Final Project Ideas for Neural Networks Course

# 1. Object Localization and Detection with CNNs

Problem: Develop a model that can identify and localize specific objects in images, such as cars or pedestrians. Object localization is essential in applications like autonomous driving and surveillance.

Vision: Using a CNN-based architecture, implement a model that detects objects and creates bounding boxes around them. The project could use techniques like sliding windows or anchor boxes.

Main Functionalities:

* - Implement CNN layers for feature extraction.
* - Integrate bounding box prediction for detected objects.
* - Evaluate model performance using Intersection over Union (IoU).
* - Deploy model on a small test set for live demo.

# 2. Building a Sentiment Analysis Model Using RNNs

Problem: Analyze the sentiment (positive, negative, or neutral) of customer reviews or social media posts. Sentiment analysis is crucial for customer feedback assessment.

Vision: Develop an RNN model to classify text data into sentiment categories. RNNs are suitable for this task as they can process sequential data, handling dependencies in text.

Main Functionalities:

* - Preprocess text data for model training.
* - Train an RNN or LSTM model for sentiment classification.
* - Implement a testing script for live sentiment prediction.
* - Visualize prediction accuracy and confusion matrix.

# 3. Handwritten Digit Recognition with CNNs

Problem: Create a model that recognizes handwritten digits (0–9) from images, a classic image classification task used in OCR applications.

Vision: Implement a simple CNN model to classify MNIST digits, showcasing CNN’s ability to capture spatial features in images.

Main Functionalities:

* - Load and preprocess the MNIST dataset.
* - Implement CNN layers for digit classification.
* - Evaluate model accuracy with training and test sets.
* - Visualize prediction outputs with a small live demo.

# 4. Implementing Neural Style Transfer

Problem: Create a neural style transfer model that combines the content of one image with the artistic style of another, enabling applications in creative industries.

Vision: Use CNNs to separate content and style from two images, then combine them into a single image. This project will apply concepts of feature extraction and loss functions in CNNs.

Main Functionalities:

* - Extract content and style features from input images.
* - Optimize the output image to match target content and style.
* - Fine-tune hyperparameters for style balance.
* - Present examples of different style-content combinations.

# 5. Image Classification with Transfer Learning

Problem: Classify images into predefined categories, such as dogs and cats, using transfer learning with pre-trained CNNs, which saves time and computation.

Vision: Apply transfer learning by fine-tuning a pre-trained model (e.g., ResNet or MobileNet) on a new image dataset. Transfer learning is efficient for complex tasks with limited data.

Main Functionalities:

* - Load and preprocess a labeled dataset.
* - Fine-tune a pre-trained CNN for classification.
* - Evaluate model accuracy with test images.
* - Present a live demo with image upload and classification output.