Neural Networks and Deep Learning Project Report: [CIFAR-100 Image Classification]

Deya Hazra, 12021002016055(37)

November 25, 2023

Dataset Chosen: Cifar-100

Objective:

The objective of this project is to develop a convolutional neural network (CNN) for image classification. The CNN will be trained on a large dataset of images and will be able to classify new images into one of a predefined set of categories

CNN Architecture:

Layer	Type	Output Shape
conv2d_2	Conv2D	(None, 32, 32, 128)
conv2d_3	Conv2D	(None, 32, 32, 128)
max_pooling2d	MaxPooling2D	(None, 16, 16, 128)
dropout	Dropout	(None, 16, 16, 128)
conv2d_4	Conv2D	(None, 16, 16, 256)
conv2d_5	Conv2D	(None, 16, 16, 256)
max_pooling2d_1	MaxPooling2D	(None, 8, 8, 256)
dropout_1	Dropout	(None, 8, 8, 256)
conv2d_6	Conv2D	(None, 8, 8, 512)
conv2d_7	Conv2D	(None, 8, 8, 512)
max_pooling2d_2	MaxPooling2D	(None, 4, 4, 512)
dropout_2	Dropout	(None, 4, 4, 512)
flatten	Flatten	(None, 8192)
dense	Dense	(None, 1000)
dropout_3	Dropout	(None, 1000)
dense_1	Dense	(None, 1000)
dropout_4	Dropout	(None, 1000)
dense_2	Dense	(None, 100)

I have also used **Data Augmentation** to artificially increase the size of a training dataset

by creating new training examples from existing ones. This has helped me to increase the accuracy of the result.

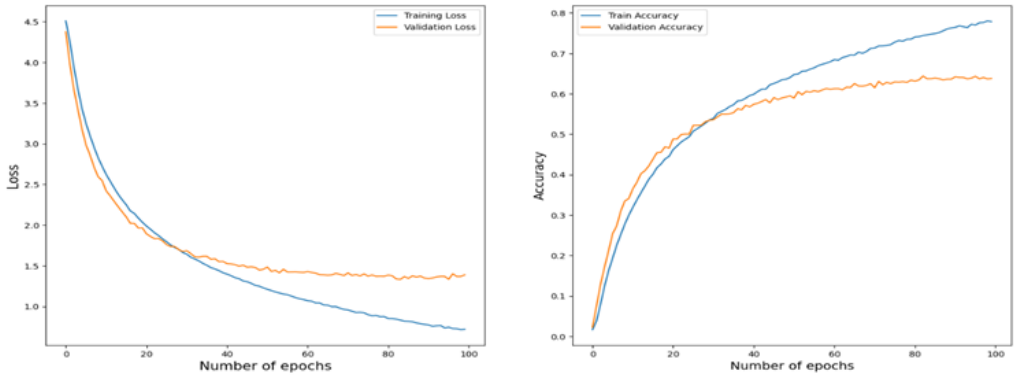
Results:

Validation Accuracy: