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Course: CS4830 - Big Data Laboratory
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Lab-8 Assignment
Roll No.: ME18B183
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Problem 1
Modify the DL.ipynb code to run inference on CIFAR 10 dataset using Pyspark.

Solution:
The modified code is included in the zipped submission folder as *Lab8.ipynb*. Following is the classification predictions from the MobileNetV2 model:

```
+-----+----------------------------------------+
|label|prediction                              |
+-----+----------------------------------------+
|frog |{n02356798, fox_squirrel, 7.4729676}    |
|bird |{n02002724, black_stork, 8.031027}      |
|frog |{n01744401, rock_python, 9.125906}      |
|deer |{n02356798, fox_squirrel, 7.5615854}    |
|frog |{n02457408, three-toed_sloth, 8.139731}|
|frog |{n01756291, sidewinder, 6.910098}       |
|bird |{n02002724, black_stork, 6.929695}      |
|frog |{n03764736, milk_can, 9.065403}         |
|frog |{n01688243, frilled_lizard, 9.57504}    |
|frog |{n02119789, kit_fox, 10.592067}         |
|deer |{n02422106, hartebeest, 9.47988}        |
|bird |{n02606052, rock_beauty, 6.9106827}     |
|frog |{n02325366, wood_rabbit, 6.7301545}     |
|frog |{n01744401, rock_python, 7.9928703}     |
|frog |{n02356798, fox_squirrel, 10.709429}    |
|frog |{n02356798, fox_squirrel, 7.484116}     |
|frog |{n01744401, rock_python, 7.1383753}     |
|frog |{n02356798, fox_squirrel, 11.222729}    |
|frog |{n02356798, fox_squirrel, 8.981187}     |
|frog |{n01744401, rock_python, 7.793873}      |
+-----+----------------------------------------+
only showing top 20 rows
```

Figure 1: Prediction output of MobileNetV2 model.

Problem 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 CIFAR10 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).

Solution:
I have used the following pre-trained models: MobileNetV2, VGG16 and ResNet50 to run inference on CIFAR10 dataset.

label	prediction
frog	{n02356798, fox_squirrel, 7.4729676}
bird	{n02002724, black_stork, 8.031027}
frog	{n01744401, rock_python, 9.125906}
deer	{n02356798, fox_squirrel, 7.5615854}
frog	{n02457408, three-toed_sloth, 8.139731}
frog	{n01756291, sidewinder, 6.910098}
bird	{n02002724, black_stork, 6.929695}
frog	{n03764736, milk_can, 9.065403}
frog	{n01688243, frilled_lizard, 9.57504}
frog	{n02119789, kit_fox, 10.592067}
deer	{n02422106, hartebeest, 9.47988}
bird	{n02606052, rock_beauty, 6.9106827}
frog	{n02325366, wood_rabbit, 6.7301545}
frog	{n01744401, rock_python, 7.9928703}
frog	{n02356798, fox_squirrel, 10.709429}
frog	{n02356798, fox_squirrel, 7.484116}
frog	{n01744401, rock_python, 7.1383753}
frog	{n02356798, fox_squirrel, 11.222729}
frog	{n02356798, fox_squirrel, 8.981187}
frog	{n01744401, rock_python, 7.793873}

only showing top 20 rows

(a)

label	prediction
frog	{n02130308, cheetah, 8.439269}
bird	{n02002724, black_stork, 5.3798957}
frog	{n01744401, rock_python, 6.444077}
deer	{n02114712, red_wolf, 5.7382617}
frog	{n02129165, lion, 7.53472}
frog	{n02128925, jaguar, 5.393148}
bird	{n01873310, platypus, 4.491262}
frog	{n01688243, frilled_lizard, 6.8681555}
frog	{n02356798, fox_squirrel, 6.2243824}
frog	{n02114712, red_wolf, 8.19412}
deer	{n02356798, fox_squirrel, 9.399976}
bird	{n07248320, book_jacket, 4.6766686}
frog	{n02356798, fox_squirrel, 6.3912754}
frog	{n03447721, gong, 6.701816}
frog	{n02115913, dhole, 8.544827}
frog	{n02356798, fox_squirrel, 5.97714}
frog	{n02128385, leopard, 6.434851}
frog	{n02115913, dhole, 7.0508432}
frog	{n02356798, fox_squirrel, 7.0748363}
frog	{n02013706, limpkin, 6.339068}

only showing top 20 rows

(b)

label	prediction
frog	{n02130308, cheetah, 10.426459}
bird	{n01443537, goldfish, 6.834964}
frog	{n01496331, electric_ray, 7.9641924}
deer	{n04525038, velvet, 7.9794655}
frog	{n01688243, frilled_lizard, 7.3185043}
frog	{n01496331, electric_ray, 7.7286572}
bird	{n02356798, fox_squirrel, 5.2075057}
frog	{n02356798, fox_squirrel, 8.57772}
frog	{n01644900, tailed_frog, 7.5442767}
frog	{n02129165, lion, 9.034145}
deer	{n02115913, dhole, 10.55313}
bird	{n02356798, fox_squirrel, 10.846921}
frog	{n02356798, fox_squirrel, 9.478152}
frog	{n01644900, tailed_frog, 10.755041}
frog	{n02356798, fox_squirrel, 10.489262}
frog	{n02356798, fox_squirrel, 8.230193}
frog	{n02002724, black_stork, 6.467869}
frog	{n02356798, fox_squirrel, 8.548313}
frog	{n02129165, lion, 6.934937}
frog	{n02119789, kit_fox, 6.5690036}

only showing top 20 rows

(c)

Figure 2: Predictions by (a) MobileNetV2; (b) VGG16; (c) ResNet50

We can see that the models used by us predict way different labels than the actual labels. This owes to the fact that these models were trained on the ImageNet dataset, which had different classes than what we have in CIFAR10 dataset. From Fig. 2 we infer that amongst all three models, **ResNet50** produces the best predictions. This argument can be backed by checking the prediction for 16^{th} data entry, whose actual label is 'frog' and the closest prediction is 'tailed_frog' made by ResNet50 model.

∗∗ End of Assignment ∗∗