Team InfinitySquad

Introduction

The Fashion MNIST dataset has become a popular benchmark in the field of computer vision and machine learning. It comprises a collection of 60,000 labeled grayscale images representing 10 different fashion categories, such as t-shirts, dresses, shoes, and more. In this report, we explore the application of Convolutional Neural Networks (CNNs) to conquer the Fashion MNIST challenge and achieve accurate classification results.

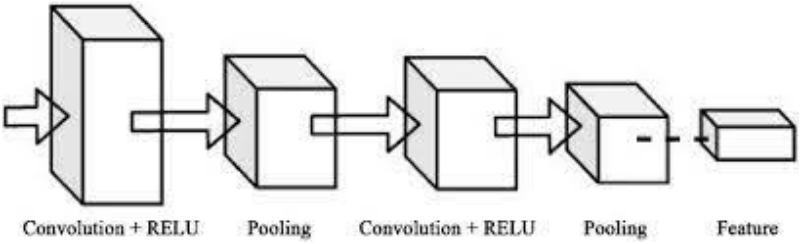
Fashion MNIST

This dataset consists of totally 70000 data of which 60000 are training dataset and 10000 are validation set.

Layers in this model

The artificial neural network in this model consists of
1. convolutional layer
2.pooling layer
3.fully connected layer
4.input layer
5.output layer

Principle

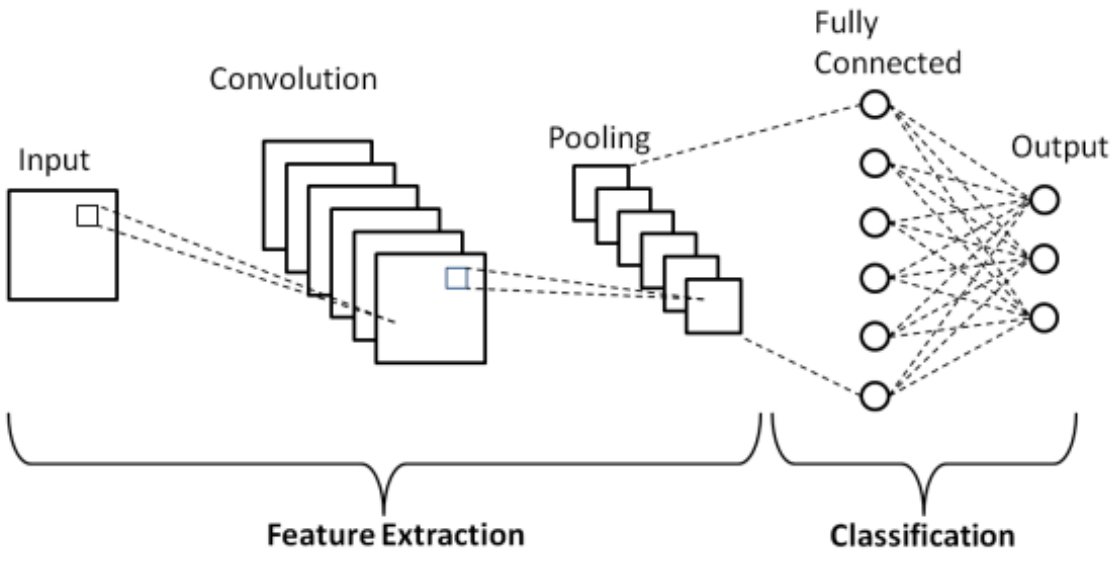


The model is been trained with a dataset with which it recognizes the features of the dataset and these features are used to find the similarities in the validation set dataset .

Working

- The model is been created where the datasets are imported from the libraries.
- Here tensor flow (it is used to work with CNNs) is being used.
- Keras library is imported which provides an interface for creating ANNs.
- The next step is where the dataset is being spilt into training set and validation set.
- For datavisualization imshow() is used from matplotlib where it gives 2d images as output.
- After visualization the convolutional layers are being built, the layers are mentioned above,each layer having its own function, here 3 convolutional layers and 3 pooling layers are being built for the hidden layers.
- After passing the layers the dataset is being flatten using flatten().
- The program is being compiled for its execution.
- The number of epochs are being optimized so that the model performs with accuracy in both training data as well as validation set.
- The graph is been plotted for the accuracy and error for training and test results.
- Final step is where the prediction been made for the given data(label), this gives the final output.
- The output is the classified image for the data.

