Tasks Performed

1. **Data Loading and Exploration**: We started by loading the Fashion MNIST dataset using the TensorFlow library. The dataset consists of 70,000 images, with 60,000 for training and 10,000 for testing. We visualized the shape of the data and displayed the first 10 images along with their corresponding class labels.

2. **Data Preprocessing**: We performed data preprocessing by converting the class labels into categorical format and normalizing the pixel values of the images between 0 and 1. We also split the training data into training and validation sets for model evaluation.

3. **Convolutional Neural Network (CNN):** We built a CNN model using the Sequential API from Keras. The model consisted of multiple convolutional, batch normalization, max pooling, and dropout layers, followed by fully connected layers. The model was compiled with the Adam optimizer and categorical cross-entropy loss function.

4. **Model Training:** We trained the model using the training data and applied data augmentation techniques using the ImageDataGenerator to improve the model's generalization ability. We ran the initial training for 10 epochs.
Results:

```
Epoch 1/10
1500/1500 [==============================] - 69s 39ms/step - loss: 1.0401 - accuracy: 0.6227
Epoch 2/10
1500/1500 [==============================] - 62s 41ms/step - loss: 0.6564 - accuracy: 0.7565
Epoch 3/10
1500/1500 [==============================] - 58s 39ms/step - loss: 0.5885 - accuracy: 0.7853
Epoch 4/10
1500/1500 [==============================] - 56s 37ms/step - loss: 0.5353 - accuracy: 0.8033
Epoch 5/10
1500/1500 [==============================] - 56s 37ms/step - loss: 0.4999 - accuracy: 0.8171
Epoch 6/10
1500/1500 [==============================] - 57s 38ms/step - loss: 0.4787 - accuracy: 0.8248
Epoch 7/10
1500/1500 [==============================] - 71s 47ms/step - loss: 0.4548 - accuracy: 0.8342
Epoch 8/10
1500/1500 [==============================] - 65s 43ms/step - loss: 0.4422 - accuracy: 0.8391
Epoch 9/10
1500/1500 [==============================] - 58s 39ms/step - loss: 0.4275 - accuracy: 0.8438
Epoch 10/10
1500/1500 [==============================] - 60s 40ms/step - loss: 0.4107 - accuracy: 0.8506
```

5. **Model Evaluation:** After the initial training, we evaluated the model's performance using the validation set. We observed the training and validation accuracy over the epochs to analyze the model's learning progress. Additionally, we calculated the test accuracy to assess the model's

performance on unseen data. We achieved a training accuracy of 99.6%, a validation accuracy of 94.67% and a test accuracy of 94.37%.

```
Epoch 45/50
1500/1500 [==============================] - 22s 15ms/step - loss: 0.0211 - accuracy: 0.9926 - val_loss: 0.3061 - val_accuracy: 0.9441
Epoch 46/50
1500/1500 [==============================] - 23s 16ms/step - loss: 0.0207 - accuracy: 0.9927 - val_loss: 0.2972 - val_accuracy: 0.9457
Epoch 47/50
1500/1500 [==============================] - 23s 15ms/step - loss: 0.0237 - accuracy: 0.9916 - val_loss: 0.2822 - val_accuracy: 0.9463
Epoch 48/50
1500/1500 [==============================] - 21s 14ms/step - loss: 0.0194 - accuracy: 0.9930 - val_loss: 0.3077 - val_accuracy: 0.9452
Epoch 49/50
1500/1500 [==============================] - 22s 14ms/step - loss: 0.0196 - accuracy: 0.9930 - val_loss: 0.3124 - val_accuracy: 0.9463
Epoch 50/50
1500/1500 [==============================] - 22s 15ms/step - loss: 0.0194 - accuracy: 0.9929 - val_loss: 0.3089 - val_accuracy: 0.9467
```

6. **Classification Report:** We generated a classification report to obtain a detailed evaluation of the model's performance on the test data. The report includes metrics such as precision, recall, F1-score, and support for each class.

