Assignment 4

This assignment covers image classification with deep learning. You will train and evaluate three different categories of networks on the Food101 dataset. For each model, it is recommended that you implement them using PyTorch Lightning. Feel free to adapt the code from the demos we did in class (available on GitHub) or from any of the examples provided on PyTorch Lightning's website.

A Basic CNN

The first network will be a *basic* CNN. That is, this network should include some number of convolutional layers followed by fully connected layers. There is no size requirement to this network nor is there a performance requirement. Train the model for up to 50 epochs. Feel free to implement early stopping in case the model begins to overfit.

In your report, describe the chosen architecture and report the training loss, validation loss, and final test accuracy of the model.

All Convolutional Net

Create an all convolutional model and train it on the Food101 dataset. Compare the number of total parameters in this model versus the basic CNN used in the previous section. Train the model for up to 50 epochs. Feel free to implement early stopping.

In your report, describe the chosen architecture and report the training loss, validation loss, and final test accuracy of the model.

Regularization

Pick one of the models you used in the previous two sections and add regularization in the form of data augmentation or dropout. Limit your training to 50 epochs on each model.

Include the final training and accuracy plots from Tensorboard in your report.

Transfer Learning

Transfer learning is an effective way to leverage features learned from another task into a new task. For this part, use a pre-trained model provided by `torchvision` and fine-tune it on the Food101 datset.

Examples of how to use a pre-trained model can be found here: `https://pytorch-lightning.readthedocs.io/en/stable/advanced/transfer_learning.html`

In your report, describe the pre-trained model you chose to use and chose the fine-tuning training plots along with the final model accuracy.

Bonus Round

For 10 bonus points, we will hold a class competition over 3 categories:

1. Train using a single epoch

2. Smallest network

3. Best all convolutional network

You can possibly get up to 30 bonus points, but if you win multiple categories then the runner up will also get bonus points.

Submission

Submit all your code, best model weights, and report via canvas in a zip file.