https://colab.research.google.com/github/google-gemini/cookbook/blob/main/templates/aistudio_gemini_prompt_freeform.ipynb

```
# import necessary modules.
import base64
import copy
import json
import pathlib
import requests


import PIL.Image
import IPython.display
from IPython.display import Markdown

try:
    # The SDK will automatically read it from the GOOGLE_API_KEY
environment variable.
    # In Colab get the key from Colab-secrets ("🔑" in the left panel).
    import os
    from google.colab import userdata

    os.environ["GOOGLE_API_KEY"] = userdata.get("GOOGLE_API_KEY")
except ImportError:
    pass

import google.generativeai as genai

# Parse the arguments

model = 'gemini-2.0-flash-exp' # @param {isTemplate: true}
contents_b64 =
'W3sicGFydHMiOlt7InRleHQiOiJpbXBvcnQgdG9yY2hcXG5pbXBvcnQgdG9yY2gubm4gYXMgb
m5cXG5pbXBvcnQgdG9yY2gub3B0aW0gYXMgb3B0aW1cXG5mcm9tIHRvcmNodmlzaW9uIGltcG9
ydCBkYXRhc2V0cywgdHJhbnNmb3Jtc1xcbmZyb20gdG9yY2gudXRpbHMuZGF0YSBpbXBvcnQgR
GF0YUxvYWRlclxcbmZyb20gc2tsZWFybi5tZXRyaWNzIGltcG9ydCBjbGFzc2lmaWNhdGlvbl9
yZXBvcnRcXG5pbXBvcnQgbWF0cGxvdGxpYi5weXBsb3QgYXMgcGx0XFxuIyBEZXZpY2UgY
29uZmlndXJhdGlvblxcbmRldmljZSA9IHRvcmNoLmRldmljZSgnY3VkYScgaWYgdG9yY2guY3V
kYS5pc19hdmFpbGFibGUoKSBlbHNlICdjcHUnKVxcblxcbiMgSHlwZXJwYXJhbWV0ZXJzFxub
nVtX2Vwb2NocyA9IDNcXG5iYXRjaF9zaXplID0gNjRcXG5sZWFybmluZ19yYXRlID0gMC4wMVx
```

