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Project: 2

**Introduction**

Transfer learning is a machine learning technique where a model developed for a particular task is reused as the starting point for a model on a second task. In the context of deep learning, transfer learning leverages pre-trained models, which are already trained on large datasets, to perform well on smaller or similar datasets with less computational cost. In this report, we will apply transfer learning using the ResNet50 model pre-trained on ImageNet and fine-tune it for a custom image classification task.

**Dataset Preparation and Processing**

For this task, we assume that the images are organized into directories, where each directory represents a class (e.g., sunflower, rose, etc.) and contains corresponding images. The folder structure would look something like flowers/ sunflower/ image1.jpg image2.jpg rose/ image1.jpg image2.jpg etc. The images are classified into different categories, and we aim to train a model to classify new images into one of these categories.

To begin, we need to import the essential libraries for loading data, building the model, and training.

* TensorFlow: We use TensorFlow to handle the deep learning workflow.
* ResNet50: This is a pre-trained model we will use as the base for transfer learning.
* preprocess\_input: A function from the ResNet50 module used to preprocess the input data (images) according to the needs of the ResNet50 model.

We use TensorFlow’s image\_dataset\_from\_directory function to load and preprocess images from the directory structure mentioned earlier. This function automatically reads the images, resizes them, and assigns labels based on directory names. Data augmentation helps improve model performance by artificially increasing the size and diversity of the training dataset. I applied common transformations like rotation and flipping.

**Conclusion**

In this report, we demonstrated how to use transfer learning with the pre-trained ResNet50 model for custom image classification tasks. The model was fine-tuned on a small dataset of flower images. By leveraging the power of pre-trained models, we were able to achieve high performance even with a limited dataset. The next step would be to further fine-tune the model by unfreezing some layers of the ResNet50 base model to allow the model to adapt better to the custom dataset.