CS4830 - BIG DATA LABORATORY
LAB 8 - ASSIGNMENT
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1. The *DL.ipynb* file uploaded on moodle uses a pre-trained mobile net model to run inference on flowers dataset using Pyspark. Modify the above code to run inference on CIFAR 10 dataset using Pyspark.

The code was modified to include the CIFAR 10 dataset. The results for this in the *mobile net v2* model are shown.

```
[5]  data_dir = tf.keras.utils.get_file(origin='http://pjreddie.com/media/files/cifar.tgz',fname='cifar', untar=True)
26s

     Downloading data from http://pjreddie.com/media/files/cifar.tgz
     168584360/168584360 [==============================] - 10s 0us/step
```

Figure 1: The code cell to download the CIFAR 10 dataset

```
+-----+----------------------------------------+
|label|prediction                              |
+-----+----------------------------------------+
|frog |{n02128925, jaguar, 13.927444}          |
|bird |{n07745940, strawberry, 9.118509}       |
|frog |{n01630670, common_newt, 11.725792}     |
|frog |{n02457408, three-toed_sloth, 9.893128} |
|deer |{n02114712, red_wolf, 7.620323}         |
|frog |{n02130308, cheetah, 12.235772}         |
|bird |{n02457408, three-toed_sloth, 11.331468}|
|frog |{n01744401, rock_python, 9.915939}      |
|frog |{n01644900, tailed_frog, 10.826723}     |
|deer |{n02356798, fox_squirrel, 10.129302}    |
+-----+----------------------------------------+
only showing top 10 rows
```

Figure 2: Ten predictions, along with the labels, made by MobileNet v2

2. Try out a few different models pre-trained on Imagenet and report which one works better (calculating exact accuracy is difficult as the class names in Imagenet and CIFAR 10 dataset don't exactly match, but still printing out the predictions for a few points and looking at the class names should give a hint).

The following 14 pre-trained models from the torch vision library were used on the dataset.

1. ResNet 18
2. AlexNet
3. SqueezeNet
4. VGG 16
5. DenseNet 161
6. Inception v3
7. GoogleNet
8. ShuffleNet v2
9. MobileNet v2
10. MobileNet v3 large
11. MobileNet v3 small
12. ResNext 50
13. Wide ResNet 50
14. MnasNet

The results are:

```
+-----+----------------------------------------+
|label|prediction                              |
+-----+----------------------------------------+
|frog |{n02130308, cheetah, 11.560522}         |
|bird |{n01443537, goldfish, 10.951969}        |
|frog |{n01744401, rock_python, 7.9980874}     |
|frog |{n01871265, tusker, 8.802372}           |
|deer |{n02114712, red_wolf, 7.421795}         |
|frog |{n02356798, fox_squirrel, 7.0292416}    |
|bird |{n02457408, three-toed_sloth, 11.415656}|
|frog |{n01644900, tailed_frog, 12.168472}     |
|frog |{n02115913, dhole, 10.988573}           |
|deer |{n03017168, chime, 8.844654}            |
+-----+----------------------------------------+
only showing top 10 rows
```

