In [1]:

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

In [2]:

```
%cd /content/drive/MyDrive/Robert_Bosch/dataset/Test_data/
%ls
# # %mkdir -p dataset
# !pip install ipdb
# # !unzip Test_data.zip -d dataset
```

```
/content/drive/MyDrive/Robert_Bosch/dataset/Test_data
Sample_Submission.csv  Test/  Train/  Val/
```

In [3]:

```
%ls
```

```
Sample_Submission.csv  Test/  Train/  Val/
```

In [6]:

```
import glob
import numpy as np
import matplotlib.pyplot as plt
import cv2
# import ipdb
import pandas as pd
import os
os.chdir('./')
train_test_val = 0
dataset = []
k_fold = True
# folders_to_look = ['Train/','Val/','Test/'] if k_fold==True else ['Train/']
classes = [cl.split('/')[1] for cl in glob.glob('Train/'+'/*')] #Class names
cls_len = len(glob.glob('Train/'+'/*')) #Number of Classes in the dataset

for folder in glob.iglob('*/'):
    if(folder == 'Test/'):

        for files in glob.iglob(folder+"/*.jpg"):
            img_path = files
            dataset.append((img_path,-1))

    else:

        for classess in glob.glob(folder+'/*'):
            for files in glob.iglob(classess+"/*.jpg"):
                img_path = files
                class_id = classes.index(files.split('/')[1])
                dataset.append((img_path,class_id))


df = pd.DataFrame(dataset,columns=['image_path','class'])

train_df, val_df, test_df = df.iloc[:970],df.iloc[970:970+2910], df.iloc[970+2910:]
print("Data Points Available in the Dataset:")
print("Train:",len(train_df),"Validate:",len(val_df),"Test:",len(test_df))


#Checking for Class Imbalance
cls, counts = np.unique(train_df['class'].values, return_counts=True)
# print([print("class:",classes[cls[i]],"counts:",counts[i]) for i in range(cls_len)])
# Hence no class imbalance
```

```
Data Points:
Train: 970 Validate: 2910 Test: 1940
```

In [ ]:

```
class config:
    test = True
    triplet = False
    num_classes = len(classes)
    clases = classes
    val_batch_size = 8*4*4

if config.triplet:
  train_batch_size = 8 # Reduce if triplet is True, defualt : 8*4*4
else:
  train_batch_size = 8*4
```

In [ ]:

```
#k-Fold Validation

# from sklearn.model_selection import StratifiedKFold
# skf = StratifiedKFold(n_splits=6)
# skf.get_n_splits(len(df))
# fold = 0
# df['fold'] =0
# for train_index, test_index in skf.split(df['image_path'],df['class']):
#     df['fold'].loc[test_index]=fold
#     fold+=1
```

```
/data/sathya/anaconda3/envs/pytorch/lib/python3.9/site-packages/pandas/core/indexing.py:1
732: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_g
uide/indexing.html#returning-a-view-versus-a-copy
  self._setitem_single_block(indexer, value, name)
```

In [ ]:

```
classes
```

Out[ ]:

```
['human', 'animal', 'truck', 'car', 'airplane']
```

In [ ]:

```
import torch
from skimage import io, transform
import numpy as np

import matplotlib.pyplot as plt
from skimage import io
from torch.utils.data import Dataset, DataLoader
from torchvision import transforms, utils
from pytorch_lightning.callbacks import ModelCheckpoint
from torchcontrib.optim import SWA
from pytorch_lightning.metrics import Metric
from pytorch_lightning.callbacks import ModelCheckpoint, EarlyStopping
import albumentations as A
from albumentations.pytorch import ToTensorV2
import imgaug.augmenters as iaa


class vdataset(Dataset):
    def __init__(self, df, triplet=False, test=False ,transform=None):
        self.df = df
        self.transforms = transform
        self.triplet = triplet
        self.test = test
    def __len__(self):
```

```
        return len(self.df)
    def read_image(self, image_path):
        image = cv2.imread(image_path).astype(np.float32)
        image = (image-np.min(image))/(np.max(image)-np.min(image))

        if self.transforms:
            image = self.transforms(image=image)
            image = image['image']
        else:
            image = np.moveaxis(image,-1,0)
        return image

    def __getitem__(self, idx):
        data = self.df.iloc[idx]
        anchor_image_path, anchor_label = data['image_path'], data['class']
        anchor_image = self.read_image(anchor_image_path)

        if self.triplet:                    #For Siamese Triplet Learning
            if(anchor_label ==1 or anchor_label ==2 or anchor_label ==3):
              #Weighted Pairs to counter the misclassifications
                if(anchor_label ==1):
                    p=[0.4,0,0.2,0.2,0.2]
                elif(anchor_label ==2):
                    p=[0.2,0.2,0,0.4,0.2]
                elif(anchor_label ==3):
                    p=[0.2,0.2,0.4,0,0.2]

                anchor_label_neg =np.random.choice(range(len(classes)),size=1,p=p)
                negative_index = np.random.choice(train_df[train_df['class']==anchor_lab
el_neg[0]].index)
                negative_image_path, negative_label = train_df.iloc[negative_index]
                negative_image = self.read_image(negative_image_path)


            else:

                negative_index = np.random.choice(train_df[train_df['class']!=anchor_lab
el].index)
                negative_image_path, negative_label = train_df.iloc[negative_index]
                negative_image = self.read_image(negative_image_path)


            positive_index = np.random.choice(train_df[train_df['class']==anchor_label].
index)
            positive_image_path, positive_label = train_df.iloc[positive_index]
            positive_image = self.read_image(positive_image_path)

            return (anchor_image,anchor_label), (positive_image, positive_label),(negati
ve_image, negative_label)

        else:
            if self.test:
                return anchor_image_path, anchor_image,torch.tensor(anchor_label)
            else:
                return anchor_image,torch.tensor(anchor_label)
```

In [ ]:

```
train_transform = A.Compose(
    [
#         A.ShiftScaleRotate(rotate_limit=(-360, 360), shift_limit=(0.1, 0.12), scale_limi
t=(0.1, 0.12)),
        A.HorizontalFlip(p=0.5),
        A.Sharpen(alpha=(0.3,0.5), lightness=(0.5, 1.0), always_apply= False, p=0.6) ,
        A.Rotate (limit=180),
#         A.RandomBrightnessContrast(brightness_limit=0.3,contrast_limit=0.2,p=0.5),
#           iaa.Sequential([
#           iaa.Canny(alpha=(0.0, 0.6))
#                ]).augment_image,
#         A.Affine (scale=None, translate_percent=None, translate_px=None, rotate=None, she
ar=(0,15),
```

```
#                 interpolation=1, cval=0, cval_mask=0, mode=0, fit_output=False, always_
apply=False, p=0.5),
#         A.RandomBrightnessContrast(contrast_limit=0.2, always_apply=False, p=0.5),
#         A.Perspective(scale=(0.05, 0.1)),
#         A.Affine (scale=1,translate_percent=0.1,fit_output=True),
        ToTensorV2(),
    ]
)




valid_transform = A.Compose(
    [
        ToTensorV2(),
    ]
)

val_dataset = vdataset(val_df, transform = valid_transform)
val_dataloader = DataLoader(val_dataset, batch_size=val_batch_size,
                        shuffle=False, num_workers=32)


if config.test:                     #For Submission
    test_dataset = vdataset(test_df, test= config.test, transform = valid_transform)

    test_dataloader = DataLoader(test_dataset, batch_size=val_batch_size,
                        shuffle=False, num_workers=32)

    fig, axs = plt.subplots(2,3)
    fig.tight_layout()
    cls_ind = 0
    for i in range(2):
        for j in range(3):
            path ,test_sample,cls = test_dataset.__getitem__(190*cls_ind)
            axs[i][j].imshow(test_sample[0,:],cmap='gray', aspect='auto')
            axs[i][j].set_title("Test Class")
            cls_ind+=1
    plt.show()



if (config.triplet==True):
    #Triplet Visualization

    train_dataset_triplet = vdataset(train_df,triplet=True, transform = train_transform)


    train_dataloader_triplet = DataLoader(train_dataset_triplet, batch_size=train_batch_s
ize,
                            shuffle=True, num_workers=32)

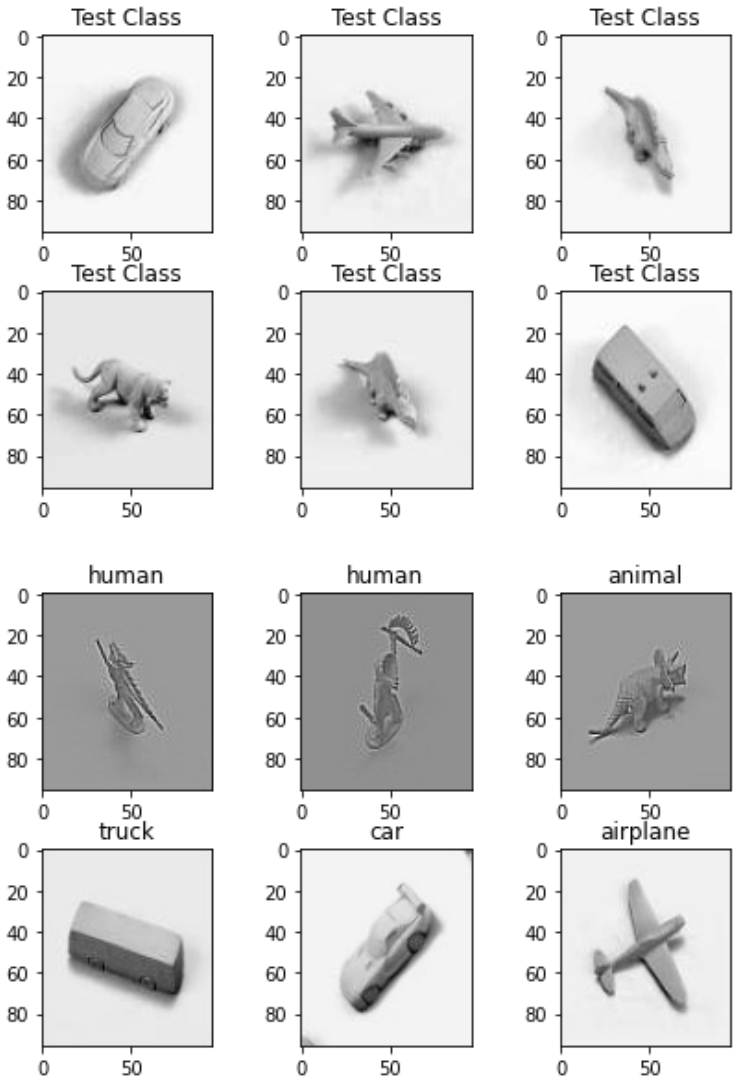

    fig, axs = plt.subplots(5, 3)
    fig.tight_layout()
    cls_ind = 0
    for i in range(5):

        (anc,cls),(pos,cls),(neg,neg_cls) = train_dataset_triplet.__getitem__(197*i+1)
        axs[i][0].imshow(anc[0,:],cmap='gray',aspect='auto')
        axs[i][0].set_title(classes[cls])
        axs[i][1].imshow(pos[0,:],cmap='gray', aspect='auto')
        axs[i][1].set_title(classes[cls])
        axs[i][2].imshow(neg[0,:],cmap='gray', aspect='auto')
        axs[i][2].set_title(classes[neg_cls])

    plt.show()

else:
    train_dataset = vdataset(train_df, transform = train_transform)
```

```
    train_dataloader = DataLoader(train_dataset, batch_size=train_batch_size,
                          shuffle=True, num_workers=32)
    fig, axs = plt.subplots(2,3)
    fig.tight_layout()
    cls_ind = 0
    for i in range(2):
        for j in range(3):
            test_sample,cls = train_dataset.__getitem__(190*cls_ind)
            axs[i][j].imshow(test_sample[0,:],cmap='gray', aspect='auto')
            axs[i][j].set_title(classes[cls])
            cls_ind+=1
    plt.show()
```