cblxcbiMgRGF0YSBhdWdtZW50YXRpb24gYW5kIG5vcm1hbGl6YXRpb25cXG50cmFuc2Zvcm0gP
SB0cmFuc2Zvcm1zLkNvbXBvc2UoW1xcbiAgICB0cmFuc2Zvcm1zLlJhbmRvbUhvcml6b250YWx
GbGlwKCksXFxuICAgIHRyYW5zZm9ybXMuUmFuZG9tUm90YXRpb24oMTApLFxcbiAgICB0cmFuc
2Zvcm1zLlRvVGVuc29yKCksXFxuICAgIHRyYW5zZm9ybXMuTm9ybWFsaXplKCgwLjUsKSwgKDA
uNSwpKSAgIyBOb3JtYWxpemUgdG8gWy0xLCAxXVxcbl0pXFxuXFxuIyBMb2FkIHRoZSBGYXNoa
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UKHJvb3Q9Jy4vZGF0YScsXFxuICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgI
CB0cmFpbj1UcnVlLFxcbiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgdHJ
hbnNmb3JtPXRyYW5zZm9ybSxcXG4gICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgI
CAgIGRvd25sb2FkPVRydWUpXFxuXFxudGVzdF9kYXRhc2V0ID0gZGF0YXNldHMuRmFzaGlvbk1
OSVNUKHJvb3Q9Jy4vZGF0YScsXFxuICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgI
CAgIHRyYWluPUZhbHNlLFxcbiAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICAgICB
0cmFuc2Zvcm09dHJhbnNmb3Jtcy5Db21wb3NlKFtcXG4gICAgICAgICAgICAgICAgICAgICAgI
CAgICAgICAgICAgICAgIHRyYW5zZm9ybXMuVG9UZW5zb3IoKSxcXG4gICAgICAgICAgICAgICA
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jaE5vcm0yZCg4KSAgIyBCYXRjaCBOb3JtYWxpemF0aW9uXFxuICAgICAgICBzZWxmLnBvb2wgP
SBubi5NYXhQb29sMmQoMiwgMilcXG4gICAgICAgIHNlbGYuY29udjIgPSBubi5Db252MmQoOCw
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CAqIDQsIDEyMClcXG4gICAgICAgIHNlbGYuZmMyID0gbm4uTGluZWFyKDEyMCwgODQpXFxuICCA
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2xvc3MgKz0gY3JpdGVyaW9uKG91dHB1dCwgdGFyZ2V0KS5pdGVtKCkgKiBkYXRhLnNpemUoMCl
cXG4gICAgICAgICAgICBwcmVkID0gb3V0cHV0LmFyZ21heChkaW09MSwga2VlcGRpbT1UcnVlK
VxcbiAgICAgICAgICAgIGNvcnJlY3QgKz0gcHJlZC5lcSh0YXJnZXQudmlld19hcyhwcmVkKSk
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udW1weSgpKVxcblxcbiAgICB0ZXN0X2xvc3MgLz0gbGVuKHRlc3RfbG9hZGVyLmRhdGFzZXQpX
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3M6LjRmfSwgQWNjdXJhY3k6IHtjb3JyZWN0fS97bGVuKHRlc3RfbG9hZGVyLmRhdGFzZXQpfSA
oe2FjY3VyYWN5Oi4wZn0lKVxcXFxuJylcXG5cXG4gICAgcmV0dXJuIHRlc3RfbG9zcywgYWNjd
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xKTpcXG4gICAgcHJpbnQoZlxcXCJFcG9jaCB7ZXBvY2h9L3tudW1fZXBvY2hzfVxcXCIpXFxuI
CAgIHRyYWluX2xvc3MgPSB0cmFpbihtb2RlbCwgZGV2aWNlLCB0cmFpbl9sb2FkZXIsIG9wdGl
taXplciwgY3JpdGVyaW9uKVxcbiAgICB0ZXN0X2xvc3MsIGFjY3VyYWN5LCBhbGxfcHJlZHMsI
GFsbF90YXJnZXRzID0gdGVzdChtb2RlbCwgZGV2aWNlLCB0ZXN0X2xvYWRlciwgY3JpdGVyaW9
uKVxcbiAgICB0cmFpbl9sb3NzZXMuYXBwZW5kKHRyYWluX2xvc3MpXFxuICAgIHRlc3RfbG9zc
2VzLmFwcGVuZCh0ZXN0X2xvc3MpXFxuICAgIGFjY3VyYWNpZXMuYXBwZW5kKGFjY3VyYWN5KVx
cbiAgICBzY2hlZHVsZXIuc3RlcCgpXFxuXFxuIyBDbGFzc2lmaWNhdGlvbiByZXBvcnRcXG5wc
mludChcXFwiXFxcXG5DbGFzc2lmaWNhdGlvbiBSZXBvcnQ6XFxcIilcXG5wcmludChjbGFzc2l

```
maWNhdGlvbl9yZXBvcnQoYWxsX3RhcmdldHMsIGFsbF9wcmVkcywgdGFyZ2V0X25hbWVzPXRyY
WluX2RhdGFzZXQuY2xhc3NlcykpXFxuXFxuIyBQbG90IHRyYWluaW5nIGxvc3NcXG5wbHQuZml
ndXJlKGZpZ3NpemU9KDEwLCA1KSlcXG5wbHQucGxvdCh0cmFpbl9sb3NzZXMsIGxhYmVsPSdUc
mFpbmluZyBMb3NzJylcXG5wbHQucGxvdCh0ZXN0X2xvc3NlcywgbGFiZWw9J1Rlc3QgTG9zcyc
pXFxucGx0LnhsYWJlbCgnRXBvY2hzJylcXG5wbHQueWxhYmVsKCdMb3NzJylcXG5wbHQudGl0b
GUoJ1RyYWluaW5nIGFuZCBUZXN0IExvc3MnKVxcbnBsdC5sZWdlbmQoKVxcbnBsdC5zaG93KCkl
cXG5cXG4jIFNhdmUgdGhlIG1vZGVsXFxudG9yY2guc2F2ZShtb2RlbCwgJ2Zhc2hpb25fbW5pc
3RfY25uX2Z1bGwucHRoJylcXG5wcmludChcXFwiTW9kZWwgc2F2ZWQgYXMgJ2Zhc2hpb25fbW5
pc3RfY25uX2Z1bGwucHRoJy5cXFwiKSJ9LHsidGV4dCI6ImlucHV0OiAifSx7InRleHQiOiJvd
XRwdXQ6ICJ9XX1d' # @param {isTemplate: true}
generation_config_b64 =
'eyJ0ZW1wZXJhdHVyZSI6MSwidG9wX3AiOjAuOTUsInRvcF9rIjo0MCwibWF4X291dHB1dF90b
2tlbnMiOjgxOTJ9' # @param {isTemplate: true}
safety_settings_b64 = "e30="  # @param {isTemplate: true}

gais_contents = json.loads(base64.b64decode(contents_b64))

generation_config = json.loads(base64.b64decode(generation_config_b64))
