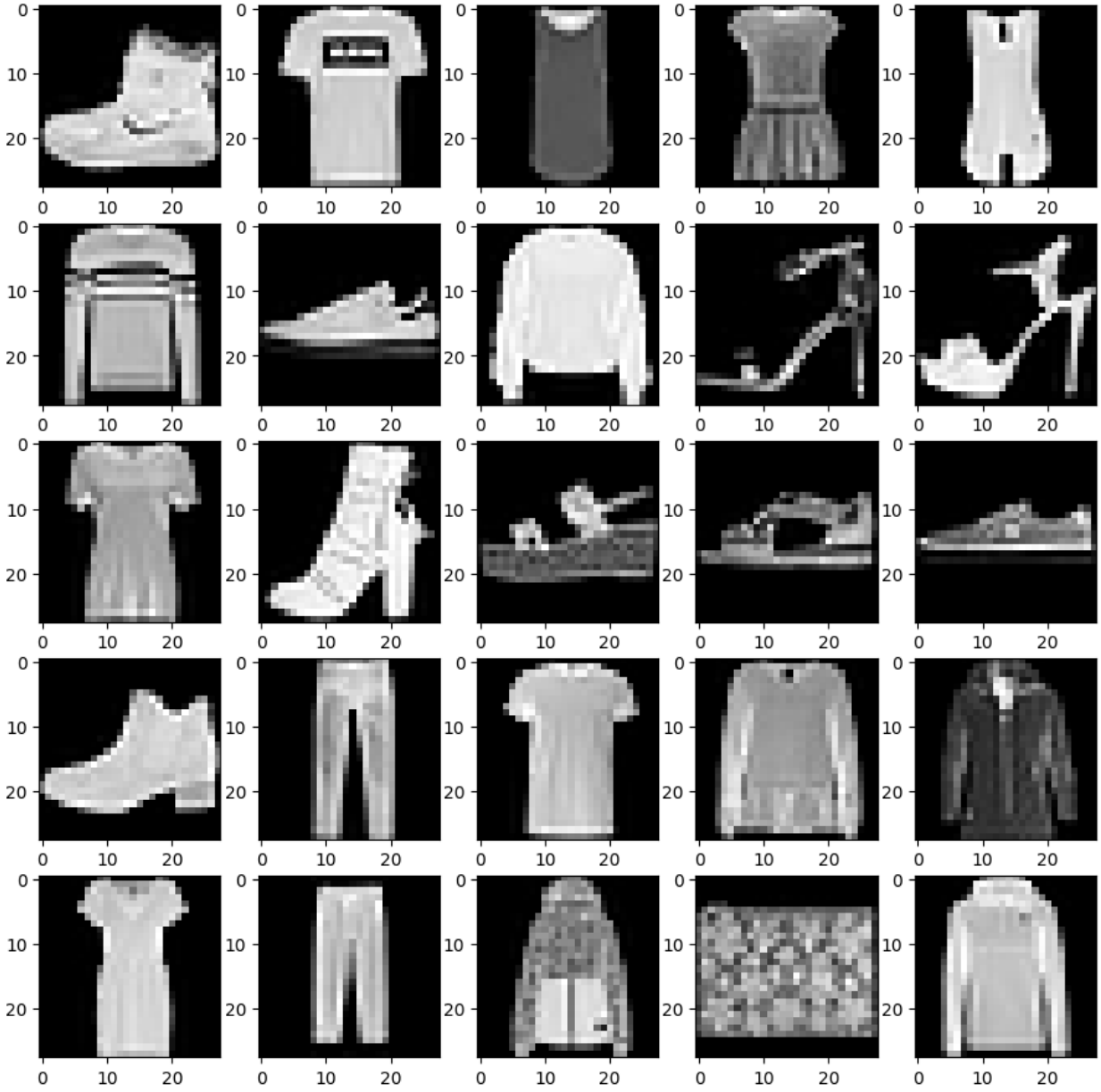
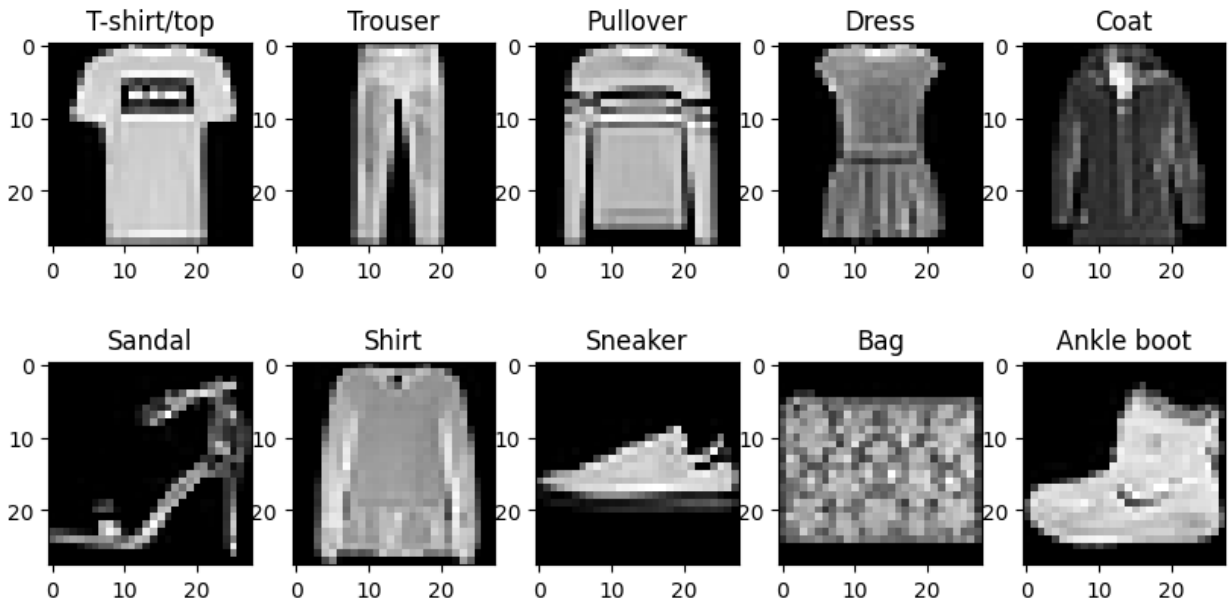
Dataset Description and Visualization