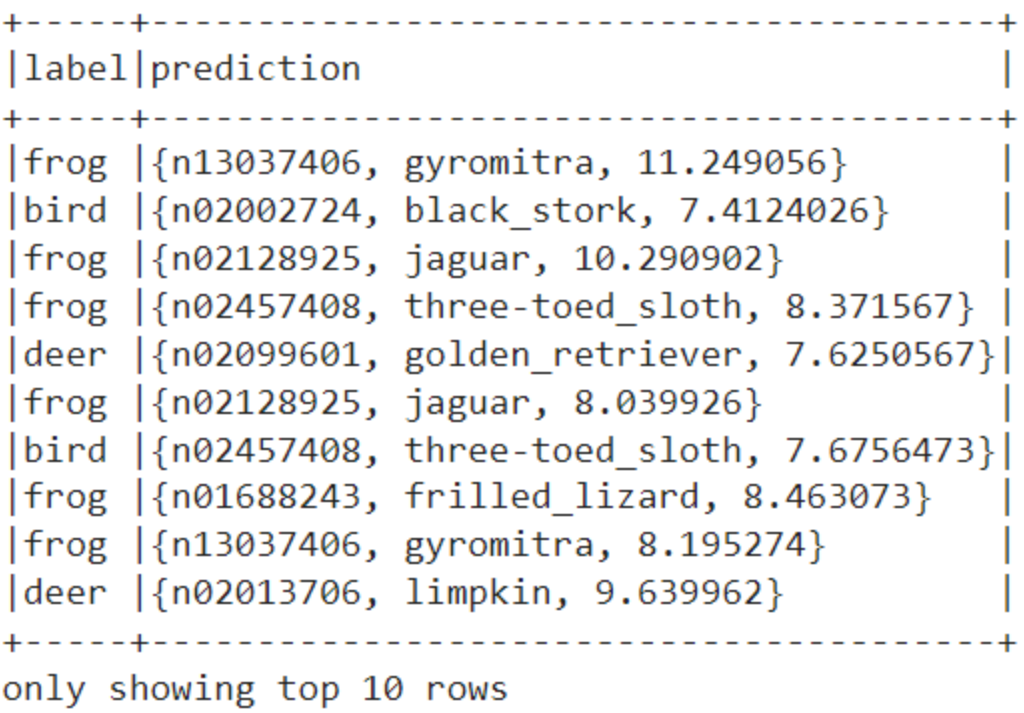
Figure 3: Ten predictions, along with the labels, made by ResNet 18

```
+-----+----------------------------------------+
|label|prediction                              |
+-----+----------------------------------------+
|frog |{n02128925, jaguar, 12.137697}          |
|bird |{n01443537, goldfish, 7.694492}         |
|frog |{n01644900, tailed_frog, 7.793912}      |
|frog |{n02487347, macaque, 7.6259594}         |
|deer |{n02356798, fox_squirrel, 8.7287}       |
|frog |{n02606052, rock_beauty, 6.159985}      |
|bird |{n02457408, three-toed_sloth, 8.934298}|
|frog |{n01688243, frilled_lizard, 10.808053}  |
|frog |{n02356798, fox_squirrel, 7.9078245}    |
|deer |{n01843065, jacamar, 6.974002}          |
+-----+----------------------------------------+
only showing top 10 rows
```

Figure 4: Ten predictions, along with the labels, made by AlexNet

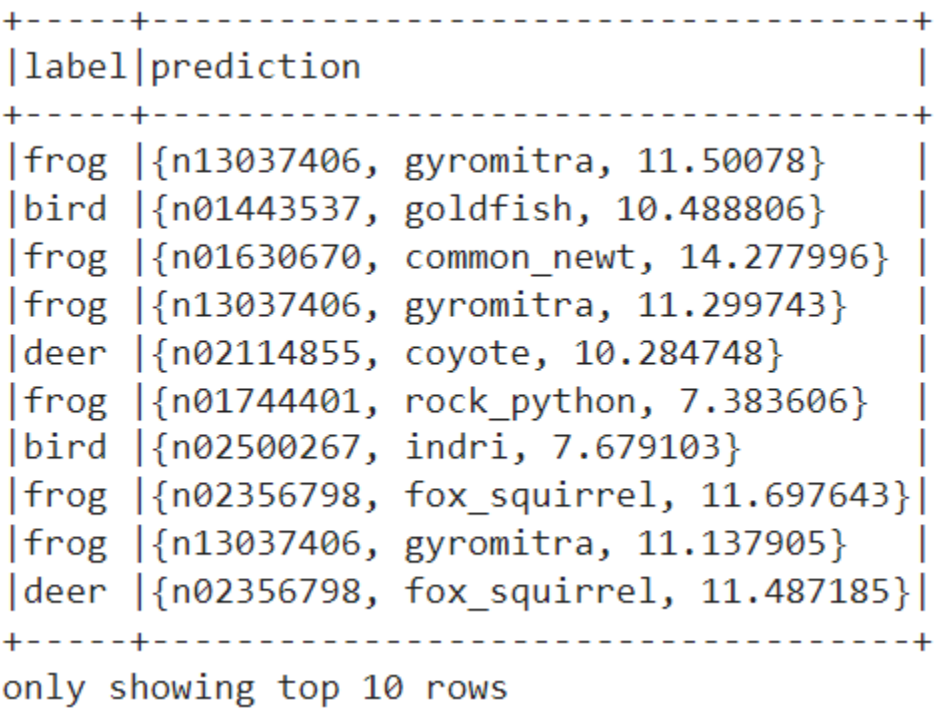
```
+-----+----------------------------------------+
|label|prediction                              |
+-----+----------------------------------------+
|frog |{n02356798, fox_squirrel, 16.09594}     |
|bird |{n01443537, goldfish, 13.846475}        |
|frog |{n07760859, custard_apple, 18.216074}   |
|frog |{n13044778, earthstar, 16.680613}       |
|deer |{n02089973, English_foxhound, 20.55805} |
|frog |{n01756291, sidewinder, 13.225813}      |
|bird |{n02457408, three-toed_sloth, 11.665099}|
|frog |{n01776313, tick, 19.134926}            |
|frog |{n02356798, fox_squirrel, 20.144127}    |
|deer |{n02119022, red_fox, 16.427446}         |
+-----+----------------------------------------+
only showing top 10 rows
```

Figure 5: Ten predictions, along with the labels, made by SqueezeNet



```
+-----+----------------------------------------+
|label|prediction                              |
+-----+----------------------------------------+
|frog |{n13037406, gyromitra, 11.249056}       |
|bird |{n02002724, black_stork, 7.4124026}     |
|frog |{n02128925, jaguar, 10.290902}          |
|frog |{n02457408, three-toed_sloth, 8.371567} |
|deer |{n02099601, golden_retriever, 7.6250567}|
|frog |{n02128925, jaguar, 8.039926}           |
|bird |{n02457408, three-toed_sloth, 7.6756473}|
|frog |{n01688243, frilled_lizard, 8.463073}   |
|frog |{n13037406, gyromitra, 8.195274}        |
|deer |{n02013706, limpkin, 9.639962}          |
+-----+----------------------------------------+
only showing top 10 rows
```

Figure 6: Ten predictions, along with the labels, made by VGG 16



```
+-----+-------------------------------------+
|label|prediction                           |
+-----+-------------------------------------+
|frog |{n13037406, gyromitra, 11.50078}     |
|bird |{n01443537, goldfish, 10.488806}     |
|frog |{n01630670, common_newt, 14.277996}  |
|frog |{n13037406, gyromitra, 11.299743}    |
|deer |{n02114855, coyote, 10.284748}       |
|frog |{n01744401, rock_python, 7.383606}   |
|bird |{n02500267, indri, 7.679103}         |
|frog |{n02356798, fox_squirrel, 11.697643}|
|frog |{n13037406, gyromitra, 11.137905}    |
|deer |{n02356798, fox_squirrel, 11.487185}|
+-----+-------------------------------------+
only showing top 10 rows
```