	precision	recall	f1-score	support
T-shirt/top	0.89	0.91	0.90	1000
Trouser	1.00	0.99	0.99	1000
Pullover	0.94	0.91	0.92	1000
Dress	0.93	0.96	0.95	1000
Coat	0.90	0.92	0.91	1000
Sandal	0.99	0.99	0.99	1000
Shirt	0.84	0.82	0.83	1000
Sneaker	0.97	0.98	0.98	1000
Bag	0.99	0.99	0.99	1000
Ankle boot	0.98	0.97	0.97	1000
accuracy			0.94	10000
macro avg	0.94	0.94	0.94	10000
weighted avg	0.94	0.94	0.94	10000

Tests Carried Out

During the project, we performed several tests to improve the model's accuracy and evaluate its performance:

1. Initial Training: We trained the model for 10 epochs using the training data and observed the training and validation accuracy.

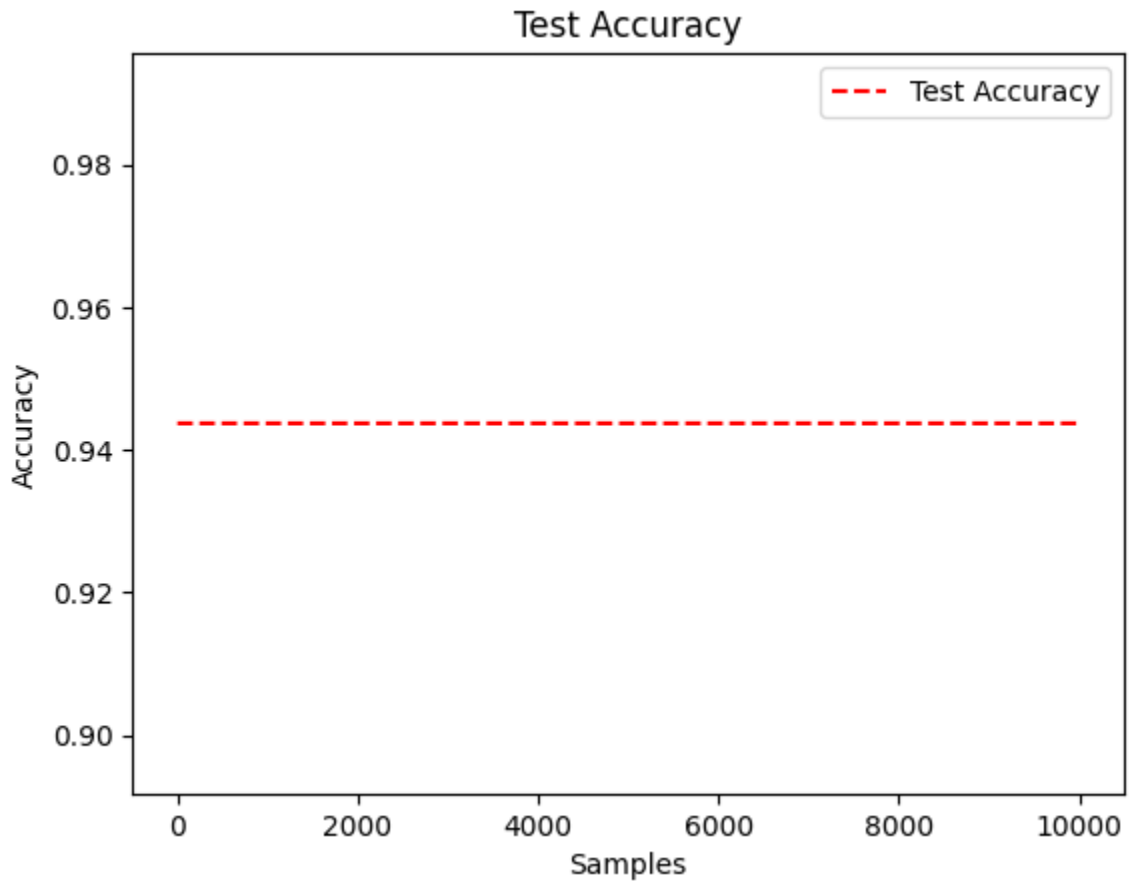
2. Hyperparameter Tuning: We experimented with different hyperparameters such as the number of convolutional layers, filter sizes, pooling sizes, and dropout rates to find the optimal configuration for the model.

