**Convolutional Neural Network on Fashion MNIST Dataset**

**Dataset Description:** Fashion-MNIST is a dataset of Zalando's article images—consisting of a training set of 60,000 examples and a test set of 10,000 examples. Each example is a 28x28 grayscale image, associated with a label from 10 classes. The pixel-value is an integer between 0 and 255. The training and test data sets have 785 columns.

**Labels:** Each training and test example is assigned to one of the following labels:

0. T-shirt/top

1. Trouser

2. Pullover

3. Dress

4. Coat

5. Sandal

6. Shirt

7. Sneaker

8. Bag

9. Ankle boot

**Pre-processing:** The pre-processing steps applied to the dataset include resizing images to a consistent size, normalizing pixel values to the range [0, 1], and splitting the data into training, validation, and testing sets. Data augmentation techniques such as rotation, shifting, shear, zoom, and horizontal flip were employed to increase dataset size and enhance model robustness.

**CNN Architecture:** The Convolutional Neural Network (CNN) architecture selected, consists of two convolutional layers with rectified linear unit (ReLU) activation, max-pooling layers, and fully connected layers. ReLU activation helps introduce non-linearity, while max-pooling layers downsample the spatial dimensions, reducing computational complexity and enhancing translation invariance.

**Training Process and Hyperparameter Tuning:** The model was trained using the Adam optimizer and the sparse categorical cross-entropy loss function. Hyperparameters like learning rate, epochs, and batch size were not extensively tuned due to the scope.

**Performance Metrics and Visualizations**: The model achieved a test accuracy of **0.887**. Visualizations included plots of training and validation accuracy over epochs, demonstrating the model's learning progress.

**Limitations:** Model Complexity: The CNN architecture is relatively simple. More complex architectures or pre-trained models might capture intricate patterns in fashion images.