safety_settings = json.loads(base64.b64decode(safety_settings_b64))

stream = False

# Convert and upload the files

tempfiles = pathlib.Path(f"tempfiles")
tempfiles.mkdir(parents=True, exist_ok=True)


drive = None
def upload_file_data(file_data, index):
    """Upload files to the Files API.

    For each file, Google AI Studio either sent:
    - a Google Drive ID,
    - a URL,
    - a file path, or
    - The raw bytes (`inline_data`).

    The API only understands `inline_data` or it's Files API.
```

```
    This code, uploads files to the files API where the API can access
them.
    """

    mime_type = file_data["mime_type"]
    if drive_id := file_data.pop("drive_id", None):
        if drive is None:
          from google.colab import drive
          drive.mount("/gdrive")

        path = next(

pathlib.Path(f"/gdrive/.shortcut-targets-by-id/{drive_id}").glob("*")
        )
        print("Uploading:", str(path))
        file_info = genai.upload_file(path=path, mime_type=mime_type)
        file_data["file_uri"] = file_info.uri
        return

    if url := file_data.pop("url", None):
        response = requests.get(url)
        data = response.content
        name = url.split("/")[-1]
        path = tempfiles / str(index)
        path.write_bytes(data)
        print("Uploading:", url)
        file_info = genai.upload_file(path, display_name=name,
mime_type=mime_type)
        file_data["file_uri"] = file_info.uri
        return

    if name := file_data.get("filename", None):
        if not pathlib.Path(name).exists():
            raise IOError(
                f"local file: `{name}` does not exist. You can upload
files "
                'to Colab using the file manager ("📁 Files" in the left '
                "toolbar)"
            )
```

```
        file_info = genai.upload_file(path, display_name=name,
mime_type=mime_type)
        file_data["file_uri"] = file_info.uri
        return

    if "inline_data" in file_data:
        return

    raise ValueError("Either `drive_id`, `url` or `inline_data` must be
provided.")


contents = copy.deepcopy(gais_contents)

index = 0
for content in contents:
    for n, part in enumerate(content["parts"]):
        if file_data := part.get("file_data", None):
            upload_file_data(file_data, index)
            index += 1

import json
print(json.dumps(contents, indent=4))
```

```
import torch
import torch.nn as nn
import torch.nn.functional as F # Import F
import torch.optim as optim
from torchvision import datasets, transforms
from torch.utils.data import DataLoader
from sklearn.metrics import classification_report
import matplotlib.pyplot as plt

# Device configuration
device = torch.device('cuda' if torch.cuda.is_available() else 'cpu')

# Hyperparameters
num_epochs = 7
batch_size = 64
learning_rate = 0.03

# Data augmentation and normalization
transform = transforms.Compose([
    transforms.RandomHorizontalFlip(),
    transforms.RandomRotation(10),
    transforms.ToTensor(),
    transforms.Normalize((0.5,), (0.5,))  # Normalize to [-1, 1]
])

# Load the Fashion-MNIST Dataset
train_dataset = datasets.FashionMNIST(root='./data',
                                      train=True,
                                      transform=transform,
                                      download=True)

test_dataset = datasets.FashionMNIST(root='./data',
                                     train=False,
                                     transform=transforms.Compose([
                                         transforms.ToTensor(),
                                         transforms.Normalize((0.5,),
(0.5,))
                                     ]),
                                     download=True)
```

```