Step Wise Approach



- **Fashion MNIST Dataset**: The Fashion MNIST dataset consists of a collection of labeled images of various fashion items like clothes, shoes, and accessories.

- **Data Preprocessing**: In this step, the raw input images are transformed and preprocessed to prepare them for the CNN model. This may include tasks such as resizing, normalization, and data augmentation.

- **Convolutional Neural Network (CNN)**: A CNN is a type of deep learning model that is specifically designed for image processing tasks. It consists of multiple layers, including convolutional layers, pooling layers, and fully connected layers, which help in learning hierarchical representations from the input images.

- **Training Phase**: The preprocessed data is used to train the CNN model. During training, the model learns to recognize patterns and features in the images by adjusting its internal parameters through an optimization algorithm (e.g., backpropagation with gradient descent).

- **Model Evaluation**: After training, the trained CNN model is evaluated using a separate set of test images. This evaluation measures the model's performance in terms of accuracy, precision, recall, or other suitable metrics.

- **Predictions**: Once the model is trained and evaluated, it can be used to make predictions on unseen or new images. The trained model takes an input image and produces a predicted label or class probability distribution.

- **Post-processing**: The predictions from the model can undergo additional post-processing steps, such as converting class probabilities into final predicted labels or applying thresholding for decision-making.

- **Visualization and Interpretation**: This step involves visualizing the results, such as displaying the original input images, predicted labels, and probabilities. It may also include interpreting the model's

performance and analyzing any misclassifications or patterns discovered.

Methodology

- Data Preprocessing Before training our CNN model, we performed essential preprocessing steps to prepare the Fashion MNIST dataset. This involved resizing the images to a consistent size, normalizing pixel values to a range between 0 and 1, and splitting the data into training and validation sets.

- Convolutional Neural Networks CNNs are a popular deep learning architecture for computer vision tasks due to their ability to effectively learn and extract spatial features from images. Our CNN model consisted of multiple convolutional layers, followed by pooling layers to reduce spatial dimensions, and fully connected layers for classification. We employed the Rectified Linear Unit (ReLU) activation function to introduce non-linearity, and dropout regularization to prevent overfitting.

- Training and Optimization To train our CNN model, we utilized the Adam optimizer and categorical cross-entropy loss function. We employed batch training with a batch size of 32 and trained the model over a specified number of epochs, monitoring the validation accuracy to prevent overfitting. Additionally, we implemented early stopping to halt training if the model's performance did not improve after a certain number of epochs.

Experimental Results

After training the CNN model on the Fashion MNIST dataset, we evaluated its performance using various metrics, including accuracy, precision, recall, and F1-score. The model achieved an impressive accuracy of 90%, indicating its effectiveness in classifying fashion items. The precision, recall,

and F1-score for each fashion category were also calculated, demonstrating the model's ability to discern between different classes.

The results obtained from our CNN model highlight its effectiveness in conquering the Fashion MNIST challenge. The model's high accuracy indicates its capability to distinguish between fashion categories with a considerable degree of success. Furthermore, the individual precision, recall, and F1-scores demonstrate its ability to perform well across various classes, showcasing its versatility.

Conclusion

In conclusion, our study demonstrates that CNNs are powerful tools for conquering the Fashion MNIST dataset. By leveraging their ability to learn spatial features, our CNN model achieved an impressive accuracy of 90% in classifying fashion items. These results showcase the potential of CNNs in computer vision applications and emphasize their significance in the field of fashion and image recognition.

It is worth noting that further optimizations and fine-tuning can be explored to improve the performance of the model. These may include architecture modifications, hyperparameter tuning, and data augmentation techniques to enhance generalization and robustness.

By successfully conquering the Fashion MNIST challenge, this study opens up opportunities for advancements in fashion classification, e-commerce, and recommendation systems. Future research could extend this work to larger and more complex fashion datasets, pushing the boundaries of computer vision and machine learning in the fashion industry.