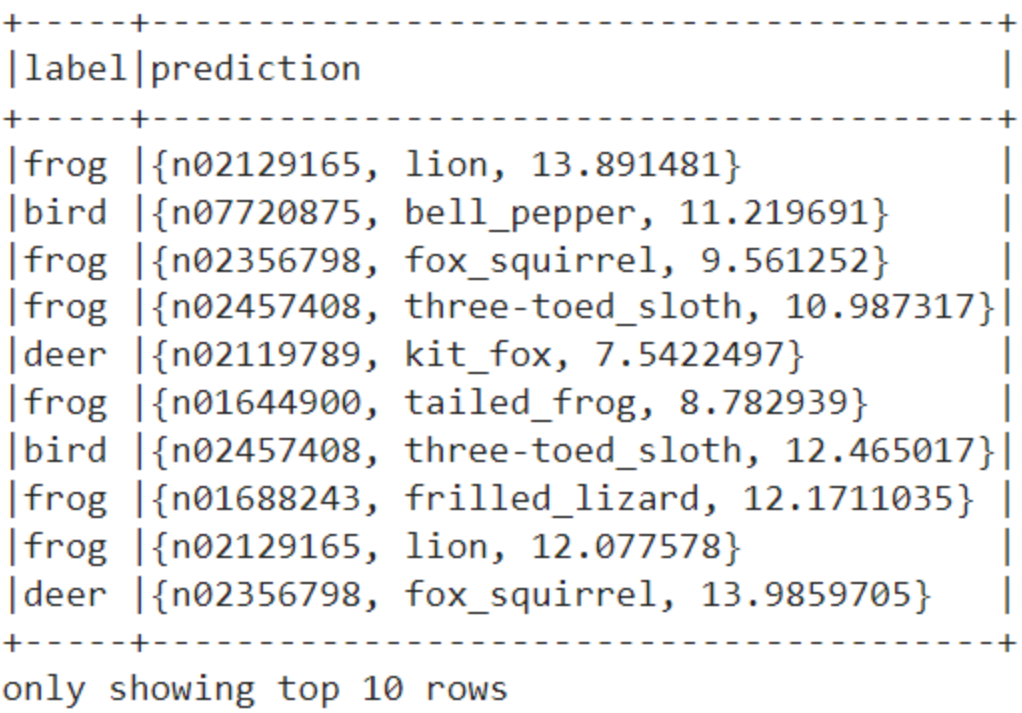
Figure 7: Ten predictions, along with the labels, made by DenseNet 161

```
+-----+----------------------------------------+
|label|prediction                              |
+-----+----------------------------------------+
|frog |{n02127052, lynx, 15.658775}            |
|bird |{n01631663, eft, 14.187774}             |
|frog |{n01644900, tailed_frog, 12.118631}     |
|frog |{n01744401, rock_python, 9.564246}      |
|deer |{n04525305, vending_machine, 8.474264}  |
|frog |{n02128385, leopard, 15.748716}         |
|bird |{n01770081, harvestman, 9.068718}       |
|frog |{n01688243, frilled_lizard, 13.252224}  |
|frog |{n09256479, coral_reef, 8.501441}       |
|deer |{n02356798, fox_squirrel, 10.647777}    |
+-----+----------------------------------------+
only showing top 10 rows
```

Figure 8: Ten predictions, along with the labels, made by Inception v3

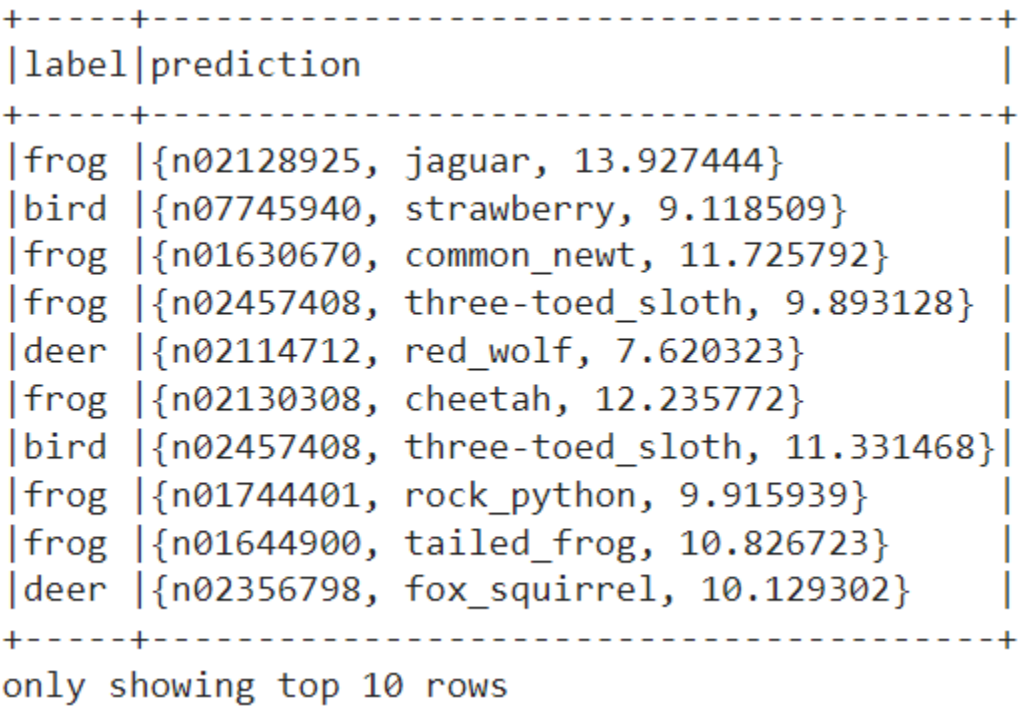
```
+-----+----------------------------------------+
|label|prediction                              |
+-----+----------------------------------------+
|frog |{n02128925, jaguar, 8.538764}           |
|bird |{n02606052, rock_beauty, 5.672103}      |
|frog |{n02128385, leopard, 6.2645426}         |
|frog |{n07730033, cardoon, 3.9538639}         |
|deer |{n03016953, chiffonier, 5.7657547}      |
|frog |{n03998194, prayer_rug, 6.065628}       |
|bird |{n02356798, fox_squirrel, 6.559846}     |
|frog |{n01644900, tailed_frog, 6.832458}      |
|frog |{n02356798, fox_squirrel, 7.4379053}    |
|deer |{n07745940, strawberry, 6.2945814}      |
+-----+----------------------------------------+
only showing top 10 rows
```

