ASSIGNMENT-1 REPORT

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Contents

1 Part-A

1.1 Number of Convolutional Layers

The accuracy increases from 3 to 4 layers and from then it starts decreasing due to overfitting.

No.of Layers	Training Loss after 40 epochs	Test Accuracy
3	1.178	49.90%
4	0.510	56.93%
5	0.105	42.21%

1.2 Number of Fully Connected Layers

The accuracy decreases with increase in the number of linear layers due to increase in time for convergence.

Linear Layers	Training Loss after 40 epochs	Test Accuracy
1	1.083	56.24%
2	1.125	53.42%
3	1.178	49.90%
4	1.402	46.45%

1.3 Number of Filters

The accuracy increases with increase in the number of filters as more number of features get captured.

Filters in each layer	Training Loss for 40 epochs	Test Accuracy
64,128,256	1.278	49.75%
64,256,256	1.178	49.90%
64,256,512	1.206	51.54%

1.4 Kernel Size for Max-Pooling

The accuracy increases with increase in the size of kernel as the larger kernel can capture more information locally.

Kernel Size	Training Loss after 40 epochs	Test Accuracy
2	1.178	49.90%
3	0.837	53.76%
4	0.672	55.60%

1.5 Training Time

With the increase in the number of epochs,the test accuracy increases upto a certain number of epochs and from then it starts decreasing due to over-fitting.But the loss function decreases with the number of epochs.

Epochs	Training Loss	Validation Accuracy
5	2.862	17.78%
10	2.488	30.12%
15	2.199	35.45%
20	1.96	40.42%
25	1.755	42.90%
30	1.571	48.39%
35	1.385	49.57%
37	1.321	51.36%
40	1.22	49.81%

1.6 Stride

There is a decrease in the accuracy of the test dataset with the increase in the stride because larger strides capture less amount of local information.

Stride	Training Loss	Test Accuracy
2	1.178	49.90%
3	0.046	42.06%
4	0.123	29.36%
5	0.002	36.79%

