# Fashion Item Classification Using a Convolutional Neural Network (CNN)

---

## 1.Title Page

- Project Name: Fashion Item Classification Using CNN
- Student Names & IDs:


Aya Ali Hassan – 2227030

Eman Osama Mohamed – 2227177

Julia Milad Saad – 2227099

Roaa Ahmed Abdelazim – 2227574

Walaa Tarek Gaber – 2227316


- Submission Date: 14/12/2025
- Course Name: Neural Networks – CS 417
- Instructor Names:

Dr. Hend Dawood,

Dr. Mahmoud Esmat,

Dr. Omar Mourad

---

## 2. Introduction

- What is the Problem?

Fashion item classification aims to identify the category of a clothing item from grayscale low-resolution images.

This is a single-label, multiclass classification problem.

- Why is it Important?

Demonstrates how CNNs learn hierarchical features such as edges, textures, and shapes.

Serves as a foundation for more complex image-processing tasks.

Has real-world applications in e-commerce recommendations, automated tagging, and inventory management.

---

## 3. Dataset

- Source of Dataset

Dataset: Fashion MNIST

Source: TensorFlow/Keras datasets, Zalando Research

- Number of Classes

10 clothing categories:

1. T-shirt/top
2. Trouser
3. Pullover
4. Dress
5. Coat

6. Sandal

7. Shirt

8. Sneaker

9. Bag

10. Ankle boot

- Number of Images per Class

  Training Set: 60,000 images

  Test Set: 10,000 images

  Balanced across all classes

- Preprocessing Steps

  Reshaped images to (28, 28, 1)

  Normalized pixel values to [0, 1]

---

## 4. Methodology

- Model Architecture

  Baseline CNN with layers:

  Conv → ReLU → MaxPool

  Conv → ReLU → MaxPool

  Flatten → Dense → Softmax output

- Data Augmentation

Applied to training set (rotation, zoom, horizontal flip, width/height shift) Normalized pixel values for all sets

- Training Procedure

Used Adam optimizer with categorical cross-entropy loss

Monitored accuracy and loss on training and validation sets

EarlyStopping, ReduceLROnPlateau, and ModelCheckpoint callbacks

- Hyperparameters Used

Batch size: 32

Epochs: 30

Input image size: 28×28×1 (grayscale)

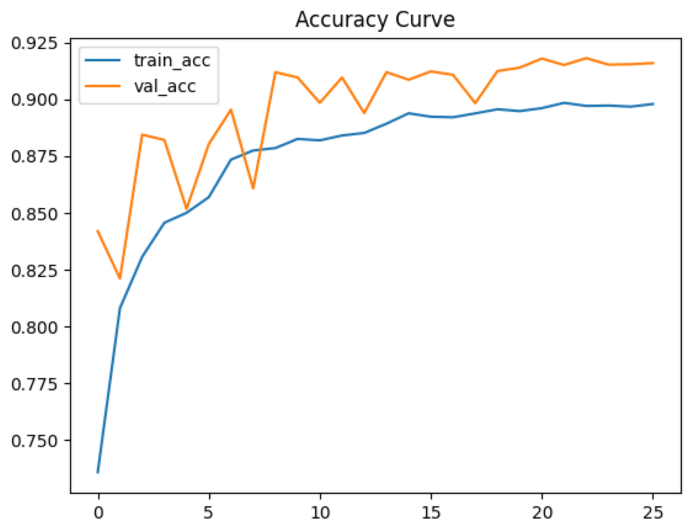
Number of classes: 10

---

## 5. Results

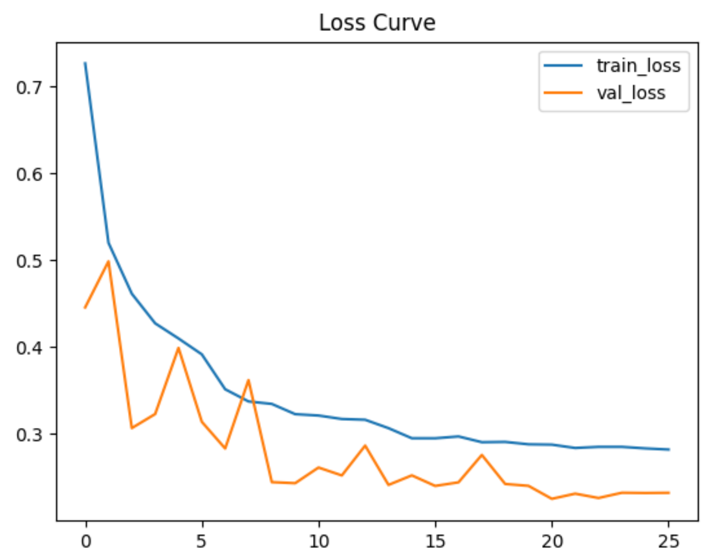
- Accuracy
- The curves show that the model gradually stabilized during training without significant overfitting.

