Kaggle Competetion

- Using Colab
- Colab Pro (High-RAM mode) is required. Otherwise, the resnet50 will crush program due to RAM overflow

Part 1: Import Training Data

- Upload dataset 5_shot.zip to colab (should be in '/content/')
- Run the following cells to:
  - Unzip the file to maintain the directory
  - Create 'train.txt' for all the training data in the format: "folder/image,label", such as "0/2.jpg, 0....."
  - Create 'test.txt' for all the testing data in the format: "image,label", such as "2.jpg, 0....."
  - Import data into pytorch dataset and dataloader

```
# Uncomment this line if unzip the dataset
!unzip 5_shot.zip
```

```
  inflating: 5_shot/train/19/0.jpg
  inflating: 5_shot/train/19/1.jpg
  inflating: 5_shot/train/19/2.jpg
  inflating: 5_shot/train/19/3.jpg
  inflating: 5_shot/train/19/4.jpg
   creating: 5_shot/train/2/
  inflating: 5_shot/train/2/29.jpg
  inflating: 5_shot/train/2/30.jpg
  inflating: 5_shot/train/2/31.jpg
  inflating: 5_shot/train/2/8.jpg
  inflating: 5_shot/train/2/9.jpg
   creating: 5_shot/train/20/
  inflating: 5_shot/train/20/0.jpg
  inflating: 5_shot/train/20/1.jpg
  inflating: 5_shot/train/20/2.jpg
  inflating: 5_shot/train/20/3.jpg
  inflating: 5_shot/train/20/4.jpg
   creating: 5_shot/train/21/
  inflating: 5_shot/train/21/0.jpg
  inflating: 5_shot/train/21/1.jpg
  inflating: 5_shot/train/21/2.jpg
  inflating: 5_shot/train/21/3.jpg
  inflating: 5_shot/train/21/5.jpg
   creating: 5_shot/train/3/
  inflating: 5_shot/train/3/15.jpg
  inflating: 5_shot/train/3/23.jpg
  inflating: 5_shot/train/3/5.jpg
  inflating: 5_shot/train/3/7.jpg
  inflating: 5_shot/train/3/8.jpg
   creating: 5_shot/train/4/
```

```
  inflating: 5_shot/train/4/0.jpg
  inflating: 5_shot/train/4/1.jpg
  inflating: 5_shot/train/4/16.jpg
  inflating: 5_shot/train/4/5.jpg
  inflating: 5_shot/train/4/8.jpg
   creating: 5_shot/train/5/
  inflating: 5_shot/train/5/0.jpg
  inflating: 5_shot/train/5/1.jpg
  inflating: 5_shot/train/5/2.jpg
  inflating: 5_shot/train/5/3.jpg
  inflating: 5_shot/train/5/4.jpg
   creating: 5_shot/train/6/
  inflating: 5_shot/train/6/1.jpg
  inflating: 5_shot/train/6/23.jpg
  inflating: 5_shot/train/6/24.jpg
  inflating: 5_shot/train/6/4.jpg
  inflating: 5_shot/train/6/5.jpg
   creating: 5_shot/train/7/
  inflating: 5_shot/train/7/1.jpg
  inflating: 5_shot/train/7/3.jpg
  inflating: 5_shot/train/7/4.jpg
  inflating: 5_shot/train/7/5.jpg
  inflating: 5_shot/train/7/6.jpg
   creating: 5_shot/train/8/
  inflating: 5_shot/train/8/0.jpg
  inflating: 5_shot/train/8/2.jpg
  inflating: 5_shot/train/8/3.jpg
  inflating: 5_shot/train/8/4.jpg
  inflating: 5_shot/train/8/5.jpg
```

```python
import os
import pandas as pd
import numpy as np
from torchvision.io import read_image
import torch
from torch.utils.data import Dataset
from torchvision import datasets
from torchvision.transforms import ToTensor
from torch.utils.data import DataLoader
import matplotlib.pyplot as plt
import argparse
from torch import nn, optim
from torch.nn import functional as F
from torchvision import datasets, transforms
from torchvision.utils import save_image
from IPython.display import Image, display
import torchvision.models as models
import gc

# script parameters
batch_size = 10

# run on GPU if possible
cuda = torch.cuda.is_available()
device = torch.device("cuda" if cuda else "cpu")

# connect to a directory with
```

```
os.chdir("/content/5_shot/train")

#  os.listdir(dirname)  returns  the  list  of  filenames  in  the  named  directory
filenames  =  os.listdir(".")

#  create  a  txt  file  for  the  training  set
with  open('train.txt',  'w')  as  f:
    f.write('image,label\n')
    for  i  in  range(22):
        path  =  './'  +  str(i)
        for  j  in  os.listdir(path):
            image  =  str(i)  +  '/'  +  str(j)  +  ','  +  str(i)  +  '\n'
            f.write(image)

#  connect  to  a  directory  with
os.chdir("/content/5_shot/test")

#  create  a  txt  file  for  the  training  set
with  open('test.txt',  'w')  as  f:
    f.write('image,label\n')
    for  i  in  range(517):
        image  =  str(i)  +  '.jpg,'  +  str(0)  +  '\n'
        f.write(image)
```

```
#  Using  CustomImageDataset  from  Pytorch  Tutorial:  https://pytorch.org/tutorials/beginner/b
class  CustomImageDataset(Dataset):
        def  __init__(self,  annotations_file,  img_dir,  transform=None,  target_transform=None
                self.img_labels  =  pd.read_csv(annotations_file)
                self.img_dir  =  img_dir
                self.transform  =  transform
                self.target_transform  =  target_transform

        def  __len__(self):
                return  len(self.img_labels)

        def  __getitem__(self,  idx):
                img_path  =  os.path.join(self.img_dir,  self.img_labels.iloc[idx,  0])
                image  =  read_image(img_path)
                image  =  image  /  255.
                label  =  self.img_labels.iloc[idx,  1]
                if  self.transform:
                        image  =  self.transform(image)
                if  self.target_transform:
                        label  =  self.target_transform(label)
                return  image,  label

crop_transform  =  transforms.Compose([  transforms.ColorJitter(brightness=.5,  hue=.3),transfor
scale_transform  =  transforms.Compose([  transforms.CenterCrop((500,1000))])

#  target  transform
def  tt(i):
    return  torch.full((4,),i)

#  Create  Dataset  and  Dataloader
```

```
training_data = CustomImageDataset('/content/5_shot/train/train.txt','/content/5_shot/train/')
center_training_data = CustomImageDataset('/content/5_shot/train/train.txt','/content/5_shot/t
crop_training_data = CustomImageDataset('/content/5_shot/train/train.txt','/content/5_shot/tra

train_loader = DataLoader(training_data, batch_size=batch_size, shuffle=True)
center_train_loader = DataLoader(center_training_data, batch_size=batch_size, shuffle=True)
crop_train_loader = DataLoader(crop_training_data, batch_size=batch_size, shuffle=True)

test_set = CustomImageDataset('/content/5_shot/test/test.txt','/content/5_shot/test/')
test_loader = DataLoader(test_set, batch_size=batch_size)
```

