Image Classification with CIFAR-10 Dataset

This project demonstrates image classification using the CIFAR-10 dataset and a Convolutional Neural Network (CNN) built with TensorFlow and Keras.

[Install Dependencies: Ensure you have TensorFlow, Keras, NumPy, Matplotlib, Seaborn, and PIL installed.]

1. Data Preparation

Load CIFAR-10 Dataset: The CIFAR-10 dataset is loaded using `keras.datasets.cifar10.load_data()`.

Preprocess Data:

- Reshape labels to 1D arrays.

- Normalize pixel values to the range [0, 1] by dividing by 255.

2. Model Building

CNN Architecture:A CNN model is created using `keras.models.Sequential` with the following layers:

- Convolutional layers with ReLU activation.

- Batch normalization layers.

- Max pooling layers.

- Spatial dropout layers.

- Residual block.

- Global average pooling layer.

- Dense layer with ReLU activation.

- Output dense layer with softmax activation for 10 classes.

Compilation: The model is compiled with the Adam optimizer, sparse categorical crossentropy loss, and accuracy metric.

3. Model Training

Training: The model is trained using `model.fit()` with early stopping based on validation accuracy.

Callbacks: EarlyStopping is used to prevent overfitting.

4. Evaluation

Prediction: Predictions are made on the test set using `model.predict()`.

Classification Report: A classification report is generated using `sklearn.metrics.classification_report()`.

Accuracy and Loss Plots: Training and validation accuracy and loss are plotted.

Confusion Matrix: A confusion matrix is plotted using `seaborn` and `matplotlib`.

5. Prediction on New Images

Preprocessing: A function `preprocess_image()` is defined to resize and normalize new images.

Prediction Function: A function `predict_class()` takes the model and preprocessed image as input and returns the predicted class and confidence.

6. Saving the Model

Saving: The trained model is saved as 'ciphar10_imageclass.h5' using `model.save()` for future use and deployment.

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