2 Part-B

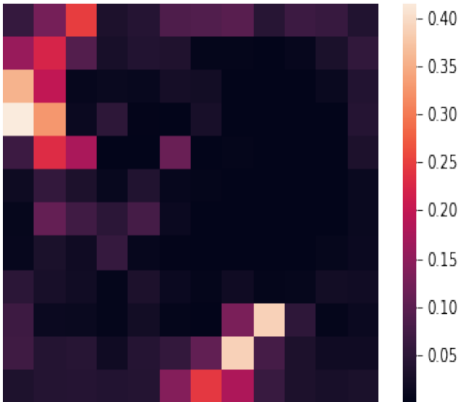## 2.1 Occlusion Sensitivity Experiment

2.1.1 Confidence Plots
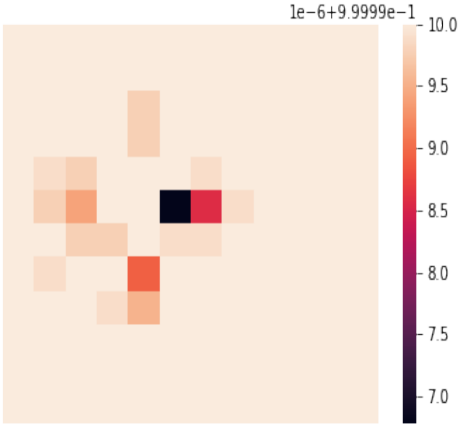
Image	Heat-Map
Lion	
Green-Mamba	
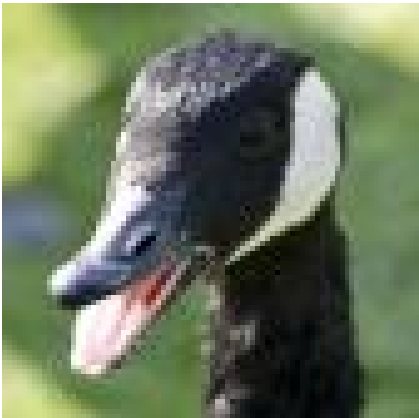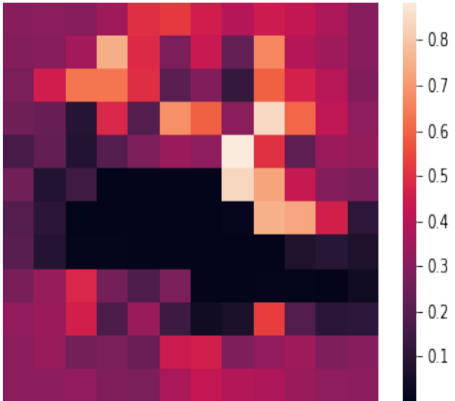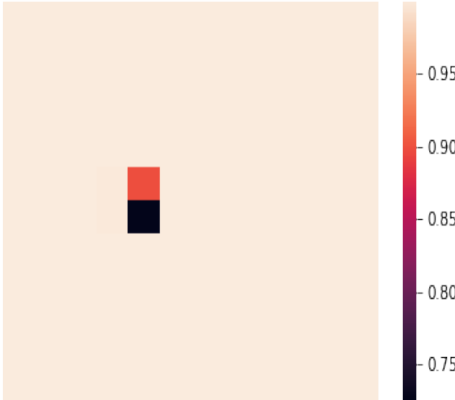
Image	Heat-Map
Goose	
Catamaran	
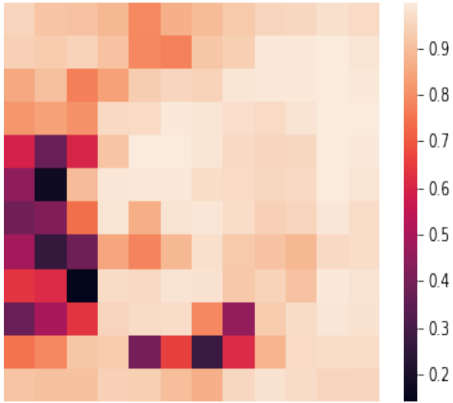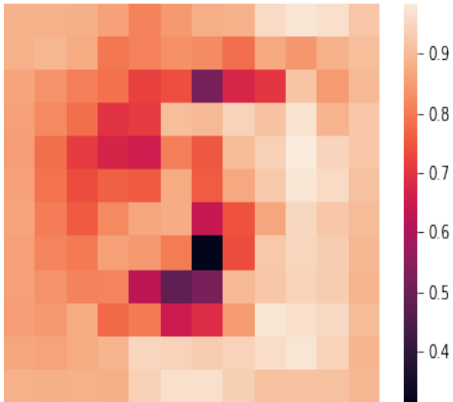