In [ ]:

```
import torch
from torch import nn
from torch.nn import functional as F
from torch.utils.data import DataLoader
from torch.utils.data import random_split
from torchvision.datasets import MNIST
from torchvision import transforms
import pytorch_lightning as pl
import torchmetrics

import os
os.environ["CUDA_DEVICE_ORDER"]="PCI_BUS_ID"
os.environ["CUDA_VISIBLE_DEVICES"]="2"
device = torch.device("cuda" if torch.cuda.is_available() else "cpu")

def conv_res(in_channels, out_channels, stride=1):
    return nn.Conv2d(in_channels, out_channels, kernel_size=3,
                     stride=stride, padding=1, bias=False)
```

```
# Residual block
class res_block(nn.Module):
    def __init__(self, in_channels, out_channels, stride=1, downsample=None):
        super(res_block, self).__init__()
        self.conv1 = conv_res(in_channels, out_channels, stride)
        self.bn = nn.BatchNorm2d(out_channels)
        self.relu = nn.ReLU(inplace=True)
        self.conv2 = conv_res(out_channels, out_channels)
        self.bn1 = nn.BatchNorm2d(out_channels)
        self.downsample = downsample

    def forward(self, x):
        residual = x
        out = self.relu(self.bn(self.conv1(x)))
        out = self.bn1(self.conv2(out))
        if self.downsample:
            residual = self.downsample(x)
        out += residual
        out = self.relu(out)
        return out

# ResNet
class res_net(nn.Module):
    def __init__(self, block, layers, triplet=False, num_classes=10):
        super(res_net, self).__init__()
        self.in_channels = 16
        self.triplet = triplet
        self.conv = conv_res(3, 8)
        self.conv1 = conv_res(8, 16)
        self.bn = nn.BatchNorm2d(8)
        self.bn1 = nn.BatchNorm2d(16)
        self.relu = nn.ReLU(inplace=True)
        self.layer1 = self.rep_layer(block, 16, layers[0])
        self.layer2 = self.rep_layer(block, 32, layers[1], 2)
        self.layer3 = self.rep_layer(block, 64, layers[2], 2)
        self.avg_pool = nn.AvgPool2d(8)
        self.fc1 = nn.Linear(576, 256)
        self.fc2 = nn.Linear(64, num_classes)
        self.sigmoid = nn.Sigmoid()


    def rep_layer(self, block, out_channels, blocks, stride=1):
        downsample = None
        if (stride != 1) or (self.in_channels != out_channels):
            downsample = nn.Sequential(
                conv_res(self.in_channels, out_channels, stride=stride),
                nn.BatchNorm2d(out_channels))
        layers = []
        layers.append(block(self.in_channels, out_channels, stride, downsample))
        self.in_channels = out_channels
        for i in range(1, blocks):
            layers.append(block(out_channels, out_channels))
        return nn.Sequential(*layers)

    def forward_pass(self,x):
        out = self.relu(self.bn(self.conv(x)))
        out = self.relu(self.bn1(self.conv1(out)))
        out = self.layer1(out)
        out = self.layer2(out)
        out = self.layer3(out)
        out = self.avg_pool(out)
        out = out.view(out.size(0), -1)
        out = self.fc1(out)

        return out

#     def dual_pass(self, x1, x2):
#         return self.sigmoid(self.forward_pass(x1)), self.sigmoid(self.forward_pass(x2))

    def forward(self, x):

        if self.triplet:
```

```
            return self.forward_pass(x)

        else:
            out = self.relu(self.forward_pass(x))
            return self.fc2(out)


# resnet = res_net(res_block, [4, 16, 16*2], triplet=True, num_classes=len(classes))
#Initial Model Layer sizes
#
resnet = res_net(res_block, [8, 36, 48], triplet=True, num_classes=len(classes))
#Upscaled denser version of the same model
from torchsummary import summary
summary(resnet,(3,96,96))
```

```
==========================================================================================
=
Layer (type:depth-idx)                   Output Shape              Param #
==========================================================================================
=
├─Conv2d: 1-1                            [-1, 8, 96, 96]           216
├─BatchNorm2d: 1-2                       [-1, 8, 96, 96]           16
├─ReLU: 1-3                              [-1, 8, 96, 96]           --
├─Conv2d: 1-4                            [-1, 16, 96, 96]          1,152
├─BatchNorm2d: 1-5                       [-1, 16, 96, 96]          32
├─ReLU: 1-6                              [-1, 16, 96, 96]          --
├─Sequential: 1-7                        [-1, 16, 96, 96]          --
|    └─res_block: 2-1                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-1                  [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-2             [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-3                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-4                  [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-5             [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-6                    [-1, 16, 96, 96]          --
|    └─res_block: 2-2                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-7                  [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-8             [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-9                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-10                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-11            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-12                   [-1, 16, 96, 96]          --
|    └─res_block: 2-3                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-13                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-14            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-15                   [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-16                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-17            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-18                   [-1, 16, 96, 96]          --
|    └─res_block: 2-4                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-19                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-20            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-21                   [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-22                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-23            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-24                   [-1, 16, 96, 96]          --
|    └─res_block: 2-5                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-25                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-26            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-27                   [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-28                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-29            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-30                   [-1, 16, 96, 96]          --
|    └─res_block: 2-6                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-31                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-32            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-33                   [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-34                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-35            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-36                   [-1, 16, 96, 96]          --
|    └─res_block: 2-7                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-37                 [-1, 16, 96, 96]          2,304
```

```
|     |     └─BatchNorm2d: 3-38                [-1, 16, 96, 96]          32
|     |     └─ReLU: 3-39                       [-1, 16, 96, 96]          --
|     |     └─Conv2d: 3-40                     [-1, 16, 96, 96]          2,304
|     |     └─BatchNorm2d: 3-41                [-1, 16, 96, 96]          32
|     |     └─ReLU: 3-42                       [-1, 16, 96, 96]          --
|     └─res_block: 2-8                         [-1, 16, 96, 96]          --
|     |     └─Conv2d: 3-43                     [-1, 16, 96, 96]          2,304
|     |     └─BatchNorm2d: 3-44                [-1, 16, 96, 96]          32
|     |     └─ReLU: 3-45                       [-1, 16, 96, 96]          --
|     |     └─Conv2d: 3-46                     [-1, 16, 96, 96]          2,304
|     |     └─BatchNorm2d: 3-47                [-1, 16, 96, 96]          32
|     |     └─ReLU: 3-48                       [-1, 16, 96, 96]          --
├─Sequential: 1-8                              [-1, 32, 48, 48]          --
|     └─res_block: 2-9                         [-1, 32, 48, 48]          --
|     |     └─Conv2d: 3-49                     [-1, 32, 48, 48]          4,608
|     |     └─BatchNorm2d: 3-50                [-1, 32, 48, 48]          64
|     |     └─ReLU: 3-51                       [-1, 32, 48, 48]          --
|     |     └─Conv2d: 3-52                     [-1, 32, 48, 48]          9,216
|     |     └─BatchNorm2d: 3-53                [-1, 32, 48, 48]          64
|     |     └─Sequential: 3-54                 [-1, 32, 48, 48]          4,672
|     |     └─ReLU: 3-55                       [-1, 32, 48, 48]          --
|     └─res_block: 2-10                        [-1, 32, 48, 48]          --
|     |     └─Conv2d: 3-56                     [-1, 32, 48, 48]          9,216
|     |     └─BatchNorm2d: 3-57                [-1, 32, 48, 48]          64
|     |     └─ReLU: 3-58                       [-1, 32, 48, 48]          --
|     |     └─Conv2d: 3-59                     [-1, 32, 48, 48]          9,216
|     |     └─BatchNorm2d: 3-60                [-1, 32, 48, 48]          64
|     |     └─ReLU: 3-61                       [-1, 32, 48, 48]          --
|     └─res_block: 2-11                        [-1, 32, 48, 48]          --
|     |     └─Conv2d: 3-62                     [-1, 32, 48, 48]          9,216
|     |     └─BatchNorm2d: 3-63                [-1, 32, 48, 48]          64
|     |     └─ReLU: 3-64                       [-1, 32, 48, 48]          --
|     |     └─Conv2d: 3-65                     [-1, 32, 48, 48]          9,216
|     |     └─BatchNorm2d: 3-66                [-1, 32, 48, 48]          64
|     |     └─ReLU: 3-67                       [-1, 32, 48, 48]          --
|     └─res_block: 2-12                        [-1, 32, 48, 48]          --
|     |     └─Conv2d: 3-68                     [-1, 32, 48, 48]          9,216
|     |     └─BatchNorm2d: 3-69                [-1, 32, 48, 48]          64
|     |     └─ReLU: 3-70                       [-1, 32, 48, 48]          --
|     |     └─Conv2d: 3-71                     [-1, 32, 48, 48]          9,216
|     |     └─BatchNorm2d: 3-72                [-1, 32, 48, 48]          64
|     |     └─ReLU: 3-73                       [-1, 32, 48, 48]          --
|     └─res_block: 2-13                        [-1, 32, 48, 48]          --
|     |     └─Conv2d: 3-74                     [-1, 32, 48, 48]          9,216
|     |     └─BatchNorm2d: 3-75                [-1, 32, 48, 48]          64
|     |     └─ReLU: 3-76                       [-1, 32, 48, 48]          --
|     |     └─Conv2d: 3-77                     [-1, 32, 48, 48]          9,216
|     |     └─BatchNorm2d: 3-78                [-1, 32, 48, 48]          64
|     |     └─ReLU: 3-79                       [-1, 32, 48, 48]          --
|     └─res_block: 2-14                        [-1, 32, 48, 48]          --
|     |     └─Conv2d: 3-80                     [-1, 32, 48, 48]          9,216
|     |     └─BatchNorm2d: 3-81                [-1, 32, 48, 48]          64
|     |     └─ReLU: 3-82                       [-1, 32, 48, 48]          --
|     |     └─Conv2d: 3-83                     [-1, 32, 48, 48]          9,216
|     |     └─BatchNorm2d: 3-84                [-1, 32, 48, 48]          64
|     |     └─ReLU: 3-85                       [-1, 32, 48, 48]          --
|     └─res_block: 2-15                        [-1, 32, 48, 48]          --
|     |     └─Conv2d: 3-86                     [-1, 32, 48, 48]          9,216
|     |     └─BatchNorm2d: 3-87                [-1, 32, 48, 48]          64
|     |     └─ReLU: 3-88                       [-1, 32, 48, 48]          --
|     |     └─Conv2d: 3-89                     [-1, 32, 48, 48]          9,216
|     |     └─BatchNorm2d: 3-90                [-1, 32, 48, 48]          64
|     |     └─ReLU: 3-91                       [-1, 32, 48, 48]          --
|     └─res_block: 2-16                        [-1, 32, 48, 48]          --
|     |     └─Conv2d: 3-92                     [-1, 32, 48, 48]          9,216
|     |     └─BatchNorm2d: 3-93                [-1, 32, 48, 48]          64
|     |     └─ReLU: 3-94                       [-1, 32, 48, 48]          --
|     |     └─Conv2d: 3-95                     [-1, 32, 48, 48]          9,216
|     |     └─BatchNorm2d: 3-96                [-1, 32, 48, 48]          64
|     |     └─ReLU: 3-97                       [-1, 32, 48, 48]          --
|     └─res_block: 2-17                        [-1, 32, 48, 48]          --
|     |     └─Conv2d: 3-98                     [-1, 32, 48, 48]          9,216
```

