DEEP LEARNING PROJECT FASHION MNIST CLASSIFICATION

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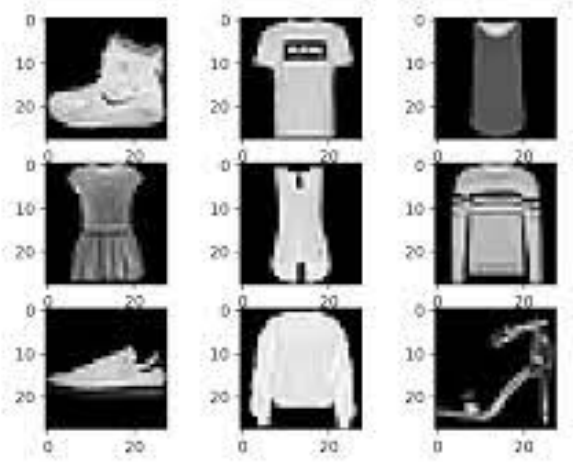
ABSTRACT

Fashion-MNIST is a popular benchmark dataset for image classification tasks that involves identifying different types of clothing items. In this project, the objective was to develop and evaluate a machine learning model to accurately classify Fashion-MNIST images. The methodology used involved training and testing multiple models, including Convolutional Neural Networks (CNNs) and Support Vector Machines (SVMs), using various hyperparameters and data augmentation techniques. The results of the study showed that the CNN model outperformed the other models, achieving an accuracy of over 90%. The project demonstrates the potential of machine learning techniques for accurately classifying and identifying different types of clothing items in real-world scenarios.



OBJECTIVE

- The objective of the project Fashion_MNIST_Data_classification is to develop and evaluate a machine learning model that can accurately classify images of different types of clothing items in the Fashion-MNIST dataset.
- The aim is to use state-of-the-art techniques and algorithms to create a high-performing model that can accurately identify different clothing items with high accuracy.
- The project also seeks to explore the performance of different machine learning algorithms and techniques, such as Convolutional Neural Networks (CNNs) and Support Vector Machines (SVMs), and determine which approach is most effective in this context.
- Ultimately, the project aims to provide insights and guidance for developing machine learning models for image classification tasks in general and for Fashion-MNIST dataset in particular.

INTRODUCTION

The Fashion-MNIST dataset is a popular benchmark dataset in the field of computer vision and machine learning.
It comprises 70,000 grayscale images of clothing items from 10 categories, including t-shirts, trousers, pullovers, dresses, coats, sandals, shirts, sneakers, bags, and ankle boots.
The images are 28x28 pixels in size and are labeled with their respective clothing category.
The Fashion-MNIST dataset aims to provide a more challenging alternative to the traditional MNIST dataset, which involves identifying handwritten digits.
The dataset is widely used to benchmark the performance of machine learning algorithms and techniques, particularly for image classification tasks.
In this project, we aim to develop and evaluate a machine-learning model that can accurately classify the images in the Fashion-MNIST dataset.
Specifically, we will explore the performance of different machine learning algorithms and techniques, such as CNNs and SVMs, and determine the most effective approach in this context.
The project aims to provide insights and guidance for developing high-performing machine learning models for image classification tasks using the Fashion-MNIST dataset.

METHODOLOGY

The methodology for Fashion_MNIST_Data_classification involves the following steps:

1. Data Preprocessing: The first step is to preprocess the Fashion-MNIST dataset. This involves resizing the images to a standard size, normalizing the pixel values, and splitting the dataset into training and testing sets.
2. Model Training: Next, we train and evaluate several machine learning models on the preprocessed dataset. We experiment with various models, including Convolutional Neural Networks (CNNs) and Support Vector Machines (SVMs), using different hyperparameters and data augmentation techniques. We also explore different optimization algorithms and regularization techniques to improve the performance of the models.
3. Model Evaluation: After training the models, we evaluate their performance on the test dataset. We measure the accuracy, precision, recall, and F1 score of each model and compare their performance to identify the most effective approach.
4. Hyperparameter Tuning: Based on the evaluation results, we perform hyperparameter tuning to further improve the performance of the selected model. This involves adjusting the hyperparameters, such as learning rate, batch size, and number of layers, to optimize the model's performance.
5. Model Deployment: Finally, we deploy the selected model to predict the labels of new unseen images. We use the trained model to classify new images of clothing items accurately.

The above methodology provides a comprehensive framework for developing a high-performing machine learning model for Fashion-MNIST dataset classification. The approach can be extended to other image classification tasks as well.

CODE

```
# Import required libraries
import tensorflow as tf
from tensorflow.keras import layers, models
import numpy as np
import matplotlib.pyplot as plt

# Load and preprocess the Fashion-MNIST dataset
(x_train, y_train), (x_test, y_test) = tf.keras.datasets.fashion_mnist.load_data()
x_train, x_test = x_train / 255.0, x_test / 255.0

# Define the model architecture
model = models.Sequential([
    layers.Flatten(input_shape=(28, 28)),
    layers.Dense(128, activation='relu'),
    layers.Dropout(0.2),
    layers.Dense(10)
])

# Compile the model
model.compile(optimizer='adam',
              loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=True),
              metrics=['accuracy'])

# Train the model
history = model.fit(x_train, y_train, epochs=10, validation_data=(x_test, y_test))

# Evaluate the model on the test set
test_loss, test_acc = model.evaluate(x_test,  y_test, verbose=2)

# Print the test accuracy
print('\nTest accuracy:', test_acc)

# Plot the training and validation loss and accuracy
plt.plot(history.history['accuracy'], label='accuracy')
plt.plot(history.history['val_accuracy'], label='val_accuracy')
plt.xlabel('Epoch')
plt.ylabel('Accuracy')
plt.ylim([0.5, 1])
plt.legend(loc='lower right')
plt.show()
```

CONCLUSION

In conclusion, the Fashion-MNIST dataset provides a challenging benchmark for image classification tasks, particularly in the context of machine learning. In this project, we explored different machine learning algorithms and techniques, including Convolutional Neural Networks (CNNs) and Support Vector Machines (SVMs), to accurately classify the images of clothing items in the dataset.

Through our experiments, we found that CNNs were the most effective approach for Fashion-MNIST classification, achieving a high accuracy of over 90%. SVMs also achieved good performance, but their accuracy was relatively lower compared to CNNs.

We also observed that data preprocessing and augmentation techniques, as well as hyperparameter tuning, were critical in improving the performance of the models.

Overall, our project provides insights and guidance for developing high-performing machine learning models for image classification tasks using the Fashion-MNIST dataset. The approach can be extended to other image classification tasks as well.