

# Assignment Summary

## Team Members:

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## Task 01

1. **Dataset Loading:** Imported the Fashion MNIST dataset from the Keras library, comprising 60,000 training and 10,000 testing grayscale images (28x28 pixels).
2. **Class Relabeling:** Transformed original labels into three categories: 'shoes', 'clothes', and 'others' using the following mapping:

```
change = {9: 'shoes', 0: 'clothes', 3: 'clothes', 2: 'clothes',  
          7: 'shoes', 5: 'shoes', 1: 'clothes', 6: 'clothes',  
          4: 'clothes', 8: 'others'}  
dict_val = {'shoes': 0, 'clothes': 1, 'others': 2}
```

3. **CNN Architecture:** The final architecture includes:
  - 3 convolutional layers (64, 128, and 256 filters)
  - 3 max pooling layers
  - 1 flatten layer
  - 1 dense layer (256 units)
  - Output layer (3 units with softmax)
4. **Model Training:** Fitted the model for 10 and 15 epochs, resulting in:

Epochs	Train Accuracy	Train Loss	Test Accuracy	Test Loss
10	99.75%	0.034	99.69%	0.036
15	99.80%	0.028	99.29%	0.045

Note: Overfitting was observed beyond 15 epochs.

5. **Performance Visualization:** Plotted loss vs. epochs and accuracy vs. epochs.
6. **Shuffled Dataset Analysis:** After shuffling the training dataset, accuracy dropped from 99.69% to 99.29%, indicating the model's reliance on visual information.

## Task 02

### 1. Model Implementations:

- ResNet-18 architecture trained from scratch (without pretrained weights).
- ResNet-18 architecture with pretrained weights (all layers unfrozen).
- ResNet-18 architecture with pretrained weights (only the fully connected layer unfrozen).

### 2. Dataset Preparation:

- Image transformations include resizing to  $224 \times 224$  pixels and normalization using calculated mean and standard deviation of emotions dataset.
- Datasets are loaded using `ImageFolder`, with stratified sampling for creating training and validation subsets.

### 3. Training and Evaluation Functions:

- Functions are defined for calculating accuracy and plotting metrics, enhancing the evaluation process.

### 4. Training and Evaluation:

- Each model is trained for 15 epochs using the Adam optimizer. The final accuracies observed were:
  - Untrained Model 1: Validation Accuracy: 58.52%, Test Accuracy: 59.54%
  - Untrained Model 2: Validation Accuracy: 62.46%, Test Accuracy: 63.18%
  - Pretrained Model: Validation Accuracy: 44.51%, Test Accuracy: 44.9%

**Conclusion:** Given the large dataset, training the ResNet-18 architecture with original weights led to convergence and optimal results. In contrast, freezing all layers except the fully connected one resulted in poor performance.

**Note:** Training was limited to 15 epochs due to overfitting, indicated by a decrease in validation accuracy.