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HOMEWORK 0

Problem 1

First Image:

Prediction:

```
[('tiger cat', 79.66744232177734), ('tabby, tabby cat', 19.672622680664062
), ('Egyptian cat', 0.5914100408554077), ('tiger, Panthera tigris', 0.0239
16659876704216), ('lynx, catamount', 0.007003657054156065)]
```

I suspect that the misclassification of a tiger is due to the size of the
cat not being apparent in the image. The model must primarily rely on the
eyes, ears, and coat of the cat to determine what it is. This extends to t
he other misclassifications presented for tiger and lynx. The tabby cat cl
assification is likely matching that the species is a cat, but the coat is
 not tabby, hence the low confidence. Similar with the Egyptian Cat.

Second Image:

```
[('space shuttle', 99.93167114257812), ('missile', 0.036954112350940704),
('projectile, missile', 0.03135554865002632), ('warplane, military plane',
 1.5263885870808735e-05), ('mashed potato', 5.9588342082861345e-06)]
```
The classification for the first 3 most likely is highly accurate. The pre
diction of warplane is likely due to the fire exiting the rocket looking l
ike an afterburner on a fighter jet and this combined with the wings led t
o misclassification. The mashed potato classification is first and foremos
t hysterical but makes sense. The large puffy clouds look somewhat like ma
shed potato leading to this error.

Third Image:


```
[('steel arch bridge', 36.37282943725586), ('pier', 27.173280715942383), (
'suspension bridge', 10.464879989624023), ('fireboat', 6.59556770324707),
('crane', 3.4209132194519043)]
```
The misclassification of steel bridge, suspension bridge, and crane are all likely to the steel girding that is present in the roller coaster and Ferris wheel. The tall pillars that support the coaster also could be seen as part of a bridge or crane. Classification is made further difficult by the variety of items in the shot. The pier classification is likely due to the pillars that look like those that would hold up a pier. The fireboat classification is likely due to the blue and red color scheme plus the apparent presence of a pier that the model perceives.

Fourth Image:


```
[('sports car, sport car', 98.20326232910156), ('convertible', 0.720690310
0013733), ('car wheel', 0.6490448713302612), ('racer, race car, racing car
', 0.3668653070926666), ('crash helmet', 0.022363141179084778)]
```

The majority of these classifications are correct with the only error being crash helmet which is likely due to most training examples of sports cars also containing drivers with a crash helmet.

Fifth Image:

```
[('space shuttle', 42.99848175048828), ('aircraft carrier, carrier, flatto
p, attack aircraft carrier', 27.45186996459961), ('missile', 14.6541414260
86426), ('projectile, missile', 10.323227882385254), ('tank, army tank, ar
mored combat vehicle, armoured combat vehicle', 2.2582790851593018)]
```

This is an interesting case. The fireball from the guns looks like a rocket launch which the model was trained to associated with rockets and the space shuttle, so we see the misclassification of space shuttle, missile, and projectile missile. The armored combat vehicle classification is likely due to most training images of large, armored guns being a tank. The size of the ship likely contributed to the classification of aircraft carrier in part due to the chance that battleship was not even part of the labels.

Problem 2:

Image 1:

Image 2:

Some of the mis colorings are likely due to how massed the horses are making it difficult to determine that the shapes are actually horses.

Image 3:

Image 4:

The error in coloring is likely due to two features. One is that the whole horse's body is not shown indicating the model was likely trained with full views of horses. The other factor is the manes of the horses do not appear to be super normal, they are knotted and different.

Image 5:

The lack of full coloring is likely due to the full body not being shown making boundaries for color hard to determine.

Part 3:

Resnet:

```
In [1]: from torchvision import models
        from ptflops import get_model_complexity_info

        resnet = models.resnet101(pretrained=True)
        macs, params = get_model_complexity_info(resnet, (3, 224, 224), as_strings=True, print_per_layer_stat=False, verbose=False)
        print('{:<30}  {:<8}'.format('Computational complexity: ', macs))
        print('{:<30}  {:<8}'.format('Number of parameters: ', params))

        Computational complexity:       7.85 GMac
        Number of parameters:           44.55 M
```

ResNetGen:

```
netG = ResNetGenerator()
macs, params = get_model_complexity_info(netG, (3, 224, 224), as_strings=True, print_per_layer
print('{:<30}  {:<8}'.format('Computational complexity: ', macs))
print('{:<30}  {:<8}'.format('Number of parameters: ', params))
```

```
Computational complexity:       43.55 GMac
Number of parameters:           11.38 M
```

Part 4:


```
tiger cat 0.6524982452392578
tabby, tabby cat 0.3171881139278412
Egyptian cat 0.023562101647257805
tiger, Panthera tigris 0.00249707093462348
lynx, catamount 0.0022880826145410538
```

```
Second Image:
```

```
space shuttle 0.9988172650337219
missile 0.0006802126881666481
projectile, missile 0.0004809879173990339
mashed potato 2.014709752984345e-05
steam locomotive 4.26946627385405e-0
```
The classification for the first 3 most likely is highly accurate. The mas
hed potato classification is first and foremost hysterical but makes sense
. The large puffy clouds look somewhat like mashed potato leading to this
error. The steam locomotive classification is similar as the smoke was lik
ely present in the training samples for steam locomotive

Third Image:


```
steel arch bridge 0.9232251048088074
coil, spiral, volute, whorl, helix 0.0106697473675012591
suspension bridge 0.010072924196720123
pier 0.005228039808571339
harp 0.004433175083249807
```
The misclassification of steel bridge and suspension bridge are all likely to the steel girding that is
present in the roller coaster and Ferris wheel. The tall pillars that support the coaster also could be seen
as part of a bridge. Classification is made further difficult by the variety of items in the shot. The pier

classification is likely due to the pillars that look like those that would hold up a pier. The harp classification is likely due to the circus wheel being somewhat similar to the shape of a harp.

Fourth Image:


```
sports car, sport car 0.9702891707420349
car wheel 0.017880164086818695
racer, race car, racing car 0.004553707782179117
cab, hack, taxi, taxicab 0.0022443532943725586
grille, radiator grille 0.0020572750363498926
```

The Taxi misclassification could be because of the color of the car which the model was trained to associate with taxis cabs. The radiator grille classification is somewhat accurate although not the main portion of the image.

Fifth Image:

```
missile 0.4829239845275879
projectile, missile 0.22751489281654358
space shuttle 0.16545383632183075
amphibian, amphibious vehicle 0.02598855458199978
aircraft carrier, carrier, flattop, attack aircraft carrier 0.022052939981
222153
```

The missile, space shuttle, and projectile classification is likely due to fireballs. These are likely present in the training images of these labels. The amphibian vehicle and aircraft carrier are likely due to the size and color of ship which were likely the same color as training images for these classes.

Complexity:

```python
from ptflops import get_model_complexity_info

model = torch.hub.load('pytorch/vision:v0.10.0', 'mobilenet_v2', pre

macs, params = get_model_complexity_info(model, (3, 224, 224), as_st
print('{:<30}  {:<8}'.format('Computational complexity: ', macs))
print('{:<30}  {:<8}'.format('Number of parameters: ', params))
model.eval()
```

```
Computational complexity:        0.32 GMac
Number of parameters:            3.5 M
```