

Lab Assignment 6 – Convolutional Neural Networks Exploration

Explore different Convolutional Neural Network design choices for Digit classification using MNIST dataset.

Exploration

1. **Number of filters:** Run CNN with 1 convolution hidden layer (32 filters of 3×3), flatten layer and output layer, (with any activation function and any optimizer) for 5 epochs. Change number of filters as 4, 32, 128, 512, 2056. What is the training and testing accuracies? Print the number of parameters of the model and training time for each of these configurations.
2. **Number of Layers:** Run CNN with 1 convolution hidden layer (32 filters of 3×3), flatten layer and output layer, (with any activation function and any optimizer) for 5 epochs. Change number of convolutional layers as 2, 3, 4. What is the training and testing accuracies? Print the number of parameters of the model and training time for each of these configurations.
3. **Size of Filters:** Run CNN with 2 convolution layer (16 filters of 3×3 filter, each layer), flatten layer and output layer (with any activation function and any optimizer) for 5 epochs. Run the same architecture with different sizes of filters as 5×5 and 7×7 . What is the training and testing accuracies? Print the number of parameters of the model and training time for each of these configurations.
4. **Activation function:** Run CNN with 2 convolution layer (16 filters of 3×3 filter, each layer), flatten layer and output layer (with any optimizer) with sigmoid activation function for all layers, for 5 epochs. Change only the activation function as tanh, relu (for all layers) etc. What is the training and testing accuracies? Run the same models for 10 epochs. Any changes?
5. **Filter Size combinations:** For the 2 convolution layers use different combinations of filter sizes such as layer 1: 3×3 , layer 2: 5×5 . There can be lot of combinations like this. Which one is the best for 2 conv layer each with 16 filter architecture?
6. **Layer-filter combinations:** Run different CNN models mimicking the following structures. i.e. increase the number of filters or decrease the number of filters etc. Which one gives best accuracy? Print the number of parameters of the model and training time for each of these configurations.
7. **Influence of Striding:** Run CNN with 2 conv layer, 32 filters each of size 3×3 filters, flatten layer and output layer with any optimizer with relu activation function for all layers, for 5 epochs. Run the same model with striding 2, 3 etc. What is the training and testing accuracies? Print the number of parameters of the model and training time for each of these configurations. Run same setup for different size of filters such as 5×5 and 7×7 .
8. **Influence of Padding:** Run CNN with 2 conv layer, 32 filters each of size 3×3 filters, flatten layer and output layer with any optimizer with relu activation function for all layers, for 5 epochs. Run the same model with padding. What is the training and testing accuracies? Print the number of parameters of the model and training time for each of these configurations. Run same setup with padding for different size of filters such as 5×5 and 7×7 also. Print your analysis.
9. **Influence of Pooling:** Run CNN with 2 conv layer, 32 filters each of size 3×3 filters, flatten layer and output layer with any optimizer with relu activation function for all

layers, for 5 epochs. Run the same model with pooling 2*2, 3*3 etc. What is the training and testing accuracies? Print the number of parameters of the model and training time for each of these configurations. Run same setup with different pooling sizes for different size of filters such as 5*5 and 7*7.