# Data loaders
train_loader = DataLoader(dataset=train_dataset,
                          batch_size=batch_size,
                          shuffle=True)

test_loader = DataLoader(dataset=test_dataset,
                         batch_size=batch_size,
                         shuffle=False)

# Define the CNN Model
class CNNModel(nn.Module):
    def __init__(self):
        super(CNNModel, self).__init__()
        self.conv1 = nn.Conv2d(1, 8, 5)
        self.bn1 = nn.BatchNorm2d(8)  # Batch Normalization
        self.pool = nn.MaxPool2d(2, 2)
        self.conv2 = nn.Conv2d(8, 16, 5)
        self.bn2 = nn.BatchNorm2d(16)  # Batch Normalization
        self.dropout = nn.Dropout(0.25)  # Dropout layer
        self.fc1 = nn.Linear(16 * 4 * 4, 120)
        self.fc2 = nn.Linear(120, 84)
        self.fc3 = nn.Linear(84, 10)

    def forward(self, x):
        x = self.pool(F.relu(self.bn1(self.conv1(x))))
        x = self.pool(F.relu(self.bn2(self.conv2(x))))
        x = x.view(-1, 16 * 4 * 4)
        x = F.relu(self.fc1(x))
        x = self.dropout(x)  # Apply dropout
        x = F.relu(self.fc2(x))
        x = self.fc3(x)
        return x

# Initialize the model, loss function, and optimizer
model = CNNModel().to(device)
criterion = nn.CrossEntropyLoss()
optimizer = optim.Adam(model.parameters(), lr=learning_rate)
scheduler = optim.lr_scheduler.StepLR(optimizer, step_size=1, gamma=0.7)

# Training function
```

```python
def train(model, device, train_loader, optimizer, criterion):
    model.train()
    epoch_loss = 0
    for batch_idx, (data, target) in enumerate(train_loader):
        data, target = data.to(device), target.to(device)
        optimizer.zero_grad()
        output = model(data)
        loss = criterion(output, target)
        loss.backward()
        optimizer.step()
        epoch_loss += loss.item()
    return epoch_loss / len(train_loader)

# Testing function
def test(model, device, test_loader, criterion):
    model.eval()
    test_loss = 0
    correct = 0
    all_preds = []
    all_targets = []
    with torch.no_grad():
        for data, target in test_loader:
            data, target = data.to(device), target.to(device)
            output = model(data)
            test_loss += criterion(output, target).item() * data.size(0)
            pred = output.argmax(dim=1, keepdim=True)
            correct += pred.eq(target.view_as(pred)).sum().item()
            all_preds.extend(pred.cpu().numpy())
            all_targets.extend(target.cpu().numpy())

    test_loss /= len(test_loader.dataset)
    accuracy = 100. * correct / len(test_loader.dataset)
    print(f'\nTest set: Average loss: {test_loss:.4f}, Accuracy:
{correct}/{len(test_loader.dataset)} ({accuracy:.0f}%)\n')

    return test_loss, accuracy, all_preds, all_targets

# Training loop with visualization
train_losses = []
test_losses = []
```

```
accuracies = []

for epoch in range(1, num_epochs + 1):
    print(f"Epoch {epoch}/{num_epochs}")
    train_loss = train(model, device, train_loader, optimizer, criterion)
    test_loss, accuracy, all_preds, all_targets = test(model, device,
test_loader, criterion)
    train_losses.append(train_loss)
    test_losses.append(test_loss)
    accuracies.append(accuracy)
    scheduler.step()

# Classification report
print("\nClassification Report:")
print(classification_report(all_targets, all_preds,
target_names=train_dataset.classes))

# Plot training loss
plt.figure(figsize=(10, 5))
plt.plot(train_losses, label='Training Loss')
plt.plot(test_losses, label='Test Loss')
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.title('Training and Test Loss')
plt.legend()
plt.show()

# Save the model
torch.save(model, 'fashion_mnist_cnn_full.pth')
print("Model saved as 'fashion_mnist_cnn_full.pth'.")
```