Image	Heat-Map
Toucan	
Coral Reef	
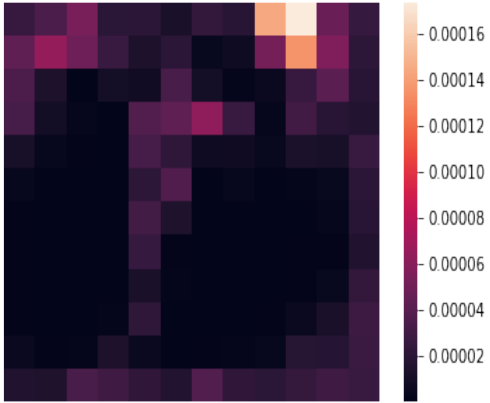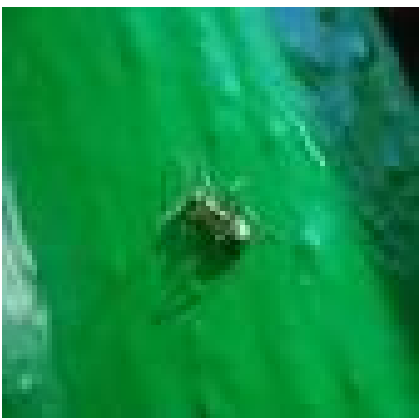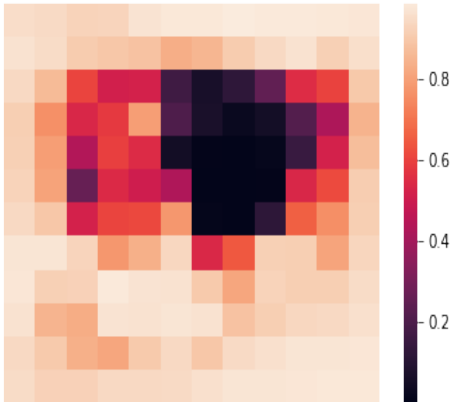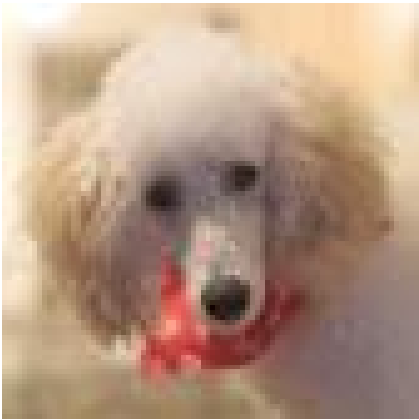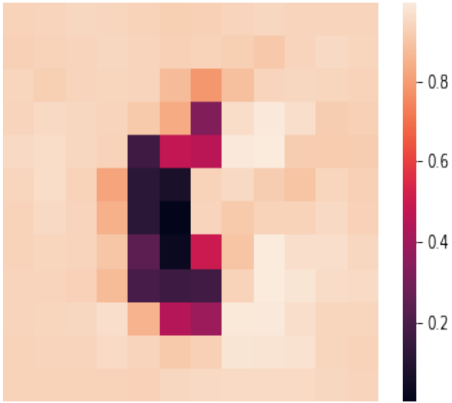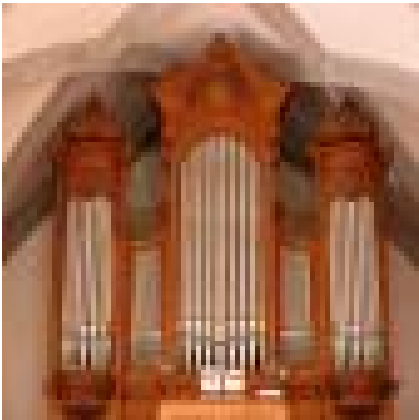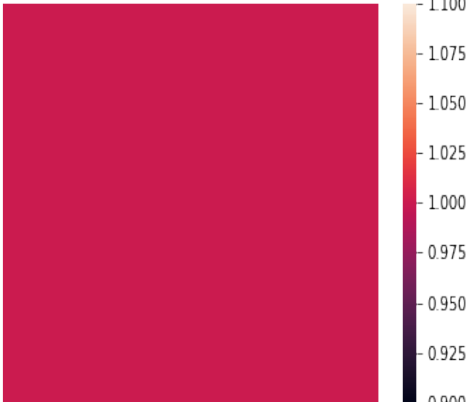
Image	Heat-Map
Spider Web	
Ant	

Image	Heat-Map
Poodle	
Organ	

2.1.2 Observations

1. For this experiment,I used a filter size of 7×7 i.e., total 144 patches for each image.

2. The model is easily able to classify lion from its body and face.

3. Since,the spider web is faint it becomes very difficult for the model to recognize it when there is patch.

4. For ant,the problem arrives when the part of body is covered with patches.

5. In case of coral reef,the central part is key to identify the reef and when covered it gives very less accuracy.

6. For organ,the model recognizes multiple parts and hence covering any of the parts does not matter much.

7. For green-mamba image,the model cannot identify the parts and hence accuracy is very low.

8. For poodle,the patch consisting of nose and eyes plays an important role.

9. For goose,the model is not that accurate.
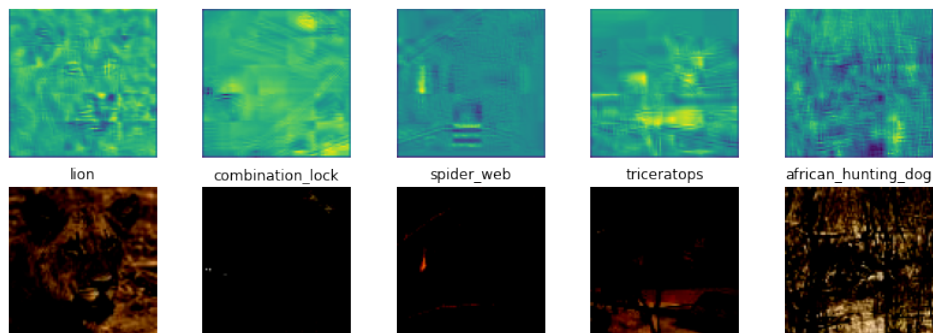
2.2 Filters

2.2.1 Filter Identification

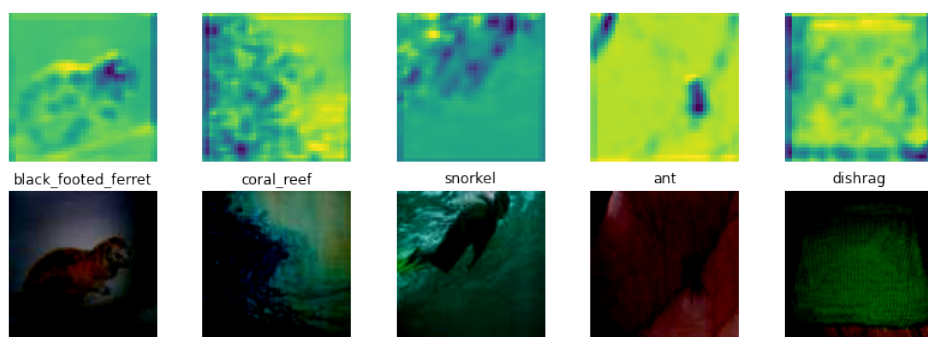
Figure 1: Layer-1 Filter-44

Figure 2: Layer-1 Filter-45

black_footed_ferret   coral_reef   snorkel   ant   dishrag

Figure 3: Layer-2 Filter-37

ant   goose   lipstick   black_footed_ferret   spider_web
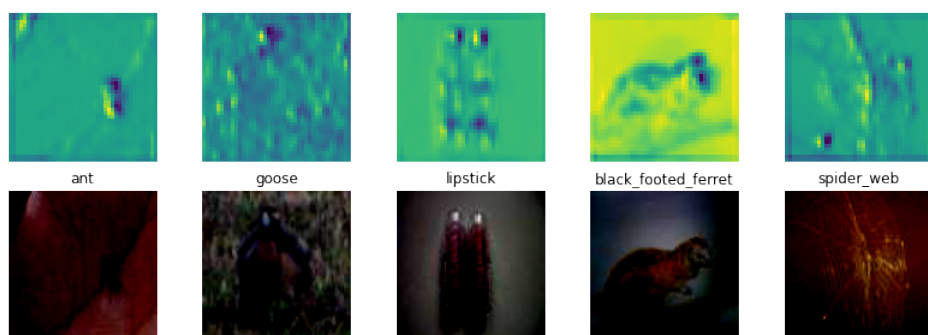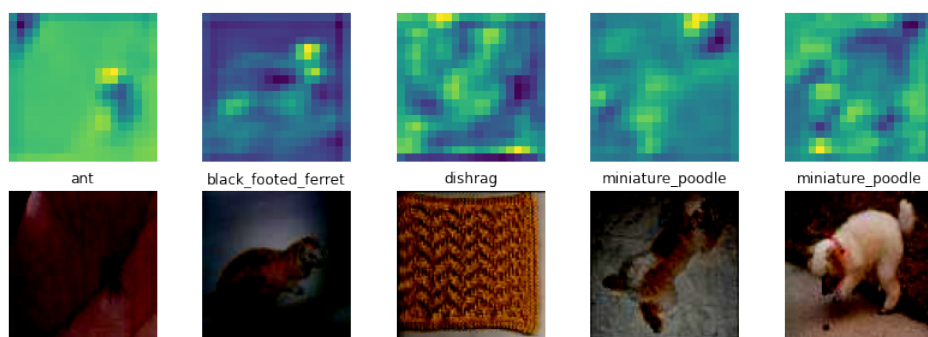
Figure 4: Layer-2 Filter-117

