageNet.
- Replace only the final fully connected layer to match the target dataset classes and train it, keeping all other layers frozen.
- Use the provided starter code to initialize, modify, and train the model with linear probing.

Problem 3: Applying LoRA on VGG11

In this problem, you will apply LoRA (Low-Rank Adaptation) to the VGG11 model. LoRA is an efficient fine-tuning technique that modifies only a subset of parameters by introducing low-rank matrices in certain layers, reducing the computational and memory cost of fine-tuning.

Instructions

- Load the pre-trained VGG11 model as in Problems 1 and 2.
- Apply LoRA to the model by adding low-rank adaptation matrices to layers in the model, and set the rank to 4.
- Train the model on the target dataset with only the LoRA and the final fully connected layer.