

**AI Disclosure:** 1. Same as SimpleCNN, Search in Chatgpt for data augmentation method, learning two method and put them in the transform\_trainer code:  
transforms.RandomHorizontalFlip(), transforms.RandomCrop(32, padding=4)  
2. Search in Chatgpt for Gradually unfreeze layers, changed layers for shorter distances, which performs better than original data set

**Model Description:** Beside the traditional CNN model, the advanced model uses the pretrain method, using ResNet50. I use gradually unfreezing layers for transfer learning. Since ResNet50 is already complex enough, I choose only linear layers and ReLU to avoid overfitting caused by complex structure.

**Hyperparameter Tuning:** For training transform, I pick the normalization value (0.5071, 0.4867, 0.4408), (0.2675, 0.2565, 0.2761) since that is the mean and deviation from CIFAR-100's website. I chose the learning rate to be 0.0005, which performs better than 0.002 and 0.001 as I tried. I choose epoch as 15, since epoch valuation and train accuracy become stable after epoch 15.

**Regularization Techniques:** I used a drop\_out rate at 0.3 to prevent overfitting. Since this model is complex enough I can choose a higher drop\_out rate than previous models. I also added a L2 weight decay so the model tends to have average weights.

**Data Augmentation:** I still use random crop and randomHorizontalFlip to improve the performance of data the model had not seen before, and to prevent overfitting.

**Results Analysis:** The ending score 0.44 is an expected result. Indicating the use of transfer learning and choice of ResNet50 give us a good training. The problem with the model is that it gets easier to overfit, so it might be proper to add weight\_decay to avoid overfitting.

**Experiment Tracking Summary:** Training and validation accuracy diverges around epoch 10, leading to a difference of 10%. The Training accuracy becomes 70% at the end, which may indicate an overfitting. The training and validation accuracy increases faster at first and becomes stable after epoch 12. This is a good sign of training.