

Assignment 4 – Image Classification

Basic CNN Model

Architecture

- First convolutional layer with 16 filters of size 3x3, stride 1, and padding 1. This layer uses ReLU activation and is followed by batch normalization and max pooling.
- Second convolutional layer with 32 filters of size 3x3, stride 1, and padding 1. It also follows with ReLU, batch normalization, and max pooling.
- Third convolutional layer with 64 filters of size 3x3, stride 1, and padding 1. This layer continues the pattern with ReLU, batch normalization, and max pooling.

Performance

- Training Loss: Approximately 0.496
- Validation Loss: Approximately 1.270
- Test Accuracy: Approximately 64.10%

All Convolutional Net

Architecture

- Convolutional Layer 1 – 3
 - These layers progressively work on the input images with 96 filters each, with layer 3 including a stride of 2 for down sampling.
- Convolutional Layer 4 – 6
 - Continuing with deeper layers, filters are increased to 192, with layer 6 also using a stride of 2 for further spatial reduction.
- Convolutional Layer 7 – 8
 - Additional convolutions refine the feature maps, with layer 8 implementing a 1x1 convolution to reduce depth dimensions.
- Convolutional Layer 9
 - This final layer has several filters equal to the number of classes (10 for Imagenette). It outputs the class scores after the global average pooling.

Performance

- Training Loss: Approximately 0.660
- Validation Loss: Approximately 1.040
- Test Accuracy: Approximately 65.63%

All Convolutional Net with Regularization

Architecture

- Convolutional Layer s
 - Sequential layers identical to the prior All Convolutional Net, ranging from 96 to 192 filters, utilizing strides for down sampling in specific layers.
- Dropout
 - Two dropout layers were inserted: one after the second convolutional layer and another after the fifth.
- Data Augmentation
 - Augmentation techniques in the training data included random horizontal flips, rotations up to 10 degrees, and random resized crops.

Performance Comparison

Without Regularization

- Training Loss: Approximately 0.662
- Validation Loss: Approximately 1.035
- Test Accuracy: Approximately 65.63%

With Regularization

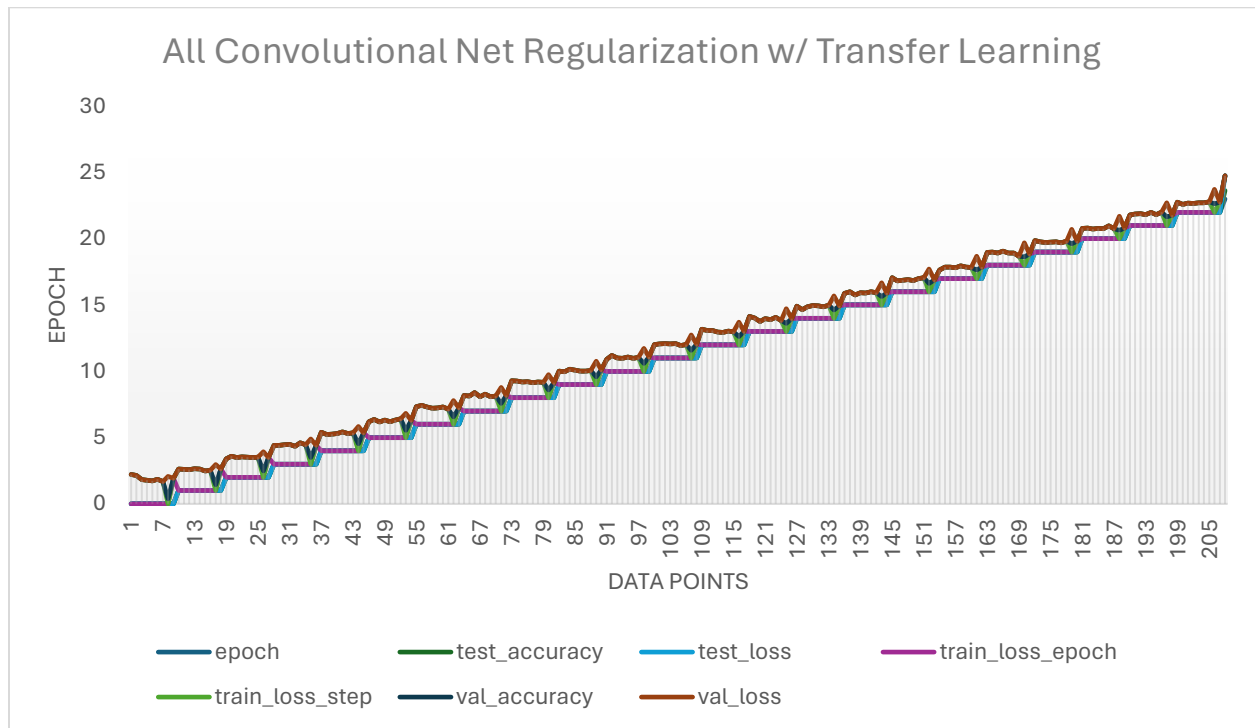
- Training Loss: Approximately 0.614
- Validation Loss: Approximately 0.948
- Test Accuracy: Approximately 69.04%

All Convolutional Net with Transfer Learning

Desired Model

- All Convolutional Net with Regularization

Training Plots



Performance

- Training Loss: Approximately 0.760
- Validation Loss: Approximately 1.080
- Test Accuracy: Approximately 63.88%

Best Model

The best model from the models trained was the All-Convolutional Net with Regularization with a test accuracy of 69.04%.