GROUP : 12

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Problem Statement : Fashion Item Classification sing Fashion MNIST

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Introduction :

Fashion item classification is an essential task in computer vision with applications in e-commerce, retail analytics, and intelligent wardrobe systems. The goal of this project is to build an image classifier that can categorize grayscale images of clothing items into one of ten classes (e.g., T-shirt/top, Trouser, Pullover, etc.) using the Fashion MNIST dataset. Fashion MNIST is a well-known benchmark dataset that consists of 70,000 labeled images (60,000 for training and 10,000 for testing), each of size 28x28 pixels.

This project applies supervised machine learning techniques, particularly Convolutional Neural Networks (CNNs), to learn visual patterns in the images and classify them accurately. The performance of the model is evaluated using a confusion matrix, which provides detailed insights into how well the model distinguishes between different clothing categories.

Methodology :

1. Dataset Descriptions:

1. T-shirt/top

- Source: Fashion MNIST (built by tensorflow keras,Algorithm used : Multilayer Perceptron(MLP))

- Classe

1. Trouser
2. Pullover
3. Dress
4. Coat

5. Sandal
6. Shirt
7. Sneaker
8. Bag
9. Ankle boot

2. Data Preprocessing

- Normalized pixel values from [0, 255] to [0, 1].
- Reshaped the input to include a channel dimension (28x28x1).
- Encoded the class labels.

3. Training

- Optimizer: Adam
- Loss Function: Categorical Crossentropy
- Epochs: 10
- Batch Size: 64
- Evaluation Metric: Accuracy

2.5 Evaluation with Confusion Matrix

- Predicted labels were compared against true labels.
- A confusion matrix was plotted using sklearn.metrics.confusion_matrix to visualize class-wise accuracy.
- Misclassifications were analyzed to identify confusing class pairs (e.g., Shirt vs T-shirt/top).

2.6 Tools Used

- Python 3.8+
- TensorFlow / Keras
- NumPy, Matplotlib, seaborn
- Scikit-learn

Code :

