

# Fashion MNIST Classification using Convolutional Neural Network

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Alon Benhaim

## 1 Convolutional Neural Networks

This is the summarizing table for the baseline architecture of our CNN.

Layers	Hyperparameters
Convolution 1	Kernel =(5,5,32); Stride = 1; Padding = 2; followed by BatchNorm = ?
ReLU 1	—
Avgpool 1	Kernel size = ?; Stride = ?; Padding = ?
Convolution 2	Kernel =(5,5,32); Stride = 1; Padding = 2; followed by BatchNorm = ?
ReLU 2	—
Avgpool 2	Kernel size = ?; Stride = ?; Padding = ?
Convolution 3	Kernel =(5,5,64); Stride = 1; Padding = 2; followed by BatchNorm = ?
ReLU 3	—
Avgpool 3	Kernel size = ?; Stride = ?; Padding = ?
Dropout	Probability = ?
Fully Connected Layer	Output Channels = 64; followed by BatchNorm = ?
ReLU 4	—
Fully Connected Layer	Output Channels = 10; followed by Softmax

Table 1: Baseline Architecture for Convolutional Neural Network

Using the following table we tuned on the given sets of hyperparameters to find the best network.

Kernel, Stride, Padding	Dropout	Batch Normalization
(2, 2, 0)	0.1	True
(4, 3, 1)	0.3	False
	0.5	

Table 2: Hyperparameter Options for Convolutional Neural Network

The best baseline network has the following hyper parameters:  
Kernel, Stride, Padding = (2, 2, 0), Dropout=0.1 and Batch Normalization=True.  
It was chosen based on the accuracy on the test set. We used 20 Epochs and batch size 100 for both train and test to produce the results.

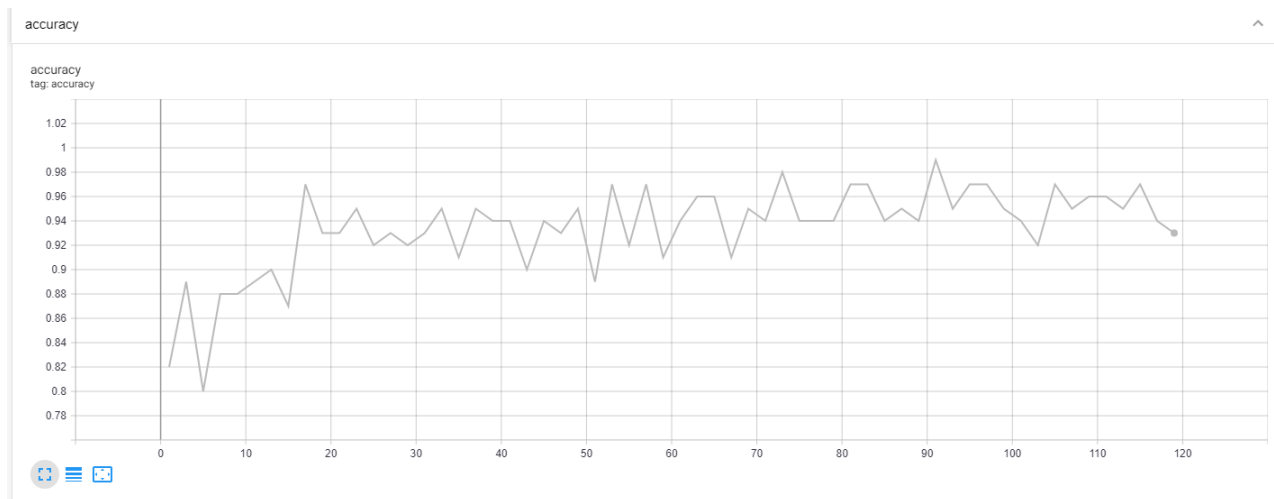


Figure 1: Accuracy curve

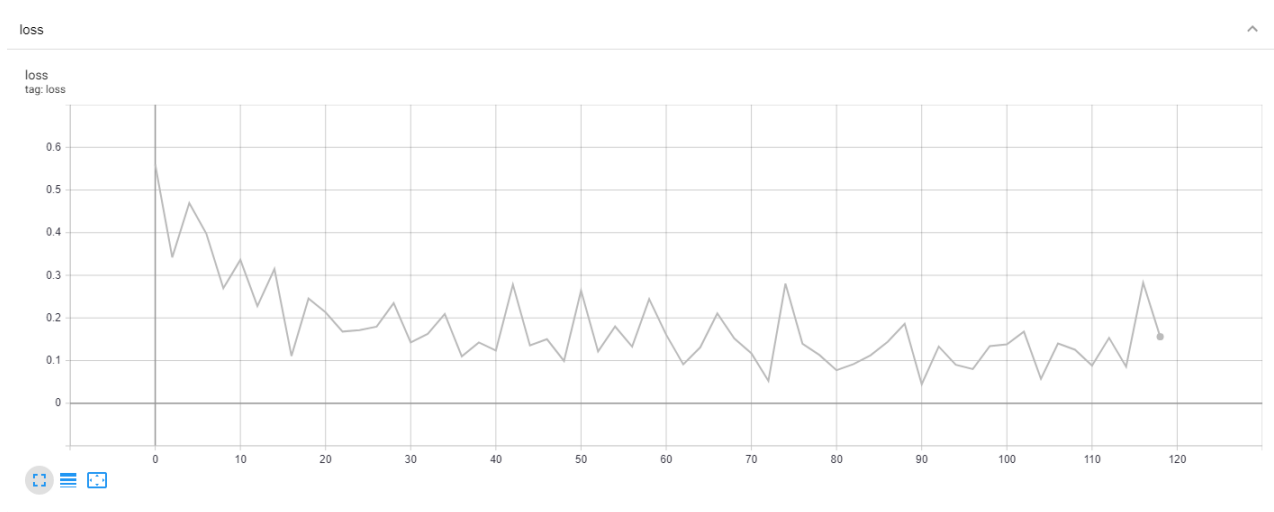


Figure 2: Loss curve

## 2 Accuracy

Overall Accuracy	92%
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Table 3: Overall Accuracy for Convolutional Neural Network

<b>Class</b>	<b>Accuracy</b>
T-shirt/top	88%
Trouser	98%
Pullover	88%
Dress	92%
Coat	83%
Sandal	98%
Shirt	79%
Sneaker	98%
Bag	99%
Ankle boot	95%

Table 4: Per Class Accuracy for Convolutional Neural Network

Most problematic classes are: Coat and Shirt. Possible reasons for low accuracy for these classes is that the network confuses a shirt/coat with a T-shirt/top or pullover. The first layers of the network are probably learning edge detection. The outline for the perimeter of the coat/shirt is pretty similar to that of the T-shirt/top and pullover so it makes sense that the network is finding it harder to distinguish than say, the trousers.

I ran a quick test to verify this (code is commented on the last section). When the network was incorrect about Shirt it thought the label was T-Shirt/top or pullover 62% of the times. When the network was incorrect about Coat it thought the label was Shirt or pullover 80% of the times. It is also evident that T-Shirt/top and pullover are the least accurate of the non-problematic classes.