The Fashion MNIST dataset contains labeled images of wardrobe items. The dataset is split into test and training sets. The training dataset has 60,000 28 x 28 grayscale images and the test set has 10,000 28 x 28 images. Each pixel can take on values from 0 to 255. Each image is labeled with an integer value 0 to 9 corresponding to a class.

The first 25 images in the training data set are shown in the grid below to get a sense of what the data looks like.



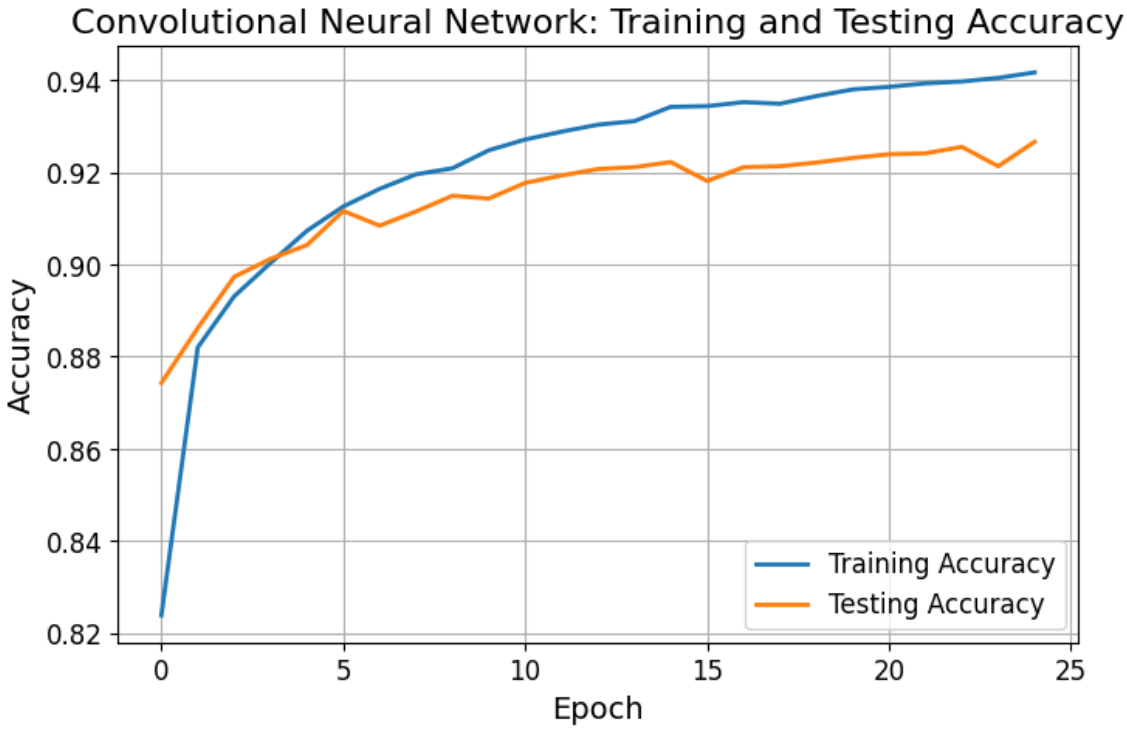
One sample from each of the 10 classes is shown in the figure below. Some items appear more distinctly than others.

