/Users/gaotangli/PycharmProjects/pythonProject/venv/bin/python /Users/gaotangli/Desktop/hw4/transfer\_learning.py

Finetune the pre-trained model

Performance of pre-trained model without finetuning

/Users/gaotangli/PycharmProjects/pythonProject/venv/lib/python3.9/site-packages/torch/nn/functional.py:718: UserWarning: Named tensors and all their associated APIs are an experimental feature and subject to change. Please do not use them for anything important until they are released as stable. (Triggered internally at ../c10/core/TensorImpl.h:1156.)

return torch.max\_pool2d(input, kernel\_size, stride, padding, dilation, ceil\_mode)

Training complete in 0m 33s

Best val Acc: 0.457516

Finetune the model

/Users/gaotangli/PycharmProjects/pythonProject/venv/lib/python3.9/site-packages/torch/optim/lr\_scheduler.py:129: UserWarning: Detected call of `lr\_scheduler.step()` before `optimizer.step()`. In PyTorch 1.1.0 and later, you should call them in the opposite order: `optimizer.step()` before `lr\_scheduler.step()`. Failure to do this will result in PyTorch skipping the first value of the learning rate schedule. See more details at https://pytorch.org/docs/stable/optim.html#how-to-adjust-learning-rate

warnings.warn("Detected call of `lr\_scheduler.step()` before `optimizer.step()`. "

Epoch 0/24

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train Loss: 0.7236 Acc: 0.6639

val Loss: 0.1830 Acc: 0.9281

Epoch 1/24

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train Loss: 0.6011 Acc: 0.7828

val Loss: 0.2958 Acc: 0.9020

Epoch 2/24

----------

train Loss: 0.5473 Acc: 0.8033

val Loss: 0.5021 Acc: 0.8301

Epoch 3/24

----------

train Loss: 0.5537 Acc: 0.7951

val Loss: 0.3043 Acc: 0.8824

Epoch 4/24

----------

train Loss: 0.5407 Acc: 0.7992

val Loss: 0.3772 Acc: 0.8562

Epoch 5/24

----------

train Loss: 0.4828 Acc: 0.7910

val Loss: 0.3027 Acc: 0.8627

Epoch 6/24

----------

train Loss: 0.3374 Acc: 0.8484

val Loss: 0.2632 Acc: 0.9020

Epoch 7/24

----------

train Loss: 0.3592 Acc: 0.8484

val Loss: 0.2668 Acc: 0.9150

Epoch 8/24

----------

train Loss: 0.2543 Acc: 0.8893

val Loss: 0.2592 Acc: 0.9216

Epoch 9/24

----------

train Loss: 0.3279 Acc: 0.8975

val Loss: 0.2550 Acc: 0.9150

Epoch 10/24

----------

train Loss: 0.3317 Acc: 0.8320

val Loss: 0.2555 Acc: 0.9216

Epoch 11/24

----------

train Loss: 0.3198 Acc: 0.8893

val Loss: 0.2764 Acc: 0.9020

Epoch 12/24

----------

train Loss: 0.3904 Acc: 0.8361

val Loss: 0.2399 Acc: 0.9150

Epoch 13/24

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train Loss: 0.2723 Acc: 0.8852