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|    |    └─BatchNorm2d: 3-99            [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-100                  [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-101                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-102           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-103                  [-1, 32, 48, 48]          --
|    └─res_block: 2-18                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-104                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-105           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-106                  [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-107                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-108           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-109                  [-1, 32, 48, 48]          --
|    └─res_block: 2-19                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-110                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-111           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-112                  [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-113                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-114           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-115                  [-1, 32, 48, 48]          --
|    └─res_block: 2-20                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-116                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-117           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-118                  [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-119                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-120           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-121                  [-1, 32, 48, 48]          --
|    └─res_block: 2-21                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-122                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-123           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-124                  [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-125                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-126           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-127                  [-1, 32, 48, 48]          --
|    └─res_block: 2-22                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-128                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-129           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-130                  [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-131                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-132           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-133                  [-1, 32, 48, 48]          --
|    └─res_block: 2-23                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-134                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-135           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-136                  [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-137                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-138           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-139                  [-1, 32, 48, 48]          --
|    └─res_block: 2-24                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-140                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-141           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-142                  [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-143                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-144           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-145                  [-1, 32, 48, 48]          --
|    └─res_block: 2-25                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-146                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-147           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-148                  [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-149                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-150           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-151                  [-1, 32, 48, 48]          --
|    └─res_block: 2-26                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-152                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-153           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-154                  [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-155                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-156           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-157                  [-1, 32, 48, 48]          --
|    └─res_block: 2-27                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-158                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-159           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-160                  [-1, 32, 48, 48]          --
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|    |    └─Conv2d: 3-161                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-162             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-163                    [-1, 32, 48, 48]          --
|    └─res_block: 2-28                     [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-164                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-165             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-166                    [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-167                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-168             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-169                    [-1, 32, 48, 48]          --
|    └─res_block: 2-29                     [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-170                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-171             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-172                    [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-173                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-174             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-175                    [-1, 32, 48, 48]          --
|    └─res_block: 2-30                     [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-176                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-177             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-178                    [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-179                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-180             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-181                    [-1, 32, 48, 48]          --
|    └─res_block: 2-31                     [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-182                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-183             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-184                    [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-185                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-186             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-187                    [-1, 32, 48, 48]          --
|    └─res_block: 2-32                     [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-188                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-189             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-190                    [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-191                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-192             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-193                    [-1, 32, 48, 48]          --
|    └─res_block: 2-33                     [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-194                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-195             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-196                    [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-197                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-198             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-199                    [-1, 32, 48, 48]          --
|    └─res_block: 2-34                     [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-200                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-201             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-202                    [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-203                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-204             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-205                    [-1, 32, 48, 48]          --
|    └─res_block: 2-35                     [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-206                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-207             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-208                    [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-209                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-210             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-211                    [-1, 32, 48, 48]          --
|    └─res_block: 2-36                     [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-212                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-213             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-214                    [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-215                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-216             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-217                    [-1, 32, 48, 48]          --
|    └─res_block: 2-37                     [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-218                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-219             [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-220                    [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-221                  [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-222             [-1, 32, 48, 48]          64
```

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|    |    └─ReLU: 3-223                  [-1, 32, 48, 48]          --
|    └─res_block: 2-38                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-224                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-225           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-226                  [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-227                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-228           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-229                  [-1, 32, 48, 48]          --
|    └─res_block: 2-39                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-230                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-231           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-232                  [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-233                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-234           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-235                  [-1, 32, 48, 48]          --
|    └─res_block: 2-40                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-236                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-237           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-238                  [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-239                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-240           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-241                  [-1, 32, 48, 48]          --
|    └─res_block: 2-41                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-242                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-243           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-244                  [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-245                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-246           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-247                  [-1, 32, 48, 48]          --
|    └─res_block: 2-42                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-248                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-249           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-250                  [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-251                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-252           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-253                  [-1, 32, 48, 48]          --
|    └─res_block: 2-43                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-254                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-255           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-256                  [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-257                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-258           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-259                  [-1, 32, 48, 48]          --
|    └─res_block: 2-44                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-260                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-261           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-262                  [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-263                [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-264           [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-265                  [-1, 32, 48, 48]          --
├─Sequential: 1-9                        [-1, 64, 24, 24]          --
|    └─res_block: 2-45                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-266                [-1, 64, 24, 24]          18,432
|    |    └─BatchNorm2d: 3-267           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-268                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-269                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-270           [-1, 64, 24, 24]          128
|    |    └─Sequential: 3-271            [-1, 64, 24, 24]          18,560
|    |    └─ReLU: 3-272                  [-1, 64, 24, 24]          --
|    └─res_block: 2-46                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-273                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-274           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-275                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-276                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-277           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-278                  [-1, 64, 24, 24]          --
|    └─res_block: 2-47                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-279                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-280           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-281                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-282                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-283           [-1, 64, 24, 24]          128
```

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|    |    └─ReLU: 3-284                  [-1, 64, 24, 24]          --
|    └─res_block: 2-48                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-285                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-286           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-287                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-288                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-289           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-290                  [-1, 64, 24, 24]          --
|    └─res_block: 2-49                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-291                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-292           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-293                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-294                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-295           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-296                  [-1, 64, 24, 24]          --
|    └─res_block: 2-50                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-297                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-298           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-299                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-300                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-301           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-302                  [-1, 64, 24, 24]          --
|    └─res_block: 2-51                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-303                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-304           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-305                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-306                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-307           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-308                  [-1, 64, 24, 24]          --
|    └─res_block: 2-52                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-309                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-310           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-311                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-312                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-313           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-314                  [-1, 64, 24, 24]          --
|    └─res_block: 2-53                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-315                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-316           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-317                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-318                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-319           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-320                  [-1, 64, 24, 24]          --
|    └─res_block: 2-54                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-321                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-322           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-323                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-324                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-325           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-326                  [-1, 64, 24, 24]          --
|    └─res_block: 2-55                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-327                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-328           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-329                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-330                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-331           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-332                  [-1, 64, 24, 24]          --
|    └─res_block: 2-56                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-333                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-334           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-335                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-336                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-337           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-338                  [-1, 64, 24, 24]          --
|    └─res_block: 2-57                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-339                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-340           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-341                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-342                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-343           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-344                  [-1, 64, 24, 24]          --
|    └─res_block: 2-58                   [-1, 64, 24, 24]          --
```

| | | └─Conv2d: 3-345 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-346 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-347 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-348 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-349 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-350 [-1, 64, 24, 24] --
| | └─res_block: 2-59 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-351 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-352 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-353 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-354 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-355 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-356 [-1, 64, 24, 24] --
| | └─res_block: 2-60 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-357 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-358 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-359 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-360 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-361 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-362 [-1, 64, 24, 24] --
| | └─res_block: 2-61 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-363 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-364 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-365 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-366 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-367 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-368 [-1, 64, 24, 24] --
| | └─res_block: 2-62 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-369 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-370 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-371 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-372 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-373 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-374 [-1, 64, 24, 24] --
| | └─res_block: 2-63 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-375 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-376 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-377 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-378 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-379 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-380 [-1, 64, 24, 24] --
| | └─res_block: 2-64 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-381 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-382 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-383 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-384 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-385 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-386 [-1, 64, 24, 24] --
| | └─res_block: 2-65 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-387 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-388 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-389 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-390 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-391 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-392 [-1, 64, 24, 24] --
| | └─res_block: 2-66 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-393 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-394 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-395 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-396 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-397 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-398 [-1, 64, 24, 24] --
| | └─res_block: 2-67 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-399 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-400 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-401 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-402 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-403 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-404 [-1, 64, 24, 24] --
| | └─res_block: 2-68 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-405 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-406 [-1, 64, 24, 24] 128

| | | └─ReLU: 3-407 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-408 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-409 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-410 [-1, 64, 24, 24] --
| | └─res_block: 2-69 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-411 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-412 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-413 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-414 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-415 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-416 [-1, 64, 24, 24] --
| | └─res_block: 2-70 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-417 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-418 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-419 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-420 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-421 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-422 [-1, 64, 24, 24] --
| | └─res_block: 2-71 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-423 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-424 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-425 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-426 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-427 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-428 [-1, 64, 24, 24] --
| | └─res_block: 2-72 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-429 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-430 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-431 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-432 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-433 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-434 [-1, 64, 24, 24] --
| | └─res_block: 2-73 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-435 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-436 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-437 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-438 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-439 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-440 [-1, 64, 24, 24] --
| | └─res_block: 2-74 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-441 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-442 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-443 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-444 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-445 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-446 [-1, 64, 24, 24] --
| | └─res_block: 2-75 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-447 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-448 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-449 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-450 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-451 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-452 [-1, 64, 24, 24] --
| | └─res_block: 2-76 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-453 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-454 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-455 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-456 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-457 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-458 [-1, 64, 24, 24] --
| | └─res_block: 2-77 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-459 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-460 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-461 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-462 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-463 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-464 [-1, 64, 24, 24] --
| | └─res_block: 2-78 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-465 [-1, 64, 24, 24] 36,864
| | | └─BatchNorm2d: 3-466 [-1, 64, 24, 24] 128
| | | └─ReLU: 3-467 [-1, 64, 24, 24] --
| | | └─Conv2d: 3-468 [-1, 64, 24, 24] 36,864