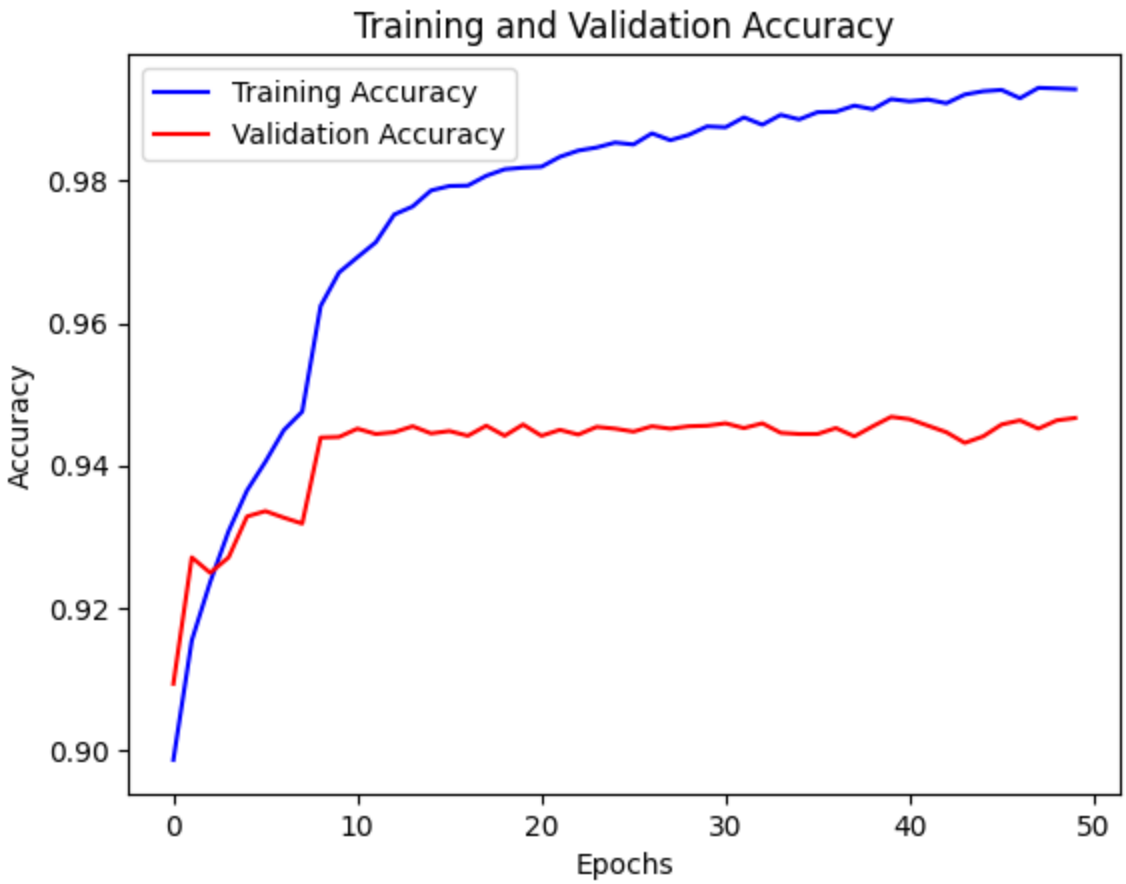
Final Accuracy

After training the model for a total of 50 epochs, the final accuracy achieved on the test set was 94.37%..

The model demonstrated good performance in classifying clothing items with a high accuracy rate.

Overall, the project successfully developed a CNN model for the Fashion MNIST dataset and achieved significant accuracy in classifying clothing items. The model can be further enhanced and deployed for real-world applications in the fashion industry.




Training and Validation Accuracy
Training Accuracy
Validation Accuracy
Accuracy
0.90
0.92
0.94
0.96
0.98
0
10
20
30
40
50
Epochs