val Loss: 0.2662 Acc: 0.9020

Epoch 14/24

----------

train Loss: 0.3015 Acc: 0.8443

val Loss: 0.2246 Acc: 0.9216

Epoch 15/24

----------

train Loss: 0.3326 Acc: 0.8525

val Loss: 0.2297 Acc: 0.9281

Epoch 16/24

----------

train Loss: 0.3034 Acc: 0.8811

val Loss: 0.2620 Acc: 0.9020

Epoch 17/24

----------

train Loss: 0.2440 Acc: 0.9016

val Loss: 0.2411 Acc: 0.9150

Epoch 18/24

----------

train Loss: 0.2925 Acc: 0.8852

val Loss: 0.2557 Acc: 0.9020

Epoch 19/24

----------

train Loss: 0.3096 Acc: 0.8402

val Loss: 0.2268 Acc: 0.9150

Epoch 20/24

----------

train Loss: 0.2528 Acc: 0.9016

val Loss: 0.2178 Acc: 0.9150

Epoch 21/24

----------

train Loss: 0.2577 Acc: 0.8893

val Loss: 0.2443 Acc: 0.9150

Epoch 22/24

----------

train Loss: 0.2785 Acc: 0.8484

val Loss: 0.2403 Acc: 0.9085

Epoch 23/24

----------

train Loss: 0.2459 Acc: 0.9016

val Loss: 0.2105 Acc: 0.9346

Epoch 24/24

----------

train Loss: 0.3002 Acc: 0.8607

val Loss: 0.2385 Acc: 0.9085

Training complete in 43m 54s

Best val Acc: 0.934641

Freeze the parameters in pre-trained model and train the final fc layer

Performance of pre-trained model without finetuning

Training complete in 0m 31s

Best val Acc: 0.640523

Finetune the model

Epoch 0/24

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train Loss: 0.7285 Acc: 0.5984

val Loss: 0.5515 Acc: 0.7059

Epoch 1/24

----------

train Loss: 0.4310 Acc: 0.8033

val Loss: 0.1973 Acc: 0.9608

Epoch 2/24

----------

train Loss: 0.3974 Acc: 0.8074

val Loss: 0.2491 Acc: 0.9150

Epoch 3/24

----------

train Loss: 0.4290 Acc: 0.8156

val Loss: 0.2169 Acc: 0.9412

Epoch 4/24

----------

train Loss: 0.4835 Acc: 0.7910

val Loss: 0.2891 Acc: 0.9150

Epoch 5/24

----------

train Loss: 0.5074 Acc: 0.7787

val Loss: 0.1939 Acc: 0.9412

Epoch 6/24

----------

train Loss: 0.3020 Acc: 0.8689

val Loss: 0.2040 Acc: 0.9477

Epoch 7/24

----------

train Loss: 0.2923 Acc: 0.8648

val Loss: 0.1868 Acc: 0.9542

Epoch 8/24

----------

train Loss: 0.3691 Acc: 0.8402

val Loss: 0.1925 Acc: 0.9477

Epoch 9/24

----------

train Loss: 0.3493 Acc: 0.8074

val Loss: 0.1902 Acc: 0.9477

Epoch 10/24

----------

train Loss: 0.3631 Acc: 0.8689

val Loss: 0.1790 Acc: 0.9542

Epoch 11/24

----------

train Loss: 0.2833 Acc: 0.8770

val Loss: 0.1843 Acc: 0.9542

Epoch 12/24

----------

train Loss: 0.3243 Acc: 0.8238

val Loss: 0.2017 Acc: 0.9412

Epoch 13/24

----------

train Loss: 0.2725 Acc: 0.8607

val Loss: 0.1815 Acc: 0.9477

Epoch 14/24

----------

train Loss: 0.3401 Acc: 0.8443

val Loss: 0.1956 Acc: 0.9412

Epoch 15/24

----------

train Loss: 0.3866 Acc: 0.8115

val Loss: 0.2077 Acc: 0.9412

Epoch 16/24

----------

train Loss: 0.3409 Acc: 0.8525

val Loss: 0.2064 Acc: 0.9477

Epoch 17/24

----------

train Loss: 0.2942 Acc: 0.8852

val Loss: 0.1986 Acc: 0.9412

Epoch 18/24

----------

train Loss: 0.2986 Acc: 0.8770

val Loss: 0.1858 Acc: 0.9412

Epoch 19/24

----------

train Loss: 0.3182 Acc: 0.8607

val Loss: 0.1942 Acc: 0.9542

Epoch 20/24

----------

train Loss: 0.3173 Acc: 0.8607

val Loss: 0.1961 Acc: 0.9477

Epoch 21/24

----------

train Loss: 0.3095 Acc: 0.8689

val Loss: 0.1894 Acc: 0.9477

Epoch 22/24

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train Loss: 0.2846 Acc: 0.8689

val Loss: 0.2103 Acc: 0.9477

Epoch 23/24

----------

train Loss: 0.2880 Acc: 0.8852

val Loss: 0.1846 Acc: 0.9412

Epoch 24/24

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train Loss: 0.3171 Acc: 0.8689

val Loss: 0.2034 Acc: 0.9412

Training complete in 26m 44s

Best val Acc: 0.960784

Process finished with exit code 0