```
|    |    └─BatchNorm2d: 3-469          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-470                 [-1, 64, 24, 24]          --
|    └─res_block: 2-79                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-471               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-472          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-473                 [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-474               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-475          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-476                 [-1, 64, 24, 24]          --
|    └─res_block: 2-80                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-477               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-478          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-479                 [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-480               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-481          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-482                 [-1, 64, 24, 24]          --
|    └─res_block: 2-81                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-483               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-484          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-485                 [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-486               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-487          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-488                 [-1, 64, 24, 24]          --
|    └─res_block: 2-82                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-489               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-490          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-491                 [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-492               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-493          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-494                 [-1, 64, 24, 24]          --
|    └─res_block: 2-83                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-495               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-496          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-497                 [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-498               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-499          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-500                 [-1, 64, 24, 24]          --
|    └─res_block: 2-84                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-501               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-502          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-503                 [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-504               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-505          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-506                 [-1, 64, 24, 24]          --
|    └─res_block: 2-85                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-507               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-508          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-509                 [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-510               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-511          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-512                 [-1, 64, 24, 24]          --
|    └─res_block: 2-86                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-513               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-514          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-515                 [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-516               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-517          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-518                 [-1, 64, 24, 24]          --
|    └─res_block: 2-87                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-519               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-520          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-521                 [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-522               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-523          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-524                 [-1, 64, 24, 24]          --
|    └─res_block: 2-88                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-525               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-526          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-527                 [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-528               [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-529          [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-530                 [-1, 64, 24, 24]          --
```

```
|    └─res_block: 2-89                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-531                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-532           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-533                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-534                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-535           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-536                  [-1, 64, 24, 24]          --
|    └─res_block: 2-90                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-537                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-538           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-539                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-540                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-541           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-542                  [-1, 64, 24, 24]          --
|    └─res_block: 2-91                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-543                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-544           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-545                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-546                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-547           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-548                  [-1, 64, 24, 24]          --
|    └─res_block: 2-92                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-549                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-550           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-551                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-552                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-553           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-554                  [-1, 64, 24, 24]          --
├─AvgPool2d: 1-10                        [-1, 64, 3, 3]            --
├─Linear: 1-11                           [-1, 256]                 147,712
==========================================================================================
=
Total params: 4,406,088
Trainable params: 4,406,088
Non-trainable params: 0
Total mult-adds (G): 3.93
==========================================================================================
=
Input size (MB): 0.11
Forward/backward pass size (MB): 176.06
Params size (MB): 16.81
Estimated Total Size (MB): 192.98
==========================================================================================
=
```

Out[ ]:

```
==========================================================================================
=
Layer (type:depth-idx)                   Output Shape              Param #
==========================================================================================
=
├─Conv2d: 1-1                            [-1, 8, 96, 96]           216
├─BatchNorm2d: 1-2                       [-1, 8, 96, 96]           16
├─ReLU: 1-3                              [-1, 8, 96, 96]           --
├─Conv2d: 1-4                            [-1, 16, 96, 96]          1,152
├─BatchNorm2d: 1-5                       [-1, 16, 96, 96]          32
├─ReLU: 1-6                              [-1, 16, 96, 96]          --
├─Sequential: 1-7                        [-1, 16, 96, 96]          --
|    └─res_block: 2-1                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-1                  [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-2             [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-3                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-4                  [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-5             [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-6                    [-1, 16, 96, 96]          --
|    └─res_block: 2-2                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-7                  [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-8             [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-9                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-10                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-11            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-12                   [-1, 16, 96, 96]          --
```