Epoch 1/3

Test set: Average loss: 0.4532, Accuracy: 8378/10000 (84%)

Epoch 2/3

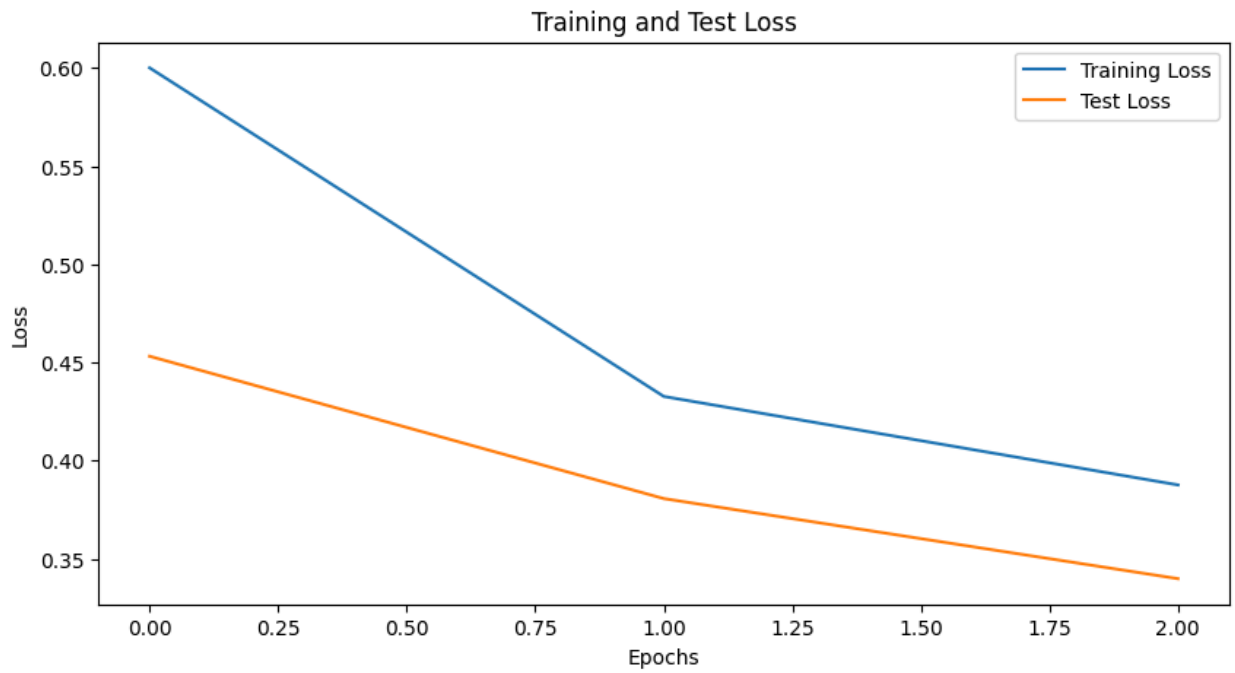
Test set: Average loss: 0.3807, Accuracy: 8594/10000 (86%)

Epoch 3/3

Test set: Average loss: 0.3399, Accuracy: 8760/10000 (88%)

Classification Report:

	precision	recall	f1-score	support
T-shirt/top	0.78	0.87	0.82	1000
Trouser	1.00	0.97	0.98	1000
Pullover	0.76	0.87	0.81	1000
Dress	0.87	0.91	0.89	1000
Coat	0.80	0.79	0.80	1000
Sandal	0.97	0.96	0.97	1000
Shirt	0.73	0.52	0.61	1000
Sneaker	0.92	0.96	0.94	1000
Bag	0.96	0.98	0.97	1000
Ankle boot	0.96	0.94	0.95	1000
accuracy			0.88	10000
macro avg	0.87	0.88	0.87	10000
weighted avg	0.87	0.88	0.87	10000



Model saved as 'fashion_mnist_cnn_full.pth'.