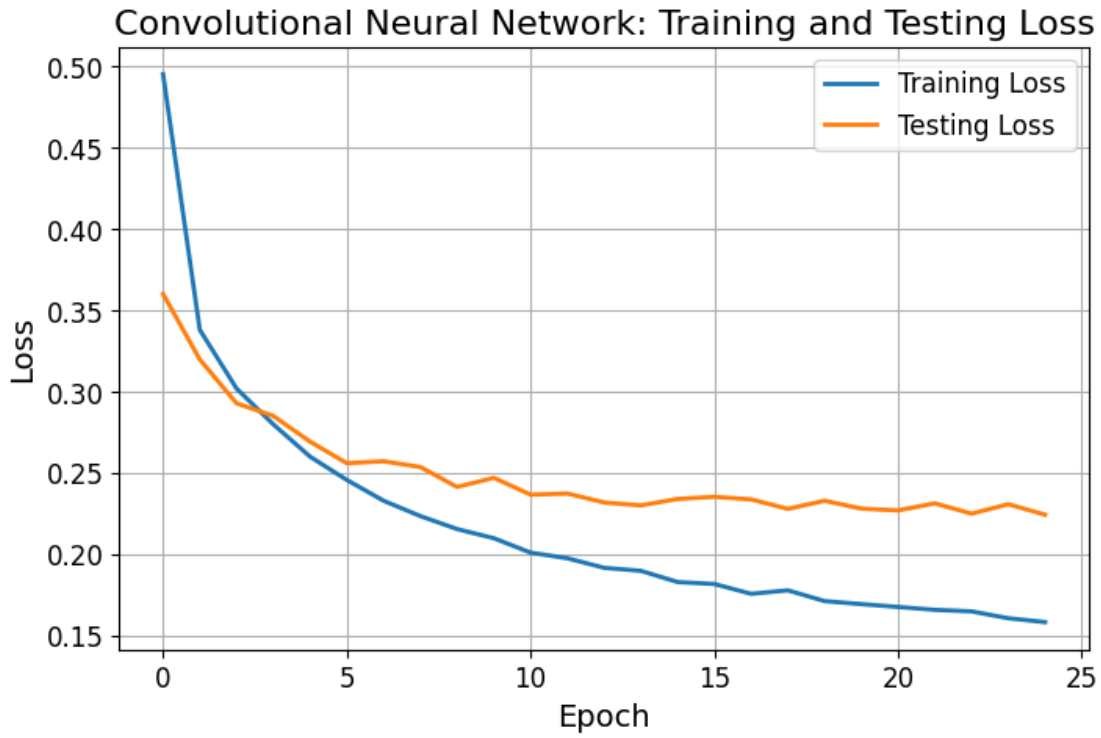


Convolutional Neural Network

Keras was used to build a basic CNN with two hidden layers to classify the images in the training set. The input is 28x28x1 images. The network consists of two convolution layers, a maximum pooling layer, a dropout layer, and a fully connected layer for the output layer. The convolution layers use the ReLU activation function. The output layer uses the softmax activation function. In both convolution layers, the kernel size is kept at 3x3, the stride is left as the default value of (1, 1), and no padding is used. Sixteen filters are used in the first convolution layer and this number is increased to 32 for the second convolution layer. The max pooling layer uses a pooling size of (2, 2) and a rate of 0.4 is used for the dropout. Both the pooling layer and dropout provide regularization that outperformed the L1 and L2 regularizations tested in the convolution layers.

The CNN achieved a testing accuracy of 92.7% and a training accuracy of 94.2%. These accuracies are comparable, indicating that the model is not overfit. The accuracy and loss profiles for the training and testing sets are shown on the next page.


Convolutional Neural Network: Training and Testing Accuracy
Accuracy
Epoch
Training Accuracy
Testing Accuracy
0.94
0.92
0.90
0.88
0.86
0.84
0.82
0
5
10
15
20
25


Convolutional Neural Network: Training and Testing Loss
Loss
Epoch
Training Loss
Testing Loss
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0
5
10
15
20
25

References

Keras Documentation

https://keras.io/api/layers/activations/

https://keras.io/api/layers/convolution_layers/convolution2d/

https://www.tensorflow.org/guide/keras/preprocessing_layers#:~:text=The%20Keras%20preprocessing%20layers%20API,part%20of%20a%20Keras%20SavedModel

Pandas Documentation

https://pandas.pydata.org/docs/reference/api/pandas.DataFrame.dropna.html

Zalando Research, Fashion-MNIST

https://github.com/zalandoresearch/fashion-mnist