```
|    └─res_block: 2-3                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-13                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-14            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-15                   [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-16                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-17            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-18                   [-1, 16, 96, 96]          --
|    └─res_block: 2-4                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-19                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-20            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-21                   [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-22                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-23            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-24                   [-1, 16, 96, 96]          --
|    └─res_block: 2-5                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-25                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-26            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-27                   [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-28                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-29            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-30                   [-1, 16, 96, 96]          --
|    └─res_block: 2-6                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-31                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-32            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-33                   [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-34                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-35            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-36                   [-1, 16, 96, 96]          --
|    └─res_block: 2-7                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-37                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-38            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-39                   [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-40                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-41            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-42                   [-1, 16, 96, 96]          --
|    └─res_block: 2-8                    [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-43                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-44            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-45                   [-1, 16, 96, 96]          --
|    |    └─Conv2d: 3-46                 [-1, 16, 96, 96]          2,304
|    |    └─BatchNorm2d: 3-47            [-1, 16, 96, 96]          32
|    |    └─ReLU: 3-48                   [-1, 16, 96, 96]          --
├─Sequential: 1-8                        [-1, 32, 48, 48]          --
|    └─res_block: 2-9                    [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-49                 [-1, 32, 48, 48]          4,608
|    |    └─BatchNorm2d: 3-50            [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-51                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-52                 [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-53            [-1, 32, 48, 48]          64
|    |    └─Sequential: 3-54             [-1, 32, 48, 48]          4,672
|    |    └─ReLU: 3-55                   [-1, 32, 48, 48]          --
|    └─res_block: 2-10                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-56                 [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-57            [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-58                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-59                 [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-60            [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-61                   [-1, 32, 48, 48]          --
|    └─res_block: 2-11                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-62                 [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-63            [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-64                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-65                 [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-66            [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-67                   [-1, 32, 48, 48]          --
|    └─res_block: 2-12                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-68                 [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-69            [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-70                   [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-71                 [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-72            [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-73                   [-1, 32, 48, 48]          --
```

	└─res_block: 2-13	[-1, 32, 48, 48]	--
		└─Conv2d: 3-74	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-75	[-1, 32, 48, 48]	64
		└─ReLU: 3-76	[-1, 32, 48, 48]	--
		└─Conv2d: 3-77	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-78	[-1, 32, 48, 48]	64
		└─ReLU: 3-79	[-1, 32, 48, 48]	--
	└─res_block: 2-14	[-1, 32, 48, 48]	--
		└─Conv2d: 3-80	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-81	[-1, 32, 48, 48]	64
		└─ReLU: 3-82	[-1, 32, 48, 48]	--
		└─Conv2d: 3-83	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-84	[-1, 32, 48, 48]	64
		└─ReLU: 3-85	[-1, 32, 48, 48]	--
	└─res_block: 2-15	[-1, 32, 48, 48]	--
		└─Conv2d: 3-86	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-87	[-1, 32, 48, 48]	64
		└─ReLU: 3-88	[-1, 32, 48, 48]	--
		└─Conv2d: 3-89	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-90	[-1, 32, 48, 48]	64
		└─ReLU: 3-91	[-1, 32, 48, 48]	--
	└─res_block: 2-16	[-1, 32, 48, 48]	--
		└─Conv2d: 3-92	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-93	[-1, 32, 48, 48]	64
		└─ReLU: 3-94	[-1, 32, 48, 48]	--
		└─Conv2d: 3-95	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-96	[-1, 32, 48, 48]	64
		└─ReLU: 3-97	[-1, 32, 48, 48]	--
	└─res_block: 2-17	[-1, 32, 48, 48]	--
		└─Conv2d: 3-98	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-99	[-1, 32, 48, 48]	64
		└─ReLU: 3-100	[-1, 32, 48, 48]	--
		└─Conv2d: 3-101	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-102	[-1, 32, 48, 48]	64
		└─ReLU: 3-103	[-1, 32, 48, 48]	--
	└─res_block: 2-18	[-1, 32, 48, 48]	--
		└─Conv2d: 3-104	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-105	[-1, 32, 48, 48]	64
		└─ReLU: 3-106	[-1, 32, 48, 48]	--
		└─Conv2d: 3-107	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-108	[-1, 32, 48, 48]	64
		└─ReLU: 3-109	[-1, 32, 48, 48]	--
	└─res_block: 2-19	[-1, 32, 48, 48]	--
		└─Conv2d: 3-110	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-111	[-1, 32, 48, 48]	64
		└─ReLU: 3-112	[-1, 32, 48, 48]	--
		└─Conv2d: 3-113	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-114	[-1, 32, 48, 48]	64
		└─ReLU: 3-115	[-1, 32, 48, 48]	--
	└─res_block: 2-20	[-1, 32, 48, 48]	--
		└─Conv2d: 3-116	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-117	[-1, 32, 48, 48]	64
		└─ReLU: 3-118	[-1, 32, 48, 48]	--
		└─Conv2d: 3-119	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-120	[-1, 32, 48, 48]	64
		└─ReLU: 3-121	[-1, 32, 48, 48]	--
	└─res_block: 2-21	[-1, 32, 48, 48]	--
		└─Conv2d: 3-122	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-123	[-1, 32, 48, 48]	64
		└─ReLU: 3-124	[-1, 32, 48, 48]	--
		└─Conv2d: 3-125	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-126	[-1, 32, 48, 48]	64
		└─ReLU: 3-127	[-1, 32, 48, 48]	--
	└─res_block: 2-22	[-1, 32, 48, 48]	--
		└─Conv2d: 3-128	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-129	[-1, 32, 48, 48]	64
		└─ReLU: 3-130	[-1, 32, 48, 48]	--
		└─Conv2d: 3-131	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-132	[-1, 32, 48, 48]	64
		└─ReLU: 3-133	[-1, 32, 48, 48]	--
	└─res_block: 2-23	[-1, 32, 48, 48]	--
		└─Conv2d: 3-134	[-1, 32, 48, 48]	9,216

	└─BatchNorm2d: 3-135	[-1, 32, 48, 48]	64
	└─ReLU: 3-136	[-1, 32, 48, 48]	--
	└─Conv2d: 3-137	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-138	[-1, 32, 48, 48]	64
	└─ReLU: 3-139	[-1, 32, 48, 48]	--
└─res_block: 2-24		[-1, 32, 48, 48]	--
	└─Conv2d: 3-140	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-141	[-1, 32, 48, 48]	64
	└─ReLU: 3-142	[-1, 32, 48, 48]	--
	└─Conv2d: 3-143	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-144	[-1, 32, 48, 48]	64
	└─ReLU: 3-145	[-1, 32, 48, 48]	--
└─res_block: 2-25		[-1, 32, 48, 48]	--
	└─Conv2d: 3-146	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-147	[-1, 32, 48, 48]	64
	└─ReLU: 3-148	[-1, 32, 48, 48]	--
	└─Conv2d: 3-149	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-150	[-1, 32, 48, 48]	64
	└─ReLU: 3-151	[-1, 32, 48, 48]	--
└─res_block: 2-26		[-1, 32, 48, 48]	--
	└─Conv2d: 3-152	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-153	[-1, 32, 48, 48]	64
	└─ReLU: 3-154	[-1, 32, 48, 48]	--
	└─Conv2d: 3-155	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-156	[-1, 32, 48, 48]	64
	└─ReLU: 3-157	[-1, 32, 48, 48]	--
└─res_block: 2-27		[-1, 32, 48, 48]	--
	└─Conv2d: 3-158	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-159	[-1, 32, 48, 48]	64
	└─ReLU: 3-160	[-1, 32, 48, 48]	--
	└─Conv2d: 3-161	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-162	[-1, 32, 48, 48]	64
	└─ReLU: 3-163	[-1, 32, 48, 48]	--
└─res_block: 2-28		[-1, 32, 48, 48]	--
	└─Conv2d: 3-164	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-165	[-1, 32, 48, 48]	64
	└─ReLU: 3-166	[-1, 32, 48, 48]	--
	└─Conv2d: 3-167	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-168	[-1, 32, 48, 48]	64
	└─ReLU: 3-169	[-1, 32, 48, 48]	--
└─res_block: 2-29		[-1, 32, 48, 48]	--
	└─Conv2d: 3-170	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-171	[-1, 32, 48, 48]	64
	└─ReLU: 3-172	[-1, 32, 48, 48]	--
	└─Conv2d: 3-173	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-174	[-1, 32, 48, 48]	64
	└─ReLU: 3-175	[-1, 32, 48, 48]	--
└─res_block: 2-30		[-1, 32, 48, 48]	--
	└─Conv2d: 3-176	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-177	[-1, 32, 48, 48]	64
	└─ReLU: 3-178	[-1, 32, 48, 48]	--
	└─Conv2d: 3-179	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-180	[-1, 32, 48, 48]	64
	└─ReLU: 3-181	[-1, 32, 48, 48]	--
└─res_block: 2-31		[-1, 32, 48, 48]	--
	└─Conv2d: 3-182	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-183	[-1, 32, 48, 48]	64
	└─ReLU: 3-184	[-1, 32, 48, 48]	--
	└─Conv2d: 3-185	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-186	[-1, 32, 48, 48]	64
	└─ReLU: 3-187	[-1, 32, 48, 48]	--
└─res_block: 2-32		[-1, 32, 48, 48]	--
	└─Conv2d: 3-188	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-189	[-1, 32, 48, 48]	64
	└─ReLU: 3-190	[-1, 32, 48, 48]	--
	└─Conv2d: 3-191	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-192	[-1, 32, 48, 48]	64
	└─ReLU: 3-193	[-1, 32, 48, 48]	--
└─res_block: 2-33		[-1, 32, 48, 48]	--
	└─Conv2d: 3-194	[-1, 32, 48, 48]	9,216
	└─BatchNorm2d: 3-195	[-1, 32, 48, 48]	64
	└─ReLU: 3-196	[-1, 32, 48, 48]	--

		└─Conv2d: 3-197	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-198	[-1, 32, 48, 48]	64
		└─ReLU: 3-199	[-1, 32, 48, 48]	--
	└─res_block: 2-34		[-1, 32, 48, 48]	--
		└─Conv2d: 3-200	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-201	[-1, 32, 48, 48]	64
		└─ReLU: 3-202	[-1, 32, 48, 48]	--
		└─Conv2d: 3-203	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-204	[-1, 32, 48, 48]	64
		└─ReLU: 3-205	[-1, 32, 48, 48]	--
	└─res_block: 2-35		[-1, 32, 48, 48]	--
		└─Conv2d: 3-206	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-207	[-1, 32, 48, 48]	64
		└─ReLU: 3-208	[-1, 32, 48, 48]	--
		└─Conv2d: 3-209	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-210	[-1, 32, 48, 48]	64
		└─ReLU: 3-211	[-1, 32, 48, 48]	--
	└─res_block: 2-36		[-1, 32, 48, 48]	--
		└─Conv2d: 3-212	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-213	[-1, 32, 48, 48]	64
		└─ReLU: 3-214	[-1, 32, 48, 48]	--
		└─Conv2d: 3-215	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-216	[-1, 32, 48, 48]	64
		└─ReLU: 3-217	[-1, 32, 48, 48]	--
	└─res_block: 2-37		[-1, 32, 48, 48]	--
		└─Conv2d: 3-218	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-219	[-1, 32, 48, 48]	64
		└─ReLU: 3-220	[-1, 32, 48, 48]	--
		└─Conv2d: 3-221	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-222	[-1, 32, 48, 48]	64
		└─ReLU: 3-223	[-1, 32, 48, 48]	--
	└─res_block: 2-38		[-1, 32, 48, 48]	--
		└─Conv2d: 3-224	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-225	[-1, 32, 48, 48]	64
		└─ReLU: 3-226	[-1, 32, 48, 48]	--
		└─Conv2d: 3-227	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-228	[-1, 32, 48, 48]	64
		└─ReLU: 3-229	[-1, 32, 48, 48]	--
	└─res_block: 2-39		[-1, 32, 48, 48]	--
		└─Conv2d: 3-230	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-231	[-1, 32, 48, 48]	64
		└─ReLU: 3-232	[-1, 32, 48, 48]	--
		└─Conv2d: 3-233	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-234	[-1, 32, 48, 48]	64
		└─ReLU: 3-235	[-1, 32, 48, 48]	--
	└─res_block: 2-40		[-1, 32, 48, 48]	--
		└─Conv2d: 3-236	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-237	[-1, 32, 48, 48]	64
		└─ReLU: 3-238	[-1, 32, 48, 48]	--
		└─Conv2d: 3-239	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-240	[-1, 32, 48, 48]	64
		└─ReLU: 3-241	[-1, 32, 48, 48]	--
	└─res_block: 2-41		[-1, 32, 48, 48]	--
		└─Conv2d: 3-242	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-243	[-1, 32, 48, 48]	64
		└─ReLU: 3-244	[-1, 32, 48, 48]	--
		└─Conv2d: 3-245	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-246	[-1, 32, 48, 48]	64
		└─ReLU: 3-247	[-1, 32, 48, 48]	--
	└─res_block: 2-42		[-1, 32, 48, 48]	--
		└─Conv2d: 3-248	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-249	[-1, 32, 48, 48]	64
		└─ReLU: 3-250	[-1, 32, 48, 48]	--
		└─Conv2d: 3-251	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-252	[-1, 32, 48, 48]	64
		└─ReLU: 3-253	[-1, 32, 48, 48]	--
	└─res_block: 2-43		[-1, 32, 48, 48]	--
		└─Conv2d: 3-254	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-255	[-1, 32, 48, 48]	64
		└─ReLU: 3-256	[-1, 32, 48, 48]	--
		└─Conv2d: 3-257	[-1, 32, 48, 48]	9,216
		└─BatchNorm2d: 3-258	[-1, 32, 48, 48]	64

