Fashion-MNIST Classification using ANN and CNN

Name: Velama Mallikarjuna Rao

P number:P2910768

Problem:

The Fashion-MNIST dataset was used in the creation and assessment of Artificial Neural Network (ANN) and Convolutional Neural Network (CNN) models for picture categorization in this paper. The project's goal was to evaluate how well convolution-based models and conventional fully linked architectures recognized fashion products in ten different categories.

Dataset and Preprocessing:

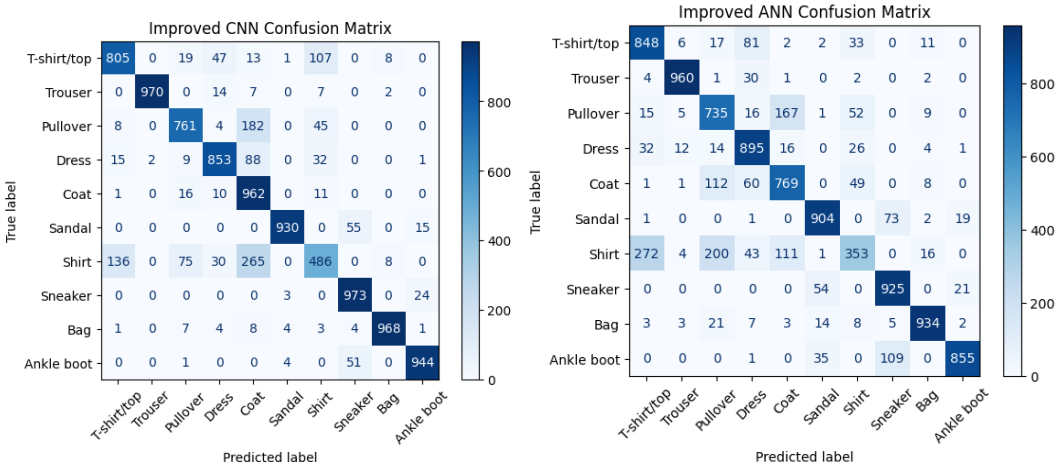
Ten apparel categories are represented by the 60,000 training and 10,000 testing grayscale images (28 x 28 pixels) in the Fashion-MNIST dataset. The training data was divided into 80% for training and 20% for validation, and the images were normalized to the range (-1, 1). When available, CUDA was used for computing, and data loaders with a batch size of 64 were written in PyTorch.

Model Architectures:

Three fully connected layers (784–256–128–10) with ReLU activations and 0.3 dropout made up the ANN model. Two convolutional layers (32 and 64 filters) with ReLU activations, max pooling, and two dense layers with 0.5 dropout were included in the CNN model. The Adam optimizer (learning rate = 0.001) and the CrossEntropy loss function were used in both models.

Results and Analysis:

The CNN scored 91.79% and 90.79% validation and test accuracy, respectively, whereas the ANN achieved 88.18% and 86.98% test and validation accuracy. The CNN's capacity to extract spatial features allowed it to show superior generalization capabilities. The majority of confusion was found between related categories, such as pullover, coat, and shirt, according to confusion matrix study. There was little overfitting and clean convergence of the learning curves.



Innovations and Improvements:

The Adam optimizer was chosen for effective learning rate adaptation, and dropout regularization (0.3 in ANN, 0.5 in CNN) was added to enhance performance. To further improve generalization, future developments might use more convolutional layers, learning rate scheduling, and data augmentation.

Conclusion:

In image classification tasks, the study verified that convolutional designs perform better than conventional fully connected networks. The CNN's capacity to recognize spatial hierarchies in picture data allowed it to attain greater accuracy and superior generalization. Through the use of PyTorch and the Fashion-MNIST dataset, this project offered invaluable expertise in model creation, training, and evaluation.