Figure 9: Ten predictions, along with the labels, made by GoogleNet



```
+-----+----------------------------------------+
|label|prediction                              |
+-----+----------------------------------------+
|frog |{n02129165, lion, 13.891481}            |
|bird |{n07720875, bell_pepper, 11.219691}     |
|frog |{n02356798, fox_squirrel, 9.561252}     |
|frog |{n02457408, three-toed_sloth, 10.987317}|
|deer |{n02119789, kit_fox, 7.5422497}         |
|frog |{n01644900, tailed_frog, 8.782939}      |
|bird |{n02457408, three-toed_sloth, 12.465017}|
|frog |{n01688243, frilled_lizard, 12.1711035} |
|frog |{n02129165, lion, 12.077578}            |
|deer |{n02356798, fox_squirrel, 13.9859705}   |
+-----+----------------------------------------+
only showing top 10 rows
```

Figure 10: Ten predictions, along with the labels, made by ShuffleNet v2



```
+-----+----------------------------------------+
|label|prediction                              |
+-----+----------------------------------------+
|frog |{n02128925, jaguar, 13.927444}          |
|bird |{n07745940, strawberry, 9.118509}       |
|frog |{n01630670, common_newt, 11.725792}     |
|frog |{n02457408, three-toed_sloth, 9.893128} |
|deer |{n02114712, red_wolf, 7.620323}         |
|frog |{n02130308, cheetah, 12.235772}         |
|bird |{n02457408, three-toed_sloth, 11.331468}|
|frog |{n01744401, rock_python, 9.915939}      |
|frog |{n01644900, tailed_frog, 10.826723}     |
|deer |{n02356798, fox_squirrel, 10.129302}    |
+-----+----------------------------------------+
only showing top 10 rows
```

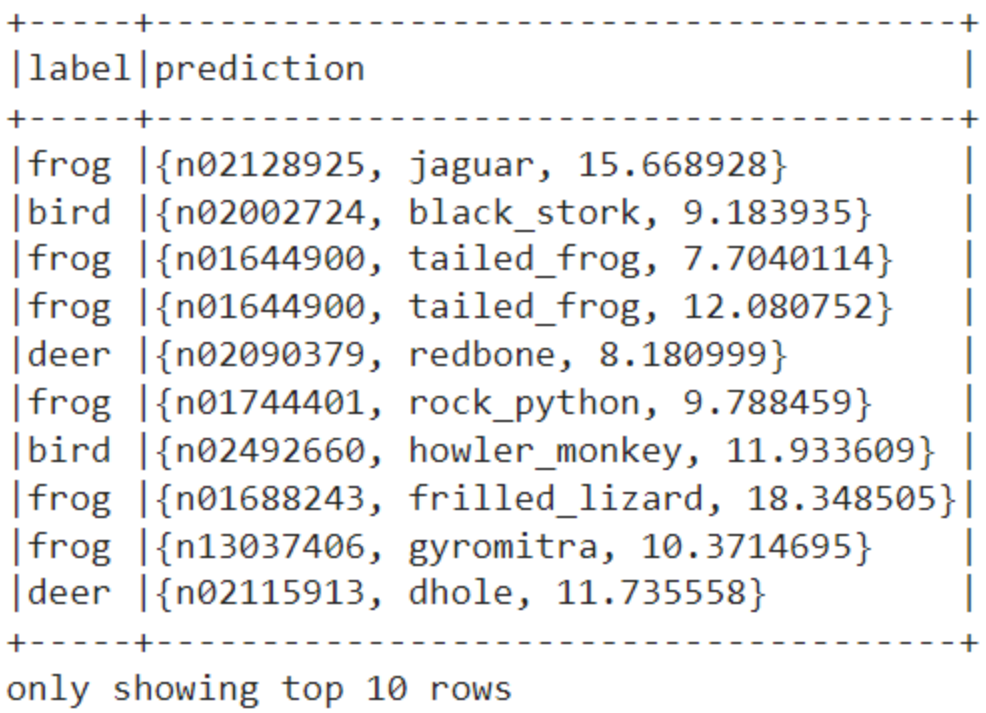
Figure 11: Ten predictions, along with the labels, made by MobileNet v2

```
+-----+-----------------------------------+
|label|prediction                         |
+-----+-----------------------------------+
|frog |{n01644900, tailed_frog, 8.541575}|
|bird |{n01818515, macaw, 7.593059}       |
|frog |{n01644900, tailed_frog, 8.550882}|
|frog |{n13037406, gyromitra, 8.226665}   |
|deer |{n02423022, gazelle, 7.046612}     |
|frog |{n02128925, jaguar, 7.5521393}     |
|bird |{n02500267, indri, 7.035239}       |
|frog |{n01644900, tailed_frog, 8.152968}|
|frog |{n13037406, gyromitra, 7.8628855}  |
|deer |{n02422106, hartebeest, 9.383434}  |
+-----+-----------------------------------+
only showing top 10 rows
```

Figure 12: Ten predictions, along with the labels, made by MobileNet v3 large

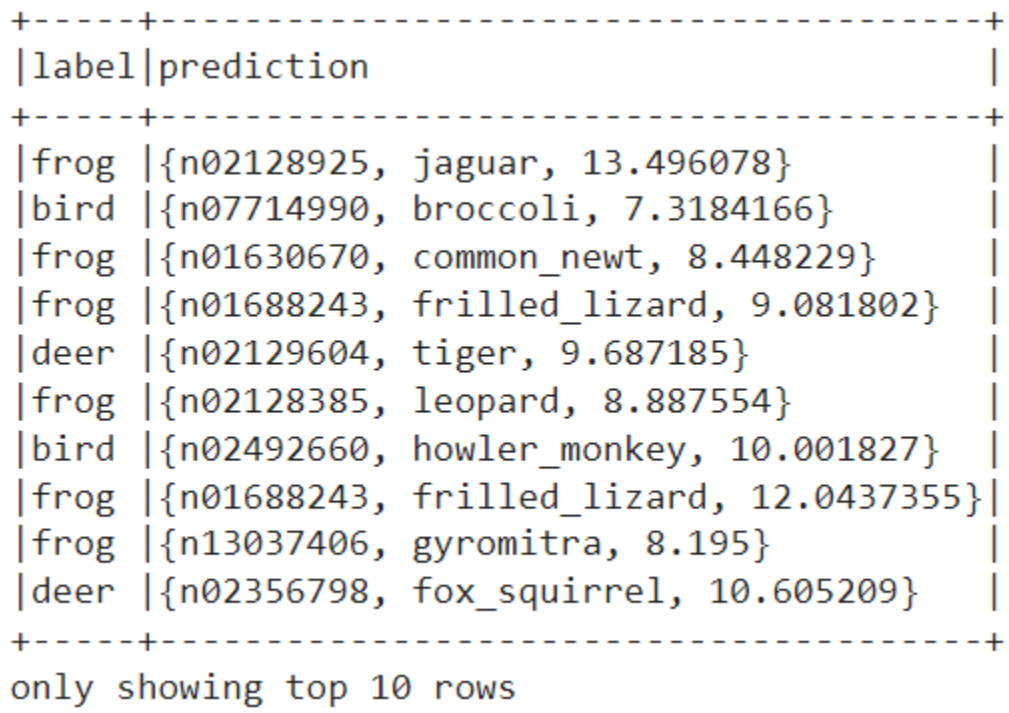
```
+-----+-----------------------------------+
|label|prediction                         |
+-----+-----------------------------------+
|frog |{n02130308, cheetah, 8.274257}     |
|bird |{n02002724, black_stork, 6.107225} |
|frog |{n01630670, common_newt, 8.539049} |
|frog |{n13037406, gyromitra, 7.852108}   |
|deer |{n02114712, red_wolf, 10.001156}   |
|frog |{n01756291, sidewinder, 7.2776165} |
|bird |{n04604644, worm_fence, 5.3525352} |
|frog |{n01644900, tailed_frog, 9.493502} |
|frog |{n02356798, fox_squirrel, 6.365085}|
|deer |{n02389026, sorrel, 4.5488844}     |
+-----+-----------------------------------+
only showing top 10 rows
```

