**Convolutional Neural Networks**

## Assignment 1: Basic - Simple CNN for AI Service Classification

**Objective**: Build a basic CNN to classify images related to AI service categories offered by One Hour AI Solution.

**Dataset**: ai_service_images.csv - A dataset of 28x28 grayscale images representing visual icons for different AI service categories.

**Instructions**:

1. Load and preprocess the provided dataset containing simple icons that represent the AI service categories

2. Implement a simple CNN architecture as discussed in the lecture with:

   o One convolutional layer with appropriate filters

   o One max pooling layer

   o A fully connected layer

   o An output layer for classification

3. Train your model to classify the icons into the correct service categories

4. Evaluate your model's accuracy on a validation set

5. Print a summary of your model architecture

**Requirements**:

- Apply appropriate activation functions (ReLU, Softmax)

- Normalize the input data

- Use appropriate loss function and optimizer

- Report final accuracy on the test set

### Assignment 2: Intermediate - CNN with Data Augmentation

**Objective**: Improve classification performance using data augmentation techniques on the One Hour AI Solution logo recognition task.

**Dataset**: ai_logo_variations.csv - A dataset containing variations of the One Hour AI Solution company logo in different contexts.

**Instructions**:

1. Load and explore the logo dataset (32x32 RGB images)

2. Implement a CNN with at least:

   o Two convolutional layers

   o Appropriate pooling layers

   o Dropout for regularization

   o Dense layers for classification

3. Implement data augmentation techniques discussed in the lecture:

   o Image rotation

   o Horizontal flipping

   o Zoom variation

4. Train your model with and without data augmentation

5. Compare the performance between the two approaches

6. Visualize at least one example of your augmented images

**Requirements**:

- Implement at least three different data augmentation techniques

- Plot training and validation accuracy/loss curves

- Discuss how data augmentation affects the model's performance

- Compare with the non-augmented approach

**Assignment 3: Advanced - Transfer Learning for AI Solution Categorization**

**Objective**: Apply transfer learning to categorize screenshots from the One Hour AI Solution platform.

**Dataset**: ai_solution_screenshots.csv - A dataset containing screenshots from the One Hour AI Solution platform showing different types of AI problems.

**Instructions**:

1. Load the provided dataset of platform screenshots (64x64 RGB images)

2. Implement transfer learning using a pre-trained CNN architecture discussed in the lecture:

   o Load a pre-trained model (excluding the top classification layers)

   o Freeze the base model layers

   o Add your own classification layers

3. Train the model to categorize screenshots into different AI solution categories

4. Implement at least one regularization technique to prevent overfitting

5. Evaluate your model's performance on a separate test set

**Requirements**:

- Use a pre-trained model as discussed in the lecture (VGG, ResNet, or MobileNet)

- Apply appropriate preprocessing for the chosen pre-trained model

- Implement early stopping to prevent overfitting

- Visualize the classification results using a confusion matrix

- Discuss the advantages of transfer learning compared to training from scratch