Exercise 1: Basic Image Classification with CNN

Duration: 2 hours

Objective: Build your first CNN to classify handwritten digits using the MNIST dataset.

Tasks:

Data Preparation (30 minutes)

```
python# Your tasks:
1. Load the MNIST dataset using tensorflow
2. Normalize the pixel values (0-1)
3. Reshape the data for CNN input
4. Split the data into training and validation sets
5. Visualize sample images from the dataset
```

Model Building (30 minutes)

```
python# Build a CNN with following requirements:
1. Input layer accepting 28x28x1 images
2. Two convolutional layers:
   - First with 32 filters
   - Second with 64 filters
3. MaxPooling layers after each convolution
4. Dense layers for classification
5. Output layer with 10 units (digits 0-9)
```

Training (30 minutes)

```
python# Training requirements:
1. Use appropriate loss function for classification
2. Choose suitable optimizer
3. Train for 10 epochs
4. Implement early stopping
5. Plot training and validation accuracy/loss
```

Evaluation (30 minutes)

```
python# Evaluation tasks:
```

```
1. Calculate model accuracy on test set
2. Create confusion matrix
3. Visualize predictions on test images
4. Identify and analyze misclassified images
```

Deliverables:

- Working [illegible]/Colab notebook
- Model achieving >95% accuracy
- Visualization of results
- Brief explanation of your architecture choices