EAST WEST UNIVERSITY

Assignment-3

Artificial Intelligence - Computer Vision

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Objective:

The objective of this assignment is to implement and compare the performance of two deep learning models, ResNet50 and MobileNetV2, for image classification tasks. The goal is to classify images into predefined categories using a specific dataset and evaluate the models based on accuracy, training time, and complexity metrics.

Introduction:

In this assignment, we aim to develop and train deep learning models for image classification tasks using the ResNet50 and MobileNetV2 architectures. The implemented models will be trained on a dataset comprising various images categorized into predefined classes. The performance of each model will be evaluated in terms of accuracy, training time, and complexity.

Data Preprocessing:

- Loading Dataset: The dataset is loaded using the `image_dataset_from_directory` function provided by TensorFlow. It is split into training and validation sets with a 80-20 split ratio.

- Data Augmentation: To increase the diversity of training data and improve model generalization, data augmentation techniques like random flip, rotation, and zoom are applied.
- Normalization: Image pixel values are scaled to the range [0, 1] using rescaling.

Model Architecture:

1. ResNet50:
    - The ResNet50 model is utilized without pre-trained weights.
    - Custom layers including GlobalAveragePooling2D and Dense layers are added on top.
    - The final layer employs a softmax activation function for multi-class classification.
2. MobileNetV2:
    - Similar to ResNet50, MobileNetV2 is used without pre-trained weights.
    - Custom layers are added on top followed by a GlobalAveragePooling2D layer and Dense layers.
    - The output layer utilizes a softmax activation function for multi-class classification

Training Process:

Both models are trained for 10 epochs with early stopping applied to prevent overfitting. The training process involves minimizing the sparse categorical cross-entropy loss using the Adam optimizer.

Evaluation Metrics:

1. Accuracy: The accuracy of both models is evaluated on the validation dataset.
2. Loss: The loss function used during training is evaluated on the validation dataset.

Result:

ResNet50 showed high accuracy, attributed to its deeper architecture which captures more complex features. However, it was slower to train due to its increased complexity.

- MobileNetV2 also demonstrated high accuracy while being faster to train, thanks to its lightweight design optimized for

efficiency. This model's performance was particularly notable given its reduced parameter count compared to ResNet50.

- Both models displayed consistent improvement during training, with no significant overfitting observed, likely due to the effective use of data augmentation and regularization techniques.

Conclusion:

In conclusion, ResNet50 outperforms MobileNetV2 in terms of accuracy but requires more computational resources. MobileNetV2 offers a lightweight alternative with faster training times and lower complexity, making it suitable for resource-constrained environments.