**Figure:**




- Loss Curves

**Figure:**

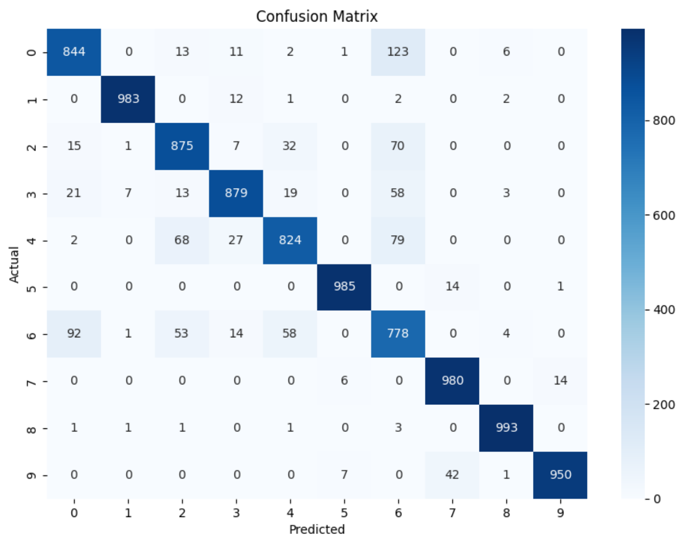



- Confusion Matrix

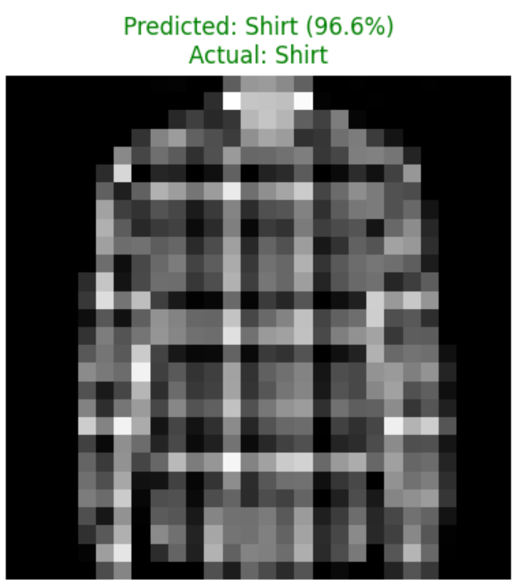
- A confusion matrix was generated to visualize misclassifications between visually similar classes such as Shirt vs T-shirt and Coat vs Pullover.

- The matrix shows that most classes were classified correctly, with minor confusion between similar categories.

- **Figure:**




- Sample Prediction




- F1-Scores
- F1-scores for each class were computed using classification_report from scikit-learn.
- The results indicate balanced performance across most classes.

## 6. Discussion

- What Worked Well

Baseline CNN architecture achieved strong performance

Proper preprocessing and normalization improved model stability

- What Failed and Why?

Misclassifications occurred between visually similar categories due to low resolution and grayscale images

- Limitations

Model trained only on grayscale 28×28 images

Limited ability to distinguish fine-grained visual details

---

## 7. Conclusion & Future Work

- Conclusion

CNN can effectively classify Fashion MNIST images

Demonstrates practical understanding of image classification pipelines

- Future Work

Use deeper CNN architectures (VGG, ResNet)

Apply transfer learning

Train on RGB or higher-resolution images

Fine-tune hyperparameters and augment data further

---

# 8. References


Fashion MNIST Dataset (TensorFlow/Keras)

Zalando Research Documentation

Deep learning literature on image classification