Epoch 1/5

Test set: Average loss: 0.5421, Accuracy: 8116/10000 (81%)

Epoch 2/5

Test set: Average loss: 0.4704, Accuracy: 8319/10000 (83%)

Epoch 3/5

Test set: Average loss: 0.4342, Accuracy: 8404/10000 (84%)

Epoch 4/5

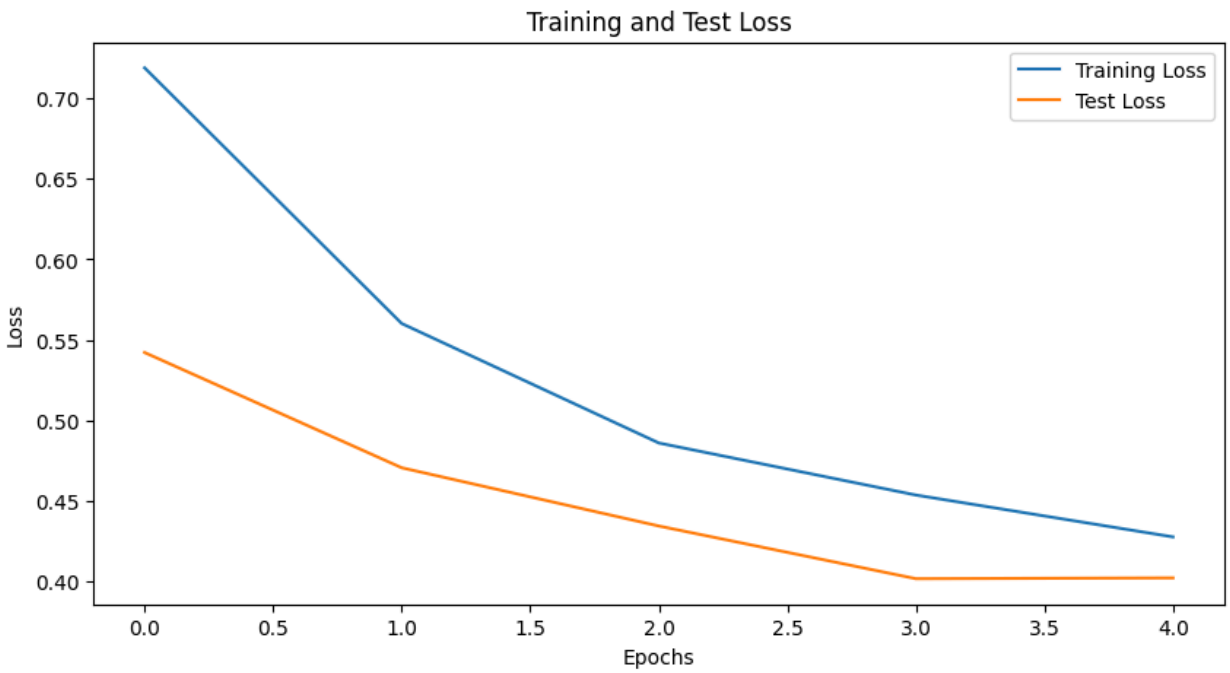
Test set: Average loss: 0.4015, Accuracy: 8504/10000 (85%)

Epoch 5/5

Test set: Average loss: 0.4019, Accuracy: 8487/10000 (85%)

Classification Report:

	precision	recall	f1-score	support
T-shirt/top	0.72	0.88	0.79	1000
Trouser	0.97	0.98	0.98	1000
Pullover	0.64	0.90	0.75	1000
Dress	0.91	0.86	0.88	1000
Coat	0.79	0.68	0.73	1000
Sandal	0.98	0.92	0.95	1000
Shirt	0.70	0.38	0.49	1000
Sneaker	0.90	0.98	0.94	1000
Bag	0.96	0.97	0.96	1000
Ankle boot	0.97	0.94	0.95	1000
accuracy			0.85	10000
macro avg	0.85	0.85	0.84	10000
weighted avg	0.85	0.85	0.84	10000



Model saved as 'fashion_mnist_cnn_full.pth'.