```
|    |    └─ReLU: 3-259                       [-1, 32, 48, 48]          --
|    └─res_block: 2-44                        [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-260                     [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-261                [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-262                       [-1, 32, 48, 48]          --
|    |    └─Conv2d: 3-263                     [-1, 32, 48, 48]          9,216
|    |    └─BatchNorm2d: 3-264                [-1, 32, 48, 48]          64
|    |    └─ReLU: 3-265                       [-1, 32, 48, 48]          --
├─Sequential: 1-9                            [-1, 64, 24, 24]          --
|    └─res_block: 2-45                        [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-266                     [-1, 64, 24, 24]          18,432
|    |    └─BatchNorm2d: 3-267                [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-268                       [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-269                     [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-270                [-1, 64, 24, 24]          128
|    |    └─Sequential: 3-271                 [-1, 64, 24, 24]          18,560
|    |    └─ReLU: 3-272                       [-1, 64, 24, 24]          --
|    └─res_block: 2-46                        [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-273                     [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-274                [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-275                       [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-276                     [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-277                [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-278                       [-1, 64, 24, 24]          --
|    └─res_block: 2-47                        [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-279                     [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-280                [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-281                       [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-282                     [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-283                [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-284                       [-1, 64, 24, 24]          --
|    └─res_block: 2-48                        [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-285                     [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-286                [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-287                       [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-288                     [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-289                [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-290                       [-1, 64, 24, 24]          --
|    └─res_block: 2-49                        [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-291                     [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-292                [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-293                       [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-294                     [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-295                [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-296                       [-1, 64, 24, 24]          --
|    └─res_block: 2-50                        [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-297                     [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-298                [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-299                       [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-300                     [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-301                [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-302                       [-1, 64, 24, 24]          --
|    └─res_block: 2-51                        [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-303                     [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-304                [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-305                       [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-306                     [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-307                [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-308                       [-1, 64, 24, 24]          --
|    └─res_block: 2-52                        [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-309                     [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-310                [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-311                       [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-312                     [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-313                [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-314                       [-1, 64, 24, 24]          --
|    └─res_block: 2-53                        [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-315                     [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-316                [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-317                       [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-318                     [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-319                [-1, 64, 24, 24]          128
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		└─ReLU: 3-320	[-1, 64, 24, 24]	--
	└─res_block: 2-54		[-1, 64, 24, 24]	--
		└─Conv2d: 3-321	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-322	[-1, 64, 24, 24]	128
		└─ReLU: 3-323	[-1, 64, 24, 24]	--
		└─Conv2d: 3-324	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-325	[-1, 64, 24, 24]	128
		└─ReLU: 3-326	[-1, 64, 24, 24]	--
	└─res_block: 2-55		[-1, 64, 24, 24]	--
		└─Conv2d: 3-327	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-328	[-1, 64, 24, 24]	128
		└─ReLU: 3-329	[-1, 64, 24, 24]	--
		└─Conv2d: 3-330	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-331	[-1, 64, 24, 24]	128
		└─ReLU: 3-332	[-1, 64, 24, 24]	--
	└─res_block: 2-56		[-1, 64, 24, 24]	--
		└─Conv2d: 3-333	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-334	[-1, 64, 24, 24]	128
		└─ReLU: 3-335	[-1, 64, 24, 24]	--
		└─Conv2d: 3-336	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-337	[-1, 64, 24, 24]	128
		└─ReLU: 3-338	[-1, 64, 24, 24]	--
	└─res_block: 2-57		[-1, 64, 24, 24]	--
		└─Conv2d: 3-339	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-340	[-1, 64, 24, 24]	128
		└─ReLU: 3-341	[-1, 64, 24, 24]	--
		└─Conv2d: 3-342	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-343	[-1, 64, 24, 24]	128
		└─ReLU: 3-344	[-1, 64, 24, 24]	--
	└─res_block: 2-58		[-1, 64, 24, 24]	--
		└─Conv2d: 3-345	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-346	[-1, 64, 24, 24]	128
		└─ReLU: 3-347	[-1, 64, 24, 24]	--
		└─Conv2d: 3-348	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-349	[-1, 64, 24, 24]	128
		└─ReLU: 3-350	[-1, 64, 24, 24]	--
	└─res_block: 2-59		[-1, 64, 24, 24]	--
		└─Conv2d: 3-351	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-352	[-1, 64, 24, 24]	128
		└─ReLU: 3-353	[-1, 64, 24, 24]	--
		└─Conv2d: 3-354	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-355	[-1, 64, 24, 24]	128
		└─ReLU: 3-356	[-1, 64, 24, 24]	--
	└─res_block: 2-60		[-1, 64, 24, 24]	--
		└─Conv2d: 3-357	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-358	[-1, 64, 24, 24]	128
		└─ReLU: 3-359	[-1, 64, 24, 24]	--
		└─Conv2d: 3-360	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-361	[-1, 64, 24, 24]	128
		└─ReLU: 3-362	[-1, 64, 24, 24]	--
	└─res_block: 2-61		[-1, 64, 24, 24]	--
		└─Conv2d: 3-363	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-364	[-1, 64, 24, 24]	128
		└─ReLU: 3-365	[-1, 64, 24, 24]	--
		└─Conv2d: 3-366	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-367	[-1, 64, 24, 24]	128
		└─ReLU: 3-368	[-1, 64, 24, 24]	--
	└─res_block: 2-62		[-1, 64, 24, 24]	--
		└─Conv2d: 3-369	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-370	[-1, 64, 24, 24]	128
		└─ReLU: 3-371	[-1, 64, 24, 24]	--
		└─Conv2d: 3-372	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-373	[-1, 64, 24, 24]	128
		└─ReLU: 3-374	[-1, 64, 24, 24]	--
	└─res_block: 2-63		[-1, 64, 24, 24]	--
		└─Conv2d: 3-375	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-376	[-1, 64, 24, 24]	128
		└─ReLU: 3-377	[-1, 64, 24, 24]	--
		└─Conv2d: 3-378	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-379	[-1, 64, 24, 24]	128
		└─ReLU: 3-380	[-1, 64, 24, 24]	--
	└─res_block: 2-64		[-1, 64, 24, 24]	--

		└─Conv2d: 3-381	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-382	[-1, 64, 24, 24]	128
		└─ReLU: 3-383	[-1, 64, 24, 24]	--
		└─Conv2d: 3-384	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-385	[-1, 64, 24, 24]	128
		└─ReLU: 3-386	[-1, 64, 24, 24]	--
	└─res_block: 2-65		[-1, 64, 24, 24]	--
		└─Conv2d: 3-387	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-388	[-1, 64, 24, 24]	128
		└─ReLU: 3-389	[-1, 64, 24, 24]	--
		└─Conv2d: 3-390	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-391	[-1, 64, 24, 24]	128
		└─ReLU: 3-392	[-1, 64, 24, 24]	--
	└─res_block: 2-66		[-1, 64, 24, 24]	--
		└─Conv2d: 3-393	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-394	[-1, 64, 24, 24]	128
		└─ReLU: 3-395	[-1, 64, 24, 24]	--
		└─Conv2d: 3-396	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-397	[-1, 64, 24, 24]	128
		└─ReLU: 3-398	[-1, 64, 24, 24]	--
	└─res_block: 2-67		[-1, 64, 24, 24]	--
		└─Conv2d: 3-399	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-400	[-1, 64, 24, 24]	128
		└─ReLU: 3-401	[-1, 64, 24, 24]	--
		└─Conv2d: 3-402	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-403	[-1, 64, 24, 24]	128
		└─ReLU: 3-404	[-1, 64, 24, 24]	--
	└─res_block: 2-68		[-1, 64, 24, 24]	--
		└─Conv2d: 3-405	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-406	[-1, 64, 24, 24]	128
		└─ReLU: 3-407	[-1, 64, 24, 24]	--
		└─Conv2d: 3-408	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-409	[-1, 64, 24, 24]	128
		└─ReLU: 3-410	[-1, 64, 24, 24]	--
	└─res_block: 2-69		[-1, 64, 24, 24]	--
		└─Conv2d: 3-411	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-412	[-1, 64, 24, 24]	128
		└─ReLU: 3-413	[-1, 64, 24, 24]	--
		└─Conv2d: 3-414	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-415	[-1, 64, 24, 24]	128
		└─ReLU: 3-416	[-1, 64, 24, 24]	--
	└─res_block: 2-70		[-1, 64, 24, 24]	--
		└─Conv2d: 3-417	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-418	[-1, 64, 24, 24]	128
		└─ReLU: 3-419	[-1, 64, 24, 24]	--
		└─Conv2d: 3-420	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-421	[-1, 64, 24, 24]	128
		└─ReLU: 3-422	[-1, 64, 24, 24]	--
	└─res_block: 2-71		[-1, 64, 24, 24]	--
		└─Conv2d: 3-423	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-424	[-1, 64, 24, 24]	128
		└─ReLU: 3-425	[-1, 64, 24, 24]	--
		└─Conv2d: 3-426	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-427	[-1, 64, 24, 24]	128
		└─ReLU: 3-428	[-1, 64, 24, 24]	--
	└─res_block: 2-72		[-1, 64, 24, 24]	--
		└─Conv2d: 3-429	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-430	[-1, 64, 24, 24]	128
		└─ReLU: 3-431	[-1, 64, 24, 24]	--
		└─Conv2d: 3-432	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-433	[-1, 64, 24, 24]	128
		└─ReLU: 3-434	[-1, 64, 24, 24]	--
	└─res_block: 2-73		[-1, 64, 24, 24]	--
		└─Conv2d: 3-435	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-436	[-1, 64, 24, 24]	128
		└─ReLU: 3-437	[-1, 64, 24, 24]	--
		└─Conv2d: 3-438	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-439	[-1, 64, 24, 24]	128
		└─ReLU: 3-440	[-1, 64, 24, 24]	--
	└─res_block: 2-74		[-1, 64, 24, 24]	--
		└─Conv2d: 3-441	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-442	[-1, 64, 24, 24]	128

		└─ReLU: 3-443	[-1, 64, 24, 24]	--
		└─Conv2d: 3-444	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-445	[-1, 64, 24, 24]	128
		└─ReLU: 3-446	[-1, 64, 24, 24]	--
	└─res_block: 2-75		[-1, 64, 24, 24]	--
		└─Conv2d: 3-447	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-448	[-1, 64, 24, 24]	128
		└─ReLU: 3-449	[-1, 64, 24, 24]	--
		└─Conv2d: 3-450	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-451	[-1, 64, 24, 24]	128
		└─ReLU: 3-452	[-1, 64, 24, 24]	--
	└─res_block: 2-76		[-1, 64, 24, 24]	--
		└─Conv2d: 3-453	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-454	[-1, 64, 24, 24]	128
		└─ReLU: 3-455	[-1, 64, 24, 24]	--
		└─Conv2d: 3-456	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-457	[-1, 64, 24, 24]	128
		└─ReLU: 3-458	[-1, 64, 24, 24]	--
	└─res_block: 2-77		[-1, 64, 24, 24]	--
		└─Conv2d: 3-459	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-460	[-1, 64, 24, 24]	128
		└─ReLU: 3-461	[-1, 64, 24, 24]	--
		└─Conv2d: 3-462	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-463	[-1, 64, 24, 24]	128
		└─ReLU: 3-464	[-1, 64, 24, 24]	--
	└─res_block: 2-78		[-1, 64, 24, 24]	--
		└─Conv2d: 3-465	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-466	[-1, 64, 24, 24]	128
		└─ReLU: 3-467	[-1, 64, 24, 24]	--
		└─Conv2d: 3-468	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-469	[-1, 64, 24, 24]	128
		└─ReLU: 3-470	[-1, 64, 24, 24]	--
	└─res_block: 2-79		[-1, 64, 24, 24]	--
		└─Conv2d: 3-471	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-472	[-1, 64, 24, 24]	128
		└─ReLU: 3-473	[-1, 64, 24, 24]	--
		└─Conv2d: 3-474	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-475	[-1, 64, 24, 24]	128
		└─ReLU: 3-476	[-1, 64, 24, 24]	--
	└─res_block: 2-80		[-1, 64, 24, 24]	--
		└─Conv2d: 3-477	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-478	[-1, 64, 24, 24]	128
		└─ReLU: 3-479	[-1, 64, 24, 24]	--
		└─Conv2d: 3-480	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-481	[-1, 64, 24, 24]	128
		└─ReLU: 3-482	[-1, 64, 24, 24]	--
	└─res_block: 2-81		[-1, 64, 24, 24]	--
		└─Conv2d: 3-483	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-484	[-1, 64, 24, 24]	128
		└─ReLU: 3-485	[-1, 64, 24, 24]	--
		└─Conv2d: 3-486	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-487	[-1, 64, 24, 24]	128
		└─ReLU: 3-488	[-1, 64, 24, 24]	--
	└─res_block: 2-82		[-1, 64, 24, 24]	--
		└─Conv2d: 3-489	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-490	[-1, 64, 24, 24]	128
		└─ReLU: 3-491	[-1, 64, 24, 24]	--
		└─Conv2d: 3-492	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-493	[-1, 64, 24, 24]	128
		└─ReLU: 3-494	[-1, 64, 24, 24]	--
	└─res_block: 2-83		[-1, 64, 24, 24]	--
		└─Conv2d: 3-495	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-496	[-1, 64, 24, 24]	128
		└─ReLU: 3-497	[-1, 64, 24, 24]	--
		└─Conv2d: 3-498	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-499	[-1, 64, 24, 24]	128
		└─ReLU: 3-500	[-1, 64, 24, 24]	--
	└─res_block: 2-84		[-1, 64, 24, 24]	--
		└─Conv2d: 3-501	[-1, 64, 24, 24]	36,864
		└─BatchNorm2d: 3-502	[-1, 64, 24, 24]	128
		└─ReLU: 3-503	[-1, 64, 24, 24]	--
		└─Conv2d: 3-504	[-1, 64, 24, 24]	36,864

