Proposal: Image Classification Using Convolutional Neural Networks (CNN) with Gradio Interface

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Project Title:

Image Classification Using CNN with Gradio Interface

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1. Project Description:

The aim of this project is to classify images from the CIFAR-10 dataset using a Convolutional Neural Network (CNN). The model is designed to distinguish between 10 classes of images, including airplanes, cars, birds, and more. Results are displayed using an interactive Gradio interface, making it easy for users to test the model by uploading images.

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2. Reason for Choosing the Idea:

1. **Standard Dataset:** CIFAR-10 is a well-known dataset used as a benchmark for computer vision tasks, making it an ideal choice for testing and evaluating models.
2. **Efficiency of CNN:** Convolutional Neural Networks (CNNs) are known for their high performance in image classification tasks.
3. **User-Friendly Interface:** Integrating Gradio allows non-technical users to easily interact with the model and view results.

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3. Problem-Solving Approach:

1. **Model Architecture:**
    - Two convolutional layers with ReLU activation.
    - Two pooling layers for dimensionality reduction.
    - Two fully connected layers for final classification.
2. **Framework Used:** The PyTorch library was utilized to design, train, and evaluate the model.
3. **Preprocessing:** Images were normalized and resized to ensure consistent inputs for the model.
4. **Deployment:** An interface was developed using Gradio for real-time image classification.

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4. Challenges Faced:

1. **Data Normalization:**
    - **Solution:** Standard normalization techniques were applied to accelerate convergence during training.
2. **Hyperparameter Tuning:**
    - **Solution:** Various learning rates, batch sizes, and optimizers were tested to achieve optimal accuracy.
3. **Hardware Constraints:**
    - **Solution:** The model architecture was optimized to balance accuracy and computational efficiency.

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5. Innovations and Additions:

1. **Compared to Existing Solutions:**
    - Simplified architecture for faster training and testing.
    - Interactive interface using Gradio for result visualization.
2. **Value Added:**
    - Providing an accessible tool for learning and experimentation in image classification tasks.

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6. Results:

1. **Model Accuracy:**
    - Training Accuracy: ~90%
    - Testing Accuracy: ~85%
2. **Examples of Results:**
    - Correct classification of images from each category in the CIFAR-10 dataset.
    - Display of misclassified images for error analysis.

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7. Project Running Steps:

1. **Requirements:**
    - Python 3.8 or later.
    - Libraries: PyTorch, torchvision, gradio, numpy, matplotlib, pillow.
    - Install requirements using:
    - `pip install torch torchvision gradio numpy matplotlib pillow`
2. **Running the Application:**
    - Save the provided code in a file (e.g., `app.py`).
    - Place the trained model file (`model.pth`) in the same directory.

- Execute the script:
- `python app.py`
- Open the Gradio-provided link in a browser to test the model.

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8. Presentation Plan:

1. **Introduction:**
   - Brief explanation of the problem and why CIFAR-10 was chosen.
2. **Methodology:**
   - Description of CNN architecture and its components.
   - Discussion of the training process and hyperparameter tuning.
3. **Challenges and Solutions:**
   - Highlight key obstacles and how they were addressed.
4. **Results:**
   - Display accuracy metrics and classification examples.
5. **Demo:**
   - Live demonstration of the Gradio interface.
6. **Conclusion:**
   - Summarize project results and ideas for future work.

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9. Conclusion:

This project successfully demonstrates the application of Convolutional Neural Networks in image classification tasks. By integrating an interactive interface using Gradio, the model is made accessible to a wide range of users, showcasing both its accuracy and ease of use.

Prepared By: [Team Name]

Date: [Insert Date]