Figure 13: Ten predictions, along with the labels, made by MobileNet v3 small



```
+-----+----------------------------------------+
|label|prediction                              |
+-----+----------------------------------------+
|frog |{n02128925, jaguar, 15.668928}          |
|bird |{n02002724, black_stork, 9.183935}      |
|frog |{n01644900, tailed_frog, 7.7040114}     |
|frog |{n01644900, tailed_frog, 12.080752}     |
|deer |{n02090379, redbone, 8.180999}          |
|frog |{n01744401, rock_python, 9.788459}      |
|bird |{n02492660, howler_monkey, 11.933609}   |
|frog |{n01688243, frilled_lizard, 18.348505}  |
|frog |{n13037406, gyromitra, 10.3714695}      |
|deer |{n02115913, dhole, 11.735558}           |
+-----+----------------------------------------+
only showing top 10 rows
```

Figure 14: Ten predictions, along with the labels, made by ResNext 50



```
+-----+----------------------------------------+
|label|prediction                              |
+-----+----------------------------------------+
|frog |{n02128925, jaguar, 13.496078}          |
|bird |{n07714990, broccoli, 7.3184166}        |
|frog |{n01630670, common_newt, 8.448229}      |
|frog |{n01688243, frilled_lizard, 9.081802}   |
|deer |{n02129604, tiger, 9.687185}            |
|frog |{n02128385, leopard, 8.887554}          |
|bird |{n02492660, howler_monkey, 10.001827}   |
|frog |{n01688243, frilled_lizard, 12.0437355}|
|frog |{n13037406, gyromitra, 8.195}           |
|deer |{n02356798, fox_squirrel, 10.605209}    |
+-----+----------------------------------------+
only showing top 10 rows
```

Figure 15: Ten predictions, along with the labels, made by Wide ResNet 50

```
+-----+----------------------------------------+
|label|prediction                              |
+-----+----------------------------------------+
|frog |{n02128925, jaguar, 15.212853}          |
|bird |{n01443537, goldfish, 10.728087}        |
|frog |{n07760859, custard_apple, 12.752817}   |
|frog |{n02457408, three-toed_sloth, 12.623458}|
|deer |{n02090379, redbone, 8.531106}          |
|frog |{n02128925, jaguar, 11.006413}          |
|bird |{n02493793, spider_monkey, 12.954729}   |
|frog |{n01688243, frilled_lizard, 11.320785}  |
|frog |{n01990800, isopod, 10.630776}          |
|deer |{n02087046, toy_terrier, 9.972003}      |
+-----+----------------------------------------+
only showing top 10 rows
```

Figure 16: Ten predictions, along with the labels, made by MnasNet

After looking manually at the results, we conclude that the AlexNet model gives the best results.