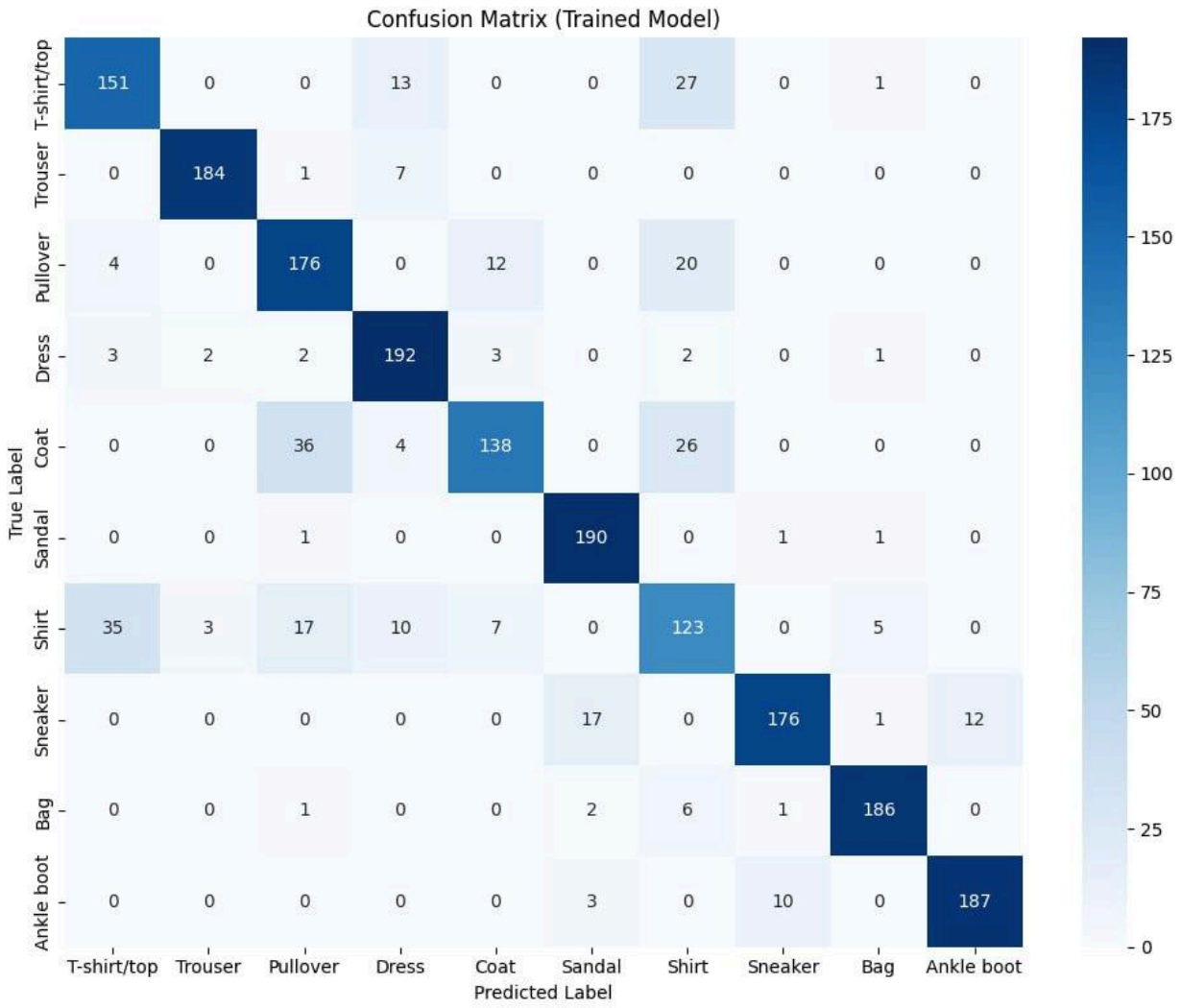
```
import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import seaborn as sns

from sklearn.metrics import confusion_matrix

from sklearn.model_selection import train_test_split
```

```
from tensorflow.keras.models import Sequential

from tensorflow.keras.layers import Dense, Flatten

from tensorflow.keras.utils import to_categorical


# Load the dataset

df = pd.read_csv("/content/fashion-mnist_test.csv")


# Prepare features and labels

X = df.drop('label', axis=1).values / 255.0  # Normalize pixel values

y = df['label'].values

y_cat = to_categorical(y, num_classes=10)


# Split into training and testing sets

X_train, X_test, y_train_cat, y_test_cat, y_train, y_test = train_test_split(

    X, y_cat, y, test_size=0.2, random_state=42)


# Define a simple neural network model

model = Sequential([

    Flatten(input_shape=(784,)),  # 28x28 images

    Dense(128, activation='relu'),
```

```
    Dense(10, activation='softmax')
])

# Compile the model
model.compile(optimizer='adam',
              loss='categorical_crossentropy',
              metrics=['accuracy'])

# Train the model
model.fit(X_train, y_train_cat, epochs=10, batch_size=32,
validation_split=0.1)

# Predict on test set
y_pred_probs = model.predict(X_test)
y_pred = np.argmax(y_pred_probs, axis=1)

# Confusion matrix
cm = confusion_matrix(y_test, y_pred)
class_names = ['T-shirt/top', 'Trouser', 'Pullover', 'Dress', 'Coat',
               'Sandal', 'Shirt', 'Sneaker', 'Bag', 'Ankle boot']
```

```
# Plot confusion matrix
plt.figure(figsize=(10, 8))
sns.heatmap(cm, annot=True, fmt='d', cmap='Blues',
            xticklabels=class_names, yticklabels=class_names)
plt.xlabel('Predicted Label')
plt.ylabel('True Label')
plt.title('Confusion Matrix (Trained Model)')
plt.tight_layout()
plt.show()
```

OUTPUT:



References:

1. Han Xiao, Kashif Rasul, Roland Vollgraf. “Fashion-MNIST: a Novel Image Dataset for Benchmarking Machine Learning Algorithms.” *arXiv preprint arXiv:1708.07747*, 2017.

2. TensorFlow Dataset Documentation: https://www.tensorflow.org/datasets/catalog/fashion_mnist

3. Keras Documentation: https://keras.io/api/

4. scikit-learn Confusion Matrix: https://scikit-learn.org/stable/modules/generated/sklearn.metrics.confusion_matrix.html

CREDITS:

Libraries & Tools: TensorFlow, Keras, Matplotlib, Seaborn, scikit-learn

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