Epoch 1/7

Test set: Average loss: 0.5426, Accuracy: 8065/10000 (81%)

Epoch 2/7

Test set: Average loss: 0.5100, Accuracy: 8144/10000 (81%)

Epoch 3/7

Test set: Average loss: 0.4346, Accuracy: 8403/10000 (84%)

Epoch 4/7

Test set: Average loss: 0.4262, Accuracy: 8425/10000 (84%)

Epoch 5/7

Test set: Average loss: 0.4010, Accuracy: 8543/10000 (85%)

Epoch 6/7

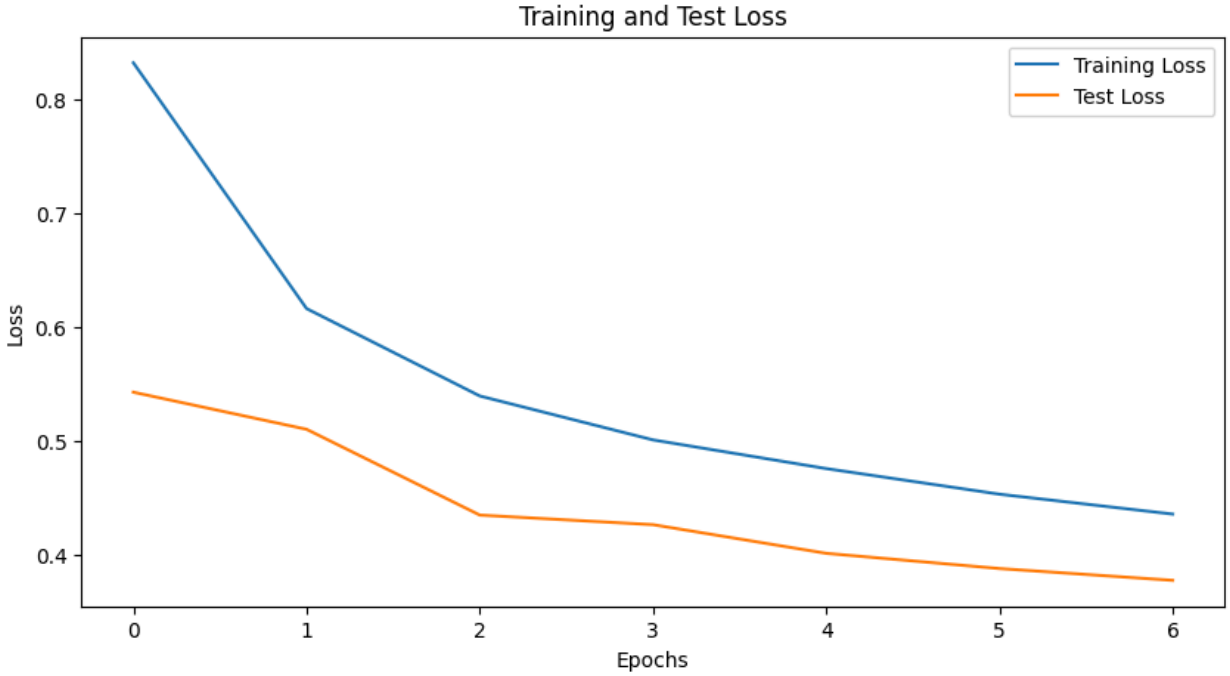
Test set: Average loss: 0.3877, Accuracy: 8581/10000 (86%)

Epoch 7/7

Test set: Average loss: 0.3773, Accuracy: 8603/10000 (86%)

Classification Report:

	precision	recall	f1-score	support
T-shirt/top	0.78	0.81	0.79	1000
Trouser	0.99	0.97	0.98	1000
Pullover	0.77	0.77	0.77	1000
Dress	0.85	0.90	0.88	1000
Coat	0.74	0.82	0.78	1000
Sandal	0.97	0.92	0.94	1000
Shirt	0.68	0.54	0.60	1000
Sneaker	0.90	0.96	0.93	1000
Bag	0.95	0.97	0.96	1000
Ankle boot	0.95	0.95	0.95	1000
accuracy			0.86	10000
macro avg	0.86	0.86	0.86	10000
weighted avg	0.86	0.86	0.86	10000



Model saved as 'fashion_mnist_cnn_full.pth'.