DLCV HW4 Report
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P1、Prototypical Network

1. implementation details

   Accuracy: 43.99 +- 0.83 %

   Prototype Network architecture:

   ```
   conv: { nn.Conv2d(in_channels, out_channels, 3, padding=1),
           bn,
           nn.ReLU(),
           nn.MaxPool2d(2) } * 4
   mlp: { nn.Linear(1600, 800),
          nn.ReLU(),
          nn.Dropout(),
          nn.Linear(800, 800),
          nn.ReLU(),
          nn.Dropout(),
          nn.Linear(800, 400) }
   ```

   Optimizer: optimizer = torch.optim.AdamW(model.parameters(), lr=1e-2, betas=(0.9, 0.999), eps=1e-08, weight_decay=1e-4)

   meta-train setting: 5 ways 5 shots

   meta-test setting : 5 ways 1 shot

   distance function: parametric function

   training epoch: 200

   lr-scheduler: none

   transforms: none

2. distance function (all in 5 way 1 shot meta learning)

   Euclidean distance: Accuracy: 38.94 +- 0.78 %

   cosine similarity: Accuracy: 42.62 +- 0.86

   parametric function: Accuracy: 43.36 +- 0.86 %

   parametric function model architecture:

   ```
   nn.Sequential(
       nn.Linear(800, 400),
       nn.ReLU(),
       nn.Dropout(),
       nn.Linear(400, 1)
   )
   ```

   discuss:

   All these three tasks were trained on the setting of 5 ways 1 shot meta-train and 5 ways 1 shot meta-test. All of them were trained for 200 epochs. We can find that if we applied the Euclidean distance function, it would get a worse performance than the other two distance functions. The parametric function got the best performance. I think it is make sense because we use a prototype network to project our images to a feature space, we should not

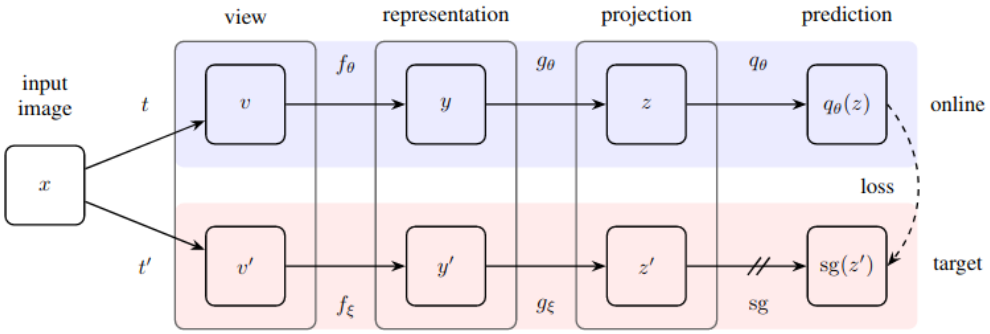
calculate all the feature distances between any two images in the same way.

3. N-way K shot
   K=1: Accuracy: 43.36 +- 0.86 %
   K=5: Accuracy: 43.99 +- 0.83 %
   K=10: Accuracy: 43.05 +- 0.86 %

   discuss:
   At first I thought that the 5-way 10-shot meta-learn task would get the best performance. I think that's because I need to train for more steps, it may be harder for training a task with higher shots. We can also find that 5-way 1-shot meta-learn task converge sooner. I guess if I trained it for more steps, a 5-way 10-shot meta-learn task can get a better result.

P2、Self-Supervised Pre-training for Image Classification

1. implementation details
   backbone model: resnet50
   learner: BYOL package



   Classifier model: nn.Linear(1000, 65)
   data augmentation for pretraining:
      filenameToPILImage,
      transforms.ToTensor(),
      transforms.Resize((128, 128)),
      transforms.Normalize([0.485, 0.456, 0.406], [0.229, 0.224, 0.225]
   data augmentation for fine turning:
      filenameToPILImage,
      transforms.AutoAugment(),
      transforms.ToTensor(),
      transforms.Resize((128, 128)),
      transforms.Normalize([0.485, 0.456, 0.406], [0.229, 0.224, 0.225]
   Optimizer: optimizer = torch.optim.AdamW(model.parameters(), lr=2e-5, betas=(0.9, 0.999), eps=1e-08, weight_decay=1e-4, amsgrad=False)
   Loss function: nn.CrossEntropyLoss()
   Lr-scheduler: get_cosine_schedule_with_warmup
   Fine turning Training epoch: 100

2. Result table

Setting	Pre-training (Mini-ImageNet)	Fine-tuning (Office-Home dataset)	Classification accuracy on valid set (Office-Home dataset)
A		Train full model (backbone + classifier)	0.12
B	w/ label (TAs have provided this backbone)	Train full model (backbone + classifier)	0.24
C	w/o label (Your SSL pre-trained backbone)	Train full model (backbone + classifier)	0.37
D	w/ label (TAs have provided this backbone)	Fix the backbone. Train classifier only	0.17
E	w/o label (Your SSL pre-trained backbone)	Fix the backbone. Train classifier only	0.18

Table[1]

3. Discuss and analyze
   I trained my models on P100 GPU, it cost almost 7 hours to train one task. Most of the training tasks would converge at about 60th epoch. Before I got the result of the table[1], I guessed that the B set should get the highest accuracy. However, that was wrong. The C set got the highest accuracy. I think the reason which caused this situation is: model pretrained on Mini dataset with labels will overfit on the dataset. If we pretrained in self-supervised learning, it wouldn't overfit on training dataset. Besides, we can also find that if we fixed the backbone model, the result could be worse than training full model.

Reference:
https://github.com/lucidrains/byol-pytorch
https://github.com/sicara/easy-few-shot-learning
https://github.com/kai860115/DLCV2020-FALL/tree/main/hw4