Image Classification

1. Introduction

This report focuses on image recognition, specifically classifying images based on the experts who handled them. Our objective is to categorize the images into five classes: **expA, expB, expC, expD, and expE**.The outcomes showcased in this report are produced using Python scripts within the PyTorch framework.<

2. Dataset

The dataset comprises 25,000 samples, with 20,000 samples allocated to the training set and 5,000 to the test set. All images have a resolution of 256 x 256 pixels and are in RGB color space.

3. Preprocessing

PyTorch was utilized for conducting data augmentation tasks including image resizing, flips, and normalization.

4. Training

For the training phase, we employed various strategies including fine-tuning, feature extraction, and training from scratch. Specifically, we utilized ResNet for training the models, implementing the aforementioned strategies. The models (ResNet 18, ResNet 34, and ResNet 50) were trained for up to 40 epochs, starting with a learning rate of 0.01 that decayed over time (every 10 epochs). ResNet 50 exhibited the highest training accuracy, reaching up to 65%, although it displayed signs of overfitting, as we will discuss in the model evaluation section. Generally, beyond 20 epochs, most training models showed no significant improvement in accuracy, as illustrated in **Fig. 1**.

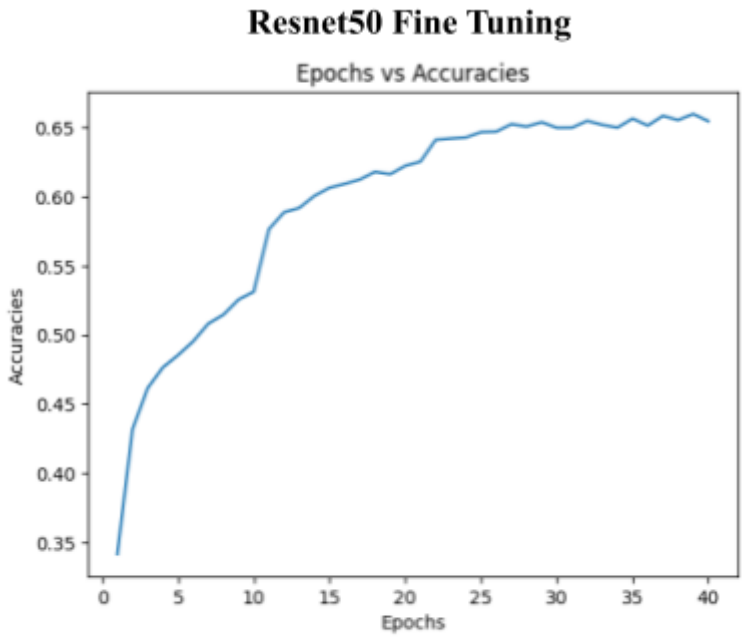

Fig. 1. Accuracy Graph depicting the Model Trained on ResNet50 with Fine Tuning across Epochs

5. Evaluation

The evaluation of the models is illustrated in the table provided below. It is evident from the results that fine-tuning ResNet 50 exhibits clear signs of overfitting, whereas training ResNet 50 from scratch emerges as the most promising model.

	Fine Tuning	Feature Extractor	Scratch
ResNet 18	Best Training Acc: 58.4% Test Acc: 42%	Best Training Acc: 34.91% Test Acc: 26%	Best Training Acc: 45.3% Test Acc: 40%
ResNet 34	Best Training Acc: 60.9% Test Acc: 40%	Best Training Acc: 35.7% Test Acc: 34%	Best Training Acc: 45.49% Test Acc: 44%
ResNet 50	Best Training Acc: 65.99% Test Acc: 44%	Best Training Acc: 39.8% Test Acc: 40%	Best Training Acc: 43.8% Test Acc: 48%

Table 1. Displays various ResNet models trained through fine-tuning, feature extraction, and training from scratch, along with their corresponding top training accuracies and test accuracies.

