Introduction
This project implements two different neural network architectures for image classification using the Imagenette dataset. The dataset consists of a subset of ImageNet images across 10 classes, serving as a benchmark for classification tasks.

Dataset Preparation
- Dataset: Imagenette, a subset of ImageNet designed for benchmarking classification models.
- Data Split: 80% training, 20% validation.
- Preprocessing:
- Images resized to 224×224 for model compatibility.
- Pixel values normalized (0-1) for stability.
- Data augmentation applied to the training set (random flipping and brightness adjustments).

Neural Network Architectures
Simple Convolutional Neural Network (CNN)
- Input Layer: 224×224×3 images.

Hidden Layers:
- Three Conv2D layers with ReLU activation for feature extraction.
- MaxPooling2D layers to reduce dimensionality.
- Flatten layer to transition to fully connected layers.
- Dense layer with 128 neurons.
- Output Layer: Softmax activation for 10-class classification.

Transfer Learning with MobileNetV2
Base Model: Pretrained MobileNetV2 with frozen weights.
Additional Layers:
- GlobalAveragePooling2D to reduce spatial dimensions.
- Fully connected Dense layer with 128 neurons.
- Softmax output layer for 10-class classification.

Training Process
Data Augmentation: Applied only to the training set to improve generalization.
Callbacks:
- Early Stopping: Stops training if validation performance does not improve.
- ReduceLROnPlateau: Reduces learning rate when performance stalls.

Training Parameters:
- Optimizer: Adam (learning rate = 0.001).
- Loss Function: Sparse Categorical Crossentropy.
- Batch Size: 32.
- Epochs: 10.

Evaluation & Results
- CNN Accuracy: 56% after 10 epochs.
- MobileNetV2 Accuracy: 98% after 10 epochs.
- Loss Trend: Validation loss decreased consistently for MobileNetV2, indicating superior learning.
- Visualization: Accuracy/loss plots confirm MobileNetV2's stability and effectiveness.

Conclusion
This project demonstrates the effectiveness of transfer learning in image classification. While a basic CNN achieved moderate accuracy (56%), leveraging MobileNetV2 significantly improved accuracy to 98%. Transfer learning proves to be a powerful approach for small datasets, benefiting from pretrained feature extraction.
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