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|    |    └─BatchNorm2d: 3-505           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-506                  [-1, 64, 24, 24]          --
|    └─res_block: 2-85                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-507                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-508           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-509                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-510                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-511           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-512                  [-1, 64, 24, 24]          --
|    └─res_block: 2-86                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-513                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-514           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-515                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-516                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-517           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-518                  [-1, 64, 24, 24]          --
|    └─res_block: 2-87                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-519                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-520           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-521                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-522                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-523           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-524                  [-1, 64, 24, 24]          --
|    └─res_block: 2-88                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-525                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-526           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-527                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-528                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-529           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-530                  [-1, 64, 24, 24]          --
|    └─res_block: 2-89                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-531                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-532           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-533                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-534                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-535           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-536                  [-1, 64, 24, 24]          --
|    └─res_block: 2-90                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-537                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-538           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-539                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-540                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-541           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-542                  [-1, 64, 24, 24]          --
|    └─res_block: 2-91                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-543                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-544           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-545                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-546                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-547           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-548                  [-1, 64, 24, 24]          --
|    └─res_block: 2-92                   [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-549                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-550           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-551                  [-1, 64, 24, 24]          --
|    |    └─Conv2d: 3-552                [-1, 64, 24, 24]          36,864
|    |    └─BatchNorm2d: 3-553           [-1, 64, 24, 24]          128
|    |    └─ReLU: 3-554                  [-1, 64, 24, 24]          --
├─AvgPool2d: 1-10                        [-1, 64, 3, 3]            --
├─Linear: 1-11                           [-1, 256]                 147,712
==========================================================================================
=
Total params: 4,406,088
Trainable params: 4,406,088
Non-trainable params: 0
Total mult-adds (G): 3.93
==========================================================================================
=
Input size (MB): 0.11
Forward/backward pass size (MB): 176.06
Params size (MB): 16.81
Estimated Total Size (MB): 192.98
```

==========
=

In [ ]:

```
checkpoint_callback = ModelCheckpoint(
        monitor='valid_acc',
        mode = 'max',
        save_last=True,
        dirpath='weights/triplet_loss+focal/256_CE_8,36,48-P',
        filename='CE_loss-{epoch:02d}-{valid_acc:.3f}'
    )

import wandb                                    #Wandb was used to monitor the performace of
the model
import ipdb

class Net(pl.LightningModule):
    def __init__(self, model, triplet=False):
        super().__init__()
        self.model = model
        self.accuracy = torchmetrics.Accuracy()
        self.triplet = triplet
        self.triplet_loss = nn.TripletMarginLoss(margin=1.0, p=2)
        self.fc2 = nn.Linear(256, 64)
        self.fc3 = nn.Linear(64, 5)
        self.alpha = 1
        self.gamma = 2
        self.relu = nn.ReLU()

    def forward(self, x1, x2=None):
        if self.triplet:
            embedding1 = self.model(x1)
            embedding2 = self.model(x2)
            return embedding1, embedding2

        else:

            embedding = self.model(x1)
            return embedding

    def configure_optimizers(self):
        self.optimizer = SWA(torch.optim.Adam(self.model.parameters(),  lr=1e-8))
        self.scheduler = torch.optim.lr_scheduler.CosineAnnealingLR(self.optimizer,
                                                                    T_max=10,
                                                                    eta_min=1e-2,
                                                                    verbose=True)

        return {'optimizer': self.optimizer, 'lr_scheduler': self.scheduler}

    def training_step(self, train_batch, batch_idx):
        if self.triplet:
            (anc,lab_anc),(pos,lab_pos),(neg,lab_neg) = train_batch

            z_anc = self.model(anc)
            z_pos = self.model(pos)
            z_neg = self.model(neg)

            z = self.fc2(self.relu(z_anc))
            z = self.fc3(self.relu(z))

            CE_loss = F.cross_entropy(z,lab_anc)
            pt = torch.exp(-CE_loss)
            F_loss = self.alpha * (1-pt)**self.gamma * CE_loss

            loss = self.triplet_loss(z_anc, z_pos, z_neg) + F_loss                #Final
loss = triplet_loss + focal_loss
            acc = self.accuracy(z, lab_anc)
            logs = {'train_loss': loss,'train_acc':acc , 'lr': self.optimizer.param_grou
ps[0]['lr']}
            self.log_dict(logs, on_step=False, on_epoch=True, prog_bar=True, logger=True
```

```
)
            return loss


        else:
            x, y = train_batch
            z = self.relu(self.model(x))
            z = self.relu(self.fc2(z))
            z = self.fc3(z)
            loss = F.cross_entropy(z,y)
            acc = self.accuracy(z, y)
            logs = {'train_loss': loss, 'train_acc': acc, 'lr': self.optimizer.param_gro
ups[0]['lr']}
            self.log_dict(logs, on_step=False, on_epoch=True, prog_bar=True, logger=True
)
            return loss

    def validation_step(self, val_batch, batch_idx):

            x, y = val_batch
            z = self.relu(self.model(x))
            z = self.fc2(z)
            z = self.fc3(self.relu(z))
            loss = F.cross_entropy(z, y)
            acc = self.accuracy(z, y)
            logs = {'valid_loss': loss, 'valid_acc': acc}
            self.log_dict(logs, on_step=False, on_epoch=True, prog_bar=True, logger=True
)
            wandb.log({"valid_acc": acc})
            return loss

    def training_epoch_end(self, outs):
        self.log('train_acc_epoch', self.accuracy.compute())



# Training

if config.test==False:
    wandb.init()

    wandb.watch(resnet)
    model = Net(resnet, triplet=config.triplet)
    trainer = pl.Trainer(gpus=1,precision=16, max_epochs=600, callbacks=[checkpoint_call
back])
    trainer.fit(model, train_dataloader_triplet, val_dataloader)
```

In [ ]:

```
# Inference and Confusion Matrix Generation

class final_net(nn.Module):
    def __init__(self, model):
        super(final_net, self).__init__()
        self.model = model
        self.fc2 = nn.Linear(256, 64)
        self.fc3 = nn.Linear(64, 5)
        self.relu = nn.ReLU()


    def forward(self, x):
        out = self.model(x)
        out = self.fc2(self.relu(out))
        out = self.fc3(self.relu(out))
        return out



FN = final_net(resnet)
chkpoint = torch.load('./weights/CE_loss-epoch=193-valid_acc=0.781.ckpt')['state_dict']
```

```
FN.load_state_dict(chkpoint)
summary(FN,(3,96,96))
```

```
==========================================================================================
=
Layer (type:depth-idx)                   Output Shape              Param #
==========================================================================================
=
├─res_net: 1-1                           [-1, 256]                 --
|    └─Conv2d: 2-1                       [-1, 8, 96, 96]           216
|    └─BatchNorm2d: 2-2                  [-1, 8, 96, 96]           16
|    └─ReLU: 2-3                         [-1, 8, 96, 96]           --
|    └─Conv2d: 2-4                       [-1, 16, 96, 96]          1,152
|    └─BatchNorm2d: 2-5                  [-1, 16, 96, 96]          32
|    └─ReLU: 2-6                         [-1, 16, 96, 96]          --
|    └─Sequential: 2-7                   [-1, 16, 96, 96]          --
|    |    └─res_block: 3-1               [-1, 16, 96, 96]          4,672
|    |    └─res_block: 3-2               [-1, 16, 96, 96]          4,672
|    |    └─res_block: 3-3               [-1, 16, 96, 96]          4,672
|    |    └─res_block: 3-4               [-1, 16, 96, 96]          4,672
|    |    └─res_block: 3-5               [-1, 16, 96, 96]          4,672
|    |    └─res_block: 3-6               [-1, 16, 96, 96]          4,672
|    |    └─res_block: 3-7               [-1, 16, 96, 96]          4,672
|    |    └─res_block: 3-8               [-1, 16, 96, 96]          4,672
|    └─Sequential: 2-8                   [-1, 32, 48, 48]          --
|    |    └─res_block: 3-9               [-1, 32, 48, 48]          18,624
|    |    └─res_block: 3-10              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-11              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-12              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-13              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-14              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-15              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-16              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-17              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-18              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-19              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-20              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-21              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-22              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-23              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-24              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-25              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-26              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-27              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-28              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-29              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-30              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-31              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-32              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-33              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-34              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-35              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-36              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-37              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-38              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-39              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-40              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-41              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-42              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-43              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-44              [-1, 32, 48, 48]          18,560
|    └─Sequential: 2-9                   [-1, 64, 24, 24]          --
|    |    └─res_block: 3-45              [-1, 64, 24, 24]          74,112
|    |    └─res_block: 3-46              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-47              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-48              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-49              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-50              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-51              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-52              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-53              [-1, 64, 24, 24]          73,984
```