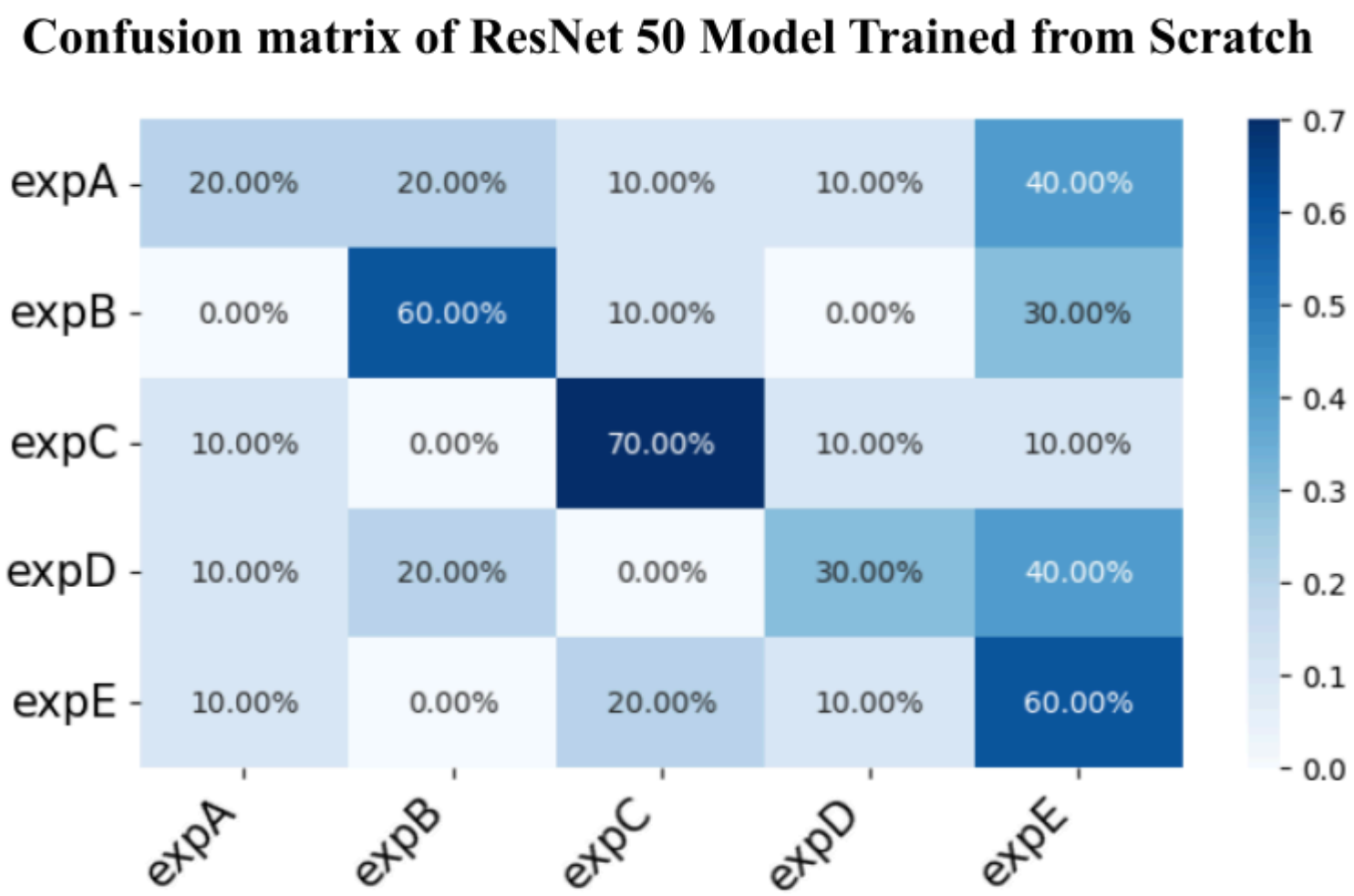

Fig. 2. The confusion matrix illustrates a high classification rate for the "expC" class and a low classification rate for "expA". Notably, there is a tendency for confusion with the "expE" class across most categories.