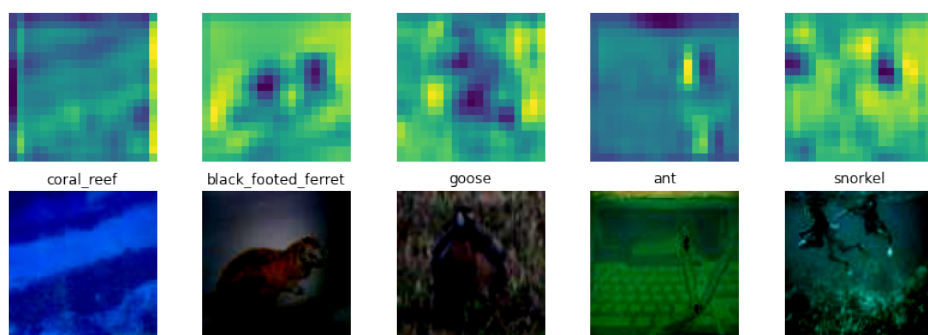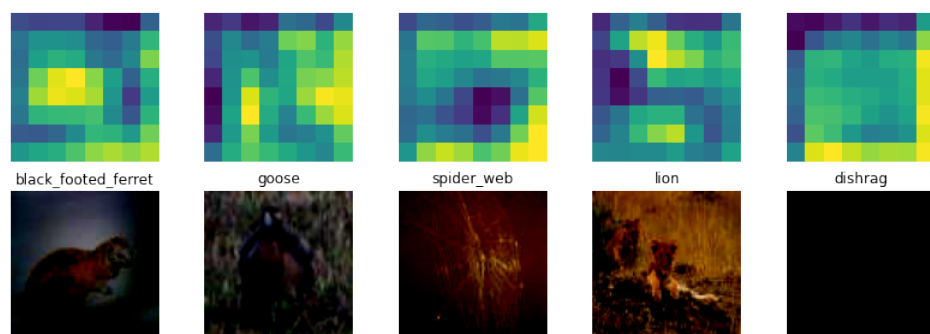Figure 5: Layer-3 Filter-209

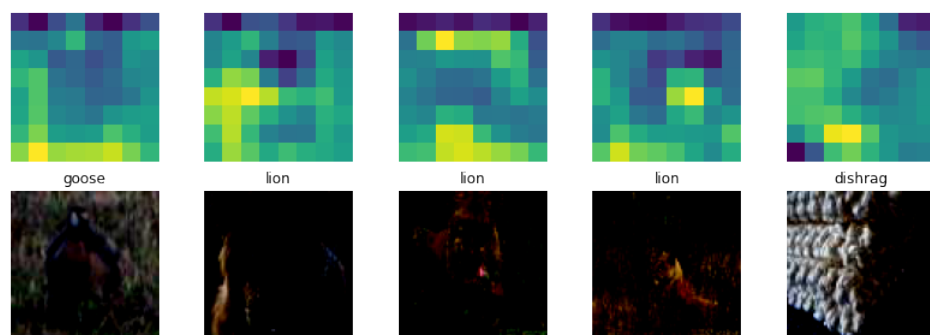

Figure 6: Layer-3 Filter-254

Figure 7: Layer-4 Filter-62

Figure 8: Layer-4 Filter-227

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2.2.2   Filter Modification

In my case on turning off these filters,the accuracy of **catamaran,toucan,lion, slot,parallel bars** decreased significantly.

3 Best Model

3.1 Architecture

Listing 1: Architecture Of Network

```
Net (
  (conv1): Conv2d(3, 64, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (conv2): Conv2d(64, 128, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (conv3): Conv2d(128, 256, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (conv4): Conv2d(256, 256, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
  (pool): MaxPool2d(kernel_size=4, stride=2, padding=0, dilation=1, ceil_mode=False)
  (fc1): Linear(in_features=256, out_features=33, bias=True)
)
```

3.2 Hyper-Parameters Used

Parameter	Value
Accuracy on Test Dataset	63.81%
Fully Connected Layers	1
Convolutional Layers	4
Epochs	40
Stride	2
Kernel Size for Max Pooling	4
Training Loss	0.003
Learning Rate	0.001
Optimizer	Adam
Momentum	0.9
Weight Decay	5×10^{-4}