CSA250: Deep Learning Project 2 Report

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Abstract

In this project, neural network and convolution neural network has been implemented for the task of classification. The classification task will be that of recognizing an image and identify it as one of ten classes. Classifiers are trained using Fashion-MNIST clothing images.

1 Introduction

Neural networks are the core of many deep learning algorithms. Neural networks are nothing but multi-layer perceptron. The effectiveness of any neural network depends on its architecture and the choice of hyper-parameters. There is a special type of neural network architecture known as convolution neural network which will be used in the task.

In this project, we are going to look at different aspects of the neural network architecture and the choice of hyper-parameters affecting the accuracy of the model. Another form of neural network is convolution neural network which are used to capture the spatial information of the image. CCNs consists of convolution layers with fully connected layers. We will encounter the problem of over-fitting and under-fitting and we will try to overcome these problems by playing with the neural network architecture and its hyper-parameters.

2 Analysis

2.1 Multi-Layered Perceptron

The problem is modelled as a classification problem with 10 categorical outputs. Input image is flattened to form an array to be used in the model. Neural network with one hidden layer has been used in the network. Relu is used as the activation function for the hidden layer. Adam optimizer is used for training the network. Loss function used in this project is cross- entropy loss function because the desired output is 10 discrete classes. Different values of hyper-parameters have been experimented to increase the accuracy of the model. I have used Batch normalization of the image before passing it to the network.

Hyper-parameters and methods	
Learning rate	0.01
Batch-size	100
Epochs	5
Regularization factor	0
Hidden layers	1
Optimizer	Adam
Output	Softmax
Loss	Cross-entropy
Activation function	Relu
Neurons in HL	500

Table 1: Experimental conditions used for the final MLP model

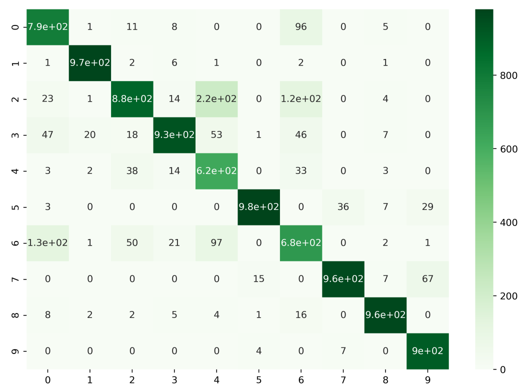

Figure 1: Confusion matrix for **MLP** model

Figure 2: Training Loss v/s number of epochs for **MLP** model

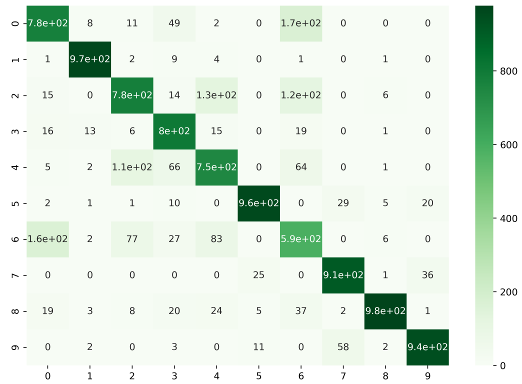

Figure 3: Confusion matrix for **CNN** model

2.2 Convolution neural network

The problem is modelled as a classification problem with 10 categorical outputs. Input image is flattened to form an array to be used in the model. Neural network with 2 convolution layers and 2 fully connected layers have been used in this task.Max-pooling layer has been used after each convolution layer. Adam optimizer has been used for this task.

Hyper-parameters and methods	
Learning rate	0.001
Batch-size	100
Epochs	5
Regularization factor	0
Convolution layers	2
Convolution layers Kernel-size	5
Fully-connected layers	3
Max-pooling layers	2
Max-pooling Stride	2
Max-pooling layers kernel-size	2
Optimizer	Adam
Output	Softmax
Loss	Cross-entropy
Activation function	Relu

Table 2: Experimental conditions used for the final CNN model

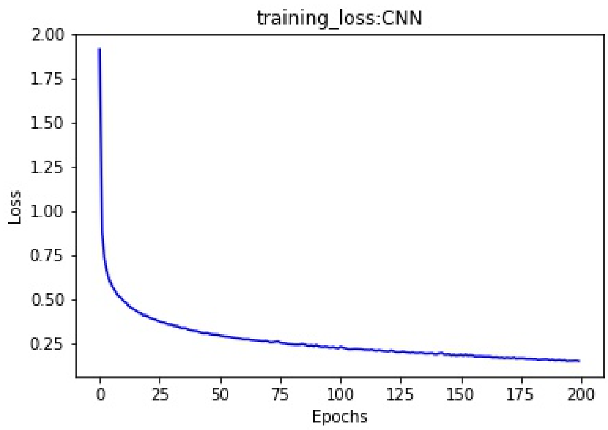

Figure 4: Training Loss v/s number of epochs for **CNN** model

3 Conclusion

It is found that CNNs work well with data that has a spatial relationship. Therefore CNNs are go-to method for any type of prediction problem involving image data as an input. The benefit of using CNNs is their ability to develop an internal representation of a two-dimensional image. This allows the model to learn position and scale in variant structures in the data, which is important when working with images.