```
|    |    └─res_block: 3-54                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-55                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-56                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-57                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-58                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-59                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-60                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-61                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-62                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-63                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-64                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-65                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-66                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-67                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-68                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-69                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-70                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-71                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-72                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-73                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-74                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-75                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-76                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-77                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-78                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-79                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-80                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-81                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-82                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-83                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-84                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-85                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-86                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-87                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-88                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-89                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-90                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-91                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-92                  [-1, 64, 24, 24]          73,984
|    └─AvgPool2d: 2-10                       [-1, 64, 3, 3]            --
|    └─Linear: 2-11                          [-1, 256]                 147,712
├─ReLU: 1-2                                  [-1, 256]                 --
├─Linear: 1-3                                [-1, 64]                  16,448
├─ReLU: 1-4                                  [-1, 64]                  --
├─Linear: 1-5                                [-1, 5]                   325
==========================================================================================
=
Total params: 4,422,861
Trainable params: 4,422,861
Non-trainable params: 0
Total mult-adds (G): 3.91
==========================================================================================
=
Input size (MB): 0.11
Forward/backward pass size (MB): 174.38
Params size (MB): 16.87
Estimated Total Size (MB): 191.35
==========================================================================================
=
```

Out[ ]:

```
==========================================================================================
=
Layer (type:depth-idx)                       Output Shape              Param #
==========================================================================================
=
├─res_net: 1-1                               [-1, 256]                 --
|    └─Conv2d: 2-1                           [-1, 8, 96, 96]           216
|    └─BatchNorm2d: 2-2                      [-1, 8, 96, 96]           16
|    └─ReLU: 2-3                             [-1, 8, 96, 96]           --
|    └─Conv2d: 2-4                           [-1, 16, 96, 96]          1,152
|    └─BatchNorm2d: 2-5                      [-1, 16, 96, 96]          32
```

```
|    └─ReLU: 2-6                         [-1, 16, 96, 96]          --
|    └─Sequential: 2-7                   [-1, 16, 96, 96]          --
|    |    └─res_block: 3-1               [-1, 16, 96, 96]          4,672
|    |    └─res_block: 3-2               [-1, 16, 96, 96]          4,672
|    |    └─res_block: 3-3               [-1, 16, 96, 96]          4,672
|    |    └─res_block: 3-4               [-1, 16, 96, 96]          4,672
|    |    └─res_block: 3-5               [-1, 16, 96, 96]          4,672
|    |    └─res_block: 3-6               [-1, 16, 96, 96]          4,672
|    |    └─res_block: 3-7               [-1, 16, 96, 96]          4,672
|    |    └─res_block: 3-8               [-1, 16, 96, 96]          4,672
|    └─Sequential: 2-8                   [-1, 32, 48, 48]          --
|    |    └─res_block: 3-9               [-1, 32, 48, 48]          18,624
|    |    └─res_block: 3-10              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-11              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-12              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-13              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-14              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-15              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-16              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-17              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-18              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-19              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-20              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-21              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-22              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-23              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-24              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-25              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-26              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-27              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-28              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-29              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-30              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-31              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-32              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-33              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-34              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-35              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-36              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-37              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-38              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-39              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-40              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-41              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-42              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-43              [-1, 32, 48, 48]          18,560
|    |    └─res_block: 3-44              [-1, 32, 48, 48]          18,560
|    └─Sequential: 2-9                   [-1, 64, 24, 24]          --
|    |    └─res_block: 3-45              [-1, 64, 24, 24]          74,112
|    |    └─res_block: 3-46              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-47              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-48              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-49              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-50              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-51              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-52              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-53              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-54              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-55              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-56              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-57              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-58              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-59              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-60              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-61              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-62              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-63              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-64              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-65              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-66              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-67              [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-68              [-1, 64, 24, 24]          73,984
```

```
|    |    └─res_block: 3-69                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-70                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-71                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-72                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-73                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-74                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-75                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-76                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-77                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-78                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-79                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-80                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-81                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-82                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-83                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-84                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-85                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-86                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-87                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-88                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-89                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-90                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-91                  [-1, 64, 24, 24]          73,984
|    |    └─res_block: 3-92                  [-1, 64, 24, 24]          73,984
|    └─AvgPool2d: 2-10                       [-1, 64, 3, 3]            --
|    └─Linear: 2-11                          [-1, 256]                 147,712
├─ReLU: 1-2                                  [-1, 256]                 --
├─Linear: 1-3                                [-1, 64]                  16,448
├─ReLU: 1-4                                  [-1, 64]                  --
├─Linear: 1-5                                [-1, 5]                   325
==========================================================================================
=
Total params: 4,422,861
Trainable params: 4,422,861
Non-trainable params: 0
Total mult-adds (G): 3.91
==========================================================================================
=
Input size (MB): 0.11
Forward/backward pass size (MB): 174.38
Params size (MB): 16.87
Estimated Total Size (MB): 191.35
==========================================================================================
=
```

In [ ]:

```
# Confusion Matrix

from sklearn.metrics import confusion_matrix
import seaborn as sn

data_loaders  = [train_dataloader, val_dataloader]

mode=0

def plot_confusion_matrix(data_loader):
    global mode
    y_true_var, y_pred_var = [], []

    for image, label in data_loader:
        image  = image.to(device)
        y_true_var.extend(np.asarray(label.detach().cpu().numpy()))
        model_out = FN(image)
        out = torch.argmax(model_out,axis=1)
        y_pred_var.extend(np.asarray(out.detach().cpu().numpy()))

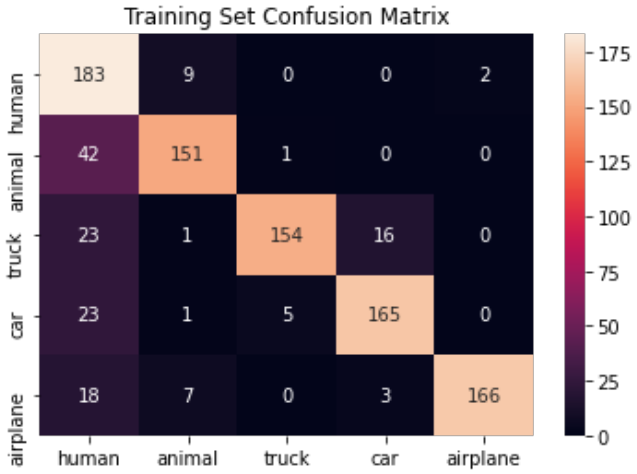

    confusion_matri = confusion_matrix(y_true_var, y_pred_var, labels=[0,1,2,3,4])

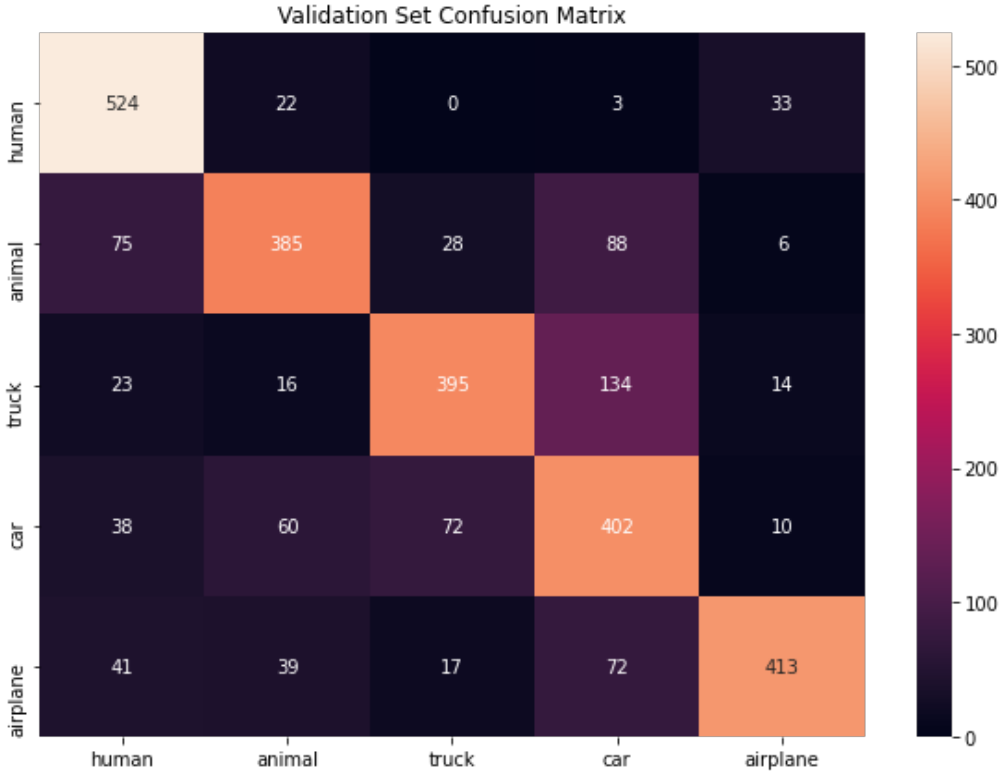
    train_matrix = pd.DataFrame(confusion_matri, index = classes,
```

```
                      columns = classes)

    ax = plt.axes()
    plt.figure(figsize = (10,7))
    sn.heatmap(train_matrix, annot=True, ax = ax, fmt="g")
    if(mode==0):
        ax.set_title("Training Set Confusion Matrix")
        mode+=1
    else:
        ax.set_title("Validation Set Confusion Matrix")

for data_load in data_loaders:
    plot_confusion_matrix(data_load)
plt.show()
```






```
<Figure size 720x504 with 0 Axes>
```

In [ ]:

```
from tqdm import tqdm
predictions = []
image_path = []
for batch_idx, data in tqdm(enumerate(test_dataloader)):
    img_path, image, _ = data
    image  = image.to(device)
    model_out = FN(image)
    out = torch.argmax(model_out,axis=1)
    out = np.asarray(out.detach().cpu().numpy())
    predictions.extend(out)
```

```
    image_path.extend(img_path)
```

```
61it [00:03, 18.70it/s]
```

In [ ]:

```
predictions = np.expand_dims(np.asarray(predictions),axis=-1)
image_path = np.expand_dims(np.asarray(image_path),axis=-1)

data = np.concatenate((image_path,predictions),axis=1)

submission_df =  pd.DataFrame(data = data,
                  columns = ['Image_Name','Label'])

submission_df['Image_Name'] = submission_df['Image_Name'].apply(lambda x: x.split('/')[1
])
submission_df['Label'] = submission_df['Label'].apply(lambda x: classes[int(x)])
submission_df.to_csv("submission.csv")
submission_df
```

Out[ ]:

	Image_Name	Label
0	037164_02_lt.jpg	car
1	034706_02_lt.jpg	human
2	038270_02_lt.jpg	human
3	039051_03_lt.jpg	human
4	035364_02_lt.jpg	car
...	...	...
1935	037851_02_lt.jpg	animal
1936	036290_02_lt.jpg	animal
1937	034252_02_lt.jpg	animal
1938	035574_02_lt.jpg	car
1939	037791_02_lt.jpg	human

1940 rows × 2 columns