Part 2: Train Model

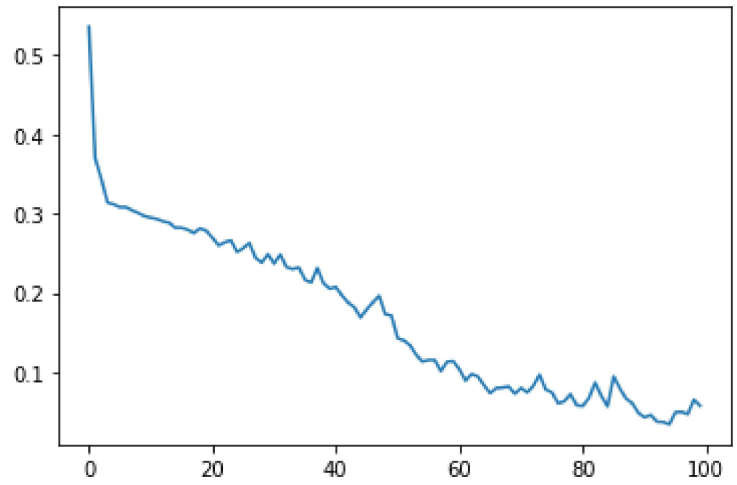
```
def train(epoch, model, optimizer, loss_fn, train_loader=train_loader):
        gc.collect()
        train_BCE = 0
        for batch_idx, (data, l) in enumerate(train_loader):
                data = data.to(device)
                l = l.to(device)
                optimizer.zero_grad()
                batch_pred = model(data)
                loss = loss_fn(batch_pred, l.type(torch.LongTensor).to(device))
                loss.backward()
                train_BCE += loss.item()
                optimizer.step()

        average_train_BCE = train_BCE / len(train_loader.dataset)
        return average_train_BCE

# train augmented dataset such as FiveCrop
def crop_train(epoch, model, optimizer, loss_fn, train_loader=train_loader):
        gc.collect()
        train_BCE = 0
        for batch_idx, (data, l) in enumerate(train_loader):
                data = data.to(device)
                l = l.to(device)
                optimizer.zero_grad()
                bat, i, c, h, w = data.shape
                batch_pred = model(data.view(-1,c,h,w))
                loss = loss_fn(batch_pred, l.view(-1).type(torch.LongTensor).to(device))
                loss.backward()
                train_BCE += loss.item()
                optimizer.step()

        average_train_BCE = train_BCE / len(train_loader.dataset)
        return average_train_BCE
```

Part 3: Main

- I used ResNet50 model, trained with 50 epochs.
- Different training data set by augmentation and transformation:

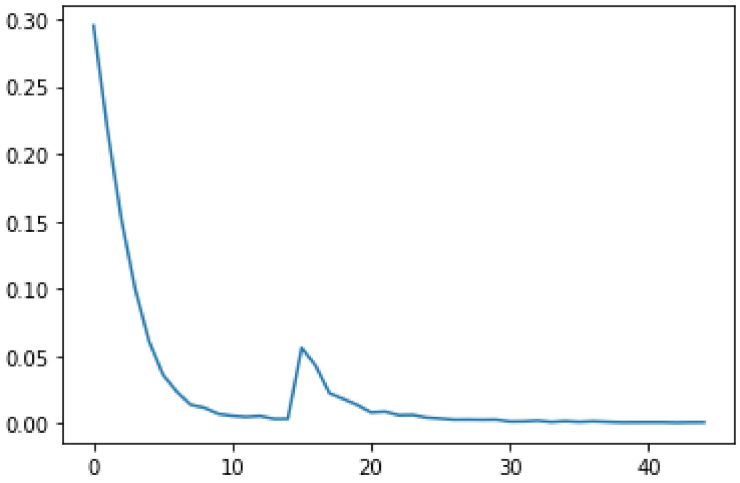
    - The first data set is augmented, that all images are center cropped.
    - The second one is the color transformed by using ColorJitter. Training with different brightness seems very helpful.
    - The third one is the original set.
- Different training optimizors are compared: Adam is more realistic than SGD, since it converges faster.

```
# train the ResNet model
epochs = 50
train_BCE = []
model_SGD = models.resnet50(pretrained=True).to(device)
model_SGD.fc = nn.Linear(model_SGD.fc.in_features, 22).to(device)
optimizer = optim.SGD(model_SGD.parameters(), lr=0.1, momentum=0.9)
loss_fn = nn.CrossEntropyLoss()

for epoch in range(1, epochs + 1):
        average_train_BCE = train(epoch, model_SGD, optimizer, loss_fn, crop_train_loader)
        train_BCE.append(average_train_BCE)

for epoch in range(1, epochs + 1):
        average_train_BCE = train(epoch, model_SGD, optimizer, loss_fn)
        train_BCE.append(average_train_BCE)

plt.plot(train_BCE)
plt.show()
```



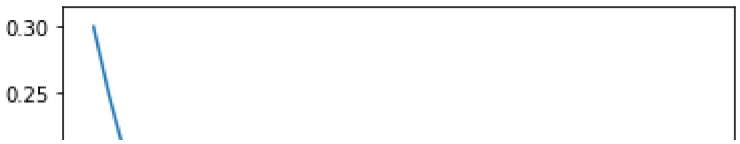

```
# train the ResNet model
epochs = 15
train_BCE = []
model = models.resnet50(pretrained=True).to(device)
model.fc = nn.Linear(model.fc.in_features, 22).to(device)
optimizer = optim.Adam(model.parameters(), lr=1e-4)
loss_fn = nn.CrossEntropyLoss()

for epoch in range(1, epochs + 1):
        average_train_BCE = train(epoch, model, optimizer, loss_fn, center_train_loader)
        train_BCE.append(average_train_BCE)
```

```
12
13 for epoch in range(1, epochs + 1):
14         average_train_BCE = train(epoch, model, optimizer, loss_fn, crop_train_loader)
15         train_BCE.append(average_train_BCE)
16
17 for epoch in range(1, epochs + 1):
18         average_train_BCE = train(epoch, model, optimizer, loss_fn)
19         train_BCE.append(average_train_BCE)
20
21 plt.plot(train_BCE)
22 plt.show()
```




```
1 # train the ResNet model
2 epochs = 20
3 train_BCE = []
4 model1 = models.resnet50(pretrained=True).to(device)
5 model1.fc = nn.Linear(model1.fc.in_features, 22).to(device)
6 optimizer = optim.Adam(model1.parameters(), lr=1e-4)
7 loss_fn = nn.CrossEntropyLoss()
8
9 for epoch in range(1, epochs + 1):
10         average_train_BCE = train(epoch, model1, optimizer, loss_fn, crop_train_loader)
11         train_BCE.append(average_train_BCE)
12
13 for epoch in range(1, epochs + 1):
14         average_train_BCE = train(epoch, model1, optimizer, loss_fn)
15         train_BCE.append(average_train_BCE)
16
17 plt.plot(train_BCE)
18 plt.show()
```

```
Downloading: "https://download.pytorch.org/models/resnet50-0676ba61.pth" to /root/.cache/tor
100%                                                  97.8M/97.8M [00:00<00:00, 197MB/s]
```



Part 4: Generate Predictions

```
def output(model):
        model.eval()
        acc = torch.tensor([-1])
        with torch.no_grad():
                for i, (data, l) in enumerate(test_loader):
                        data = data.to(device)
                        l = l.to(device)
                        batch_pred = model(data)
                        acc = torch.cat((acc,(torch.max(batch_pred,dim=1)[1].to("cpu"))),0)
        return acc
```

```
o1 = output(model1)
```

```
# Print the predictions to '/content/'
with open('/content/20757202Wang.csv', 'w') as f:
    f.write('id,category\n')
    for i in range(517):
            image = str(i) + ',' + str(o1[i+1].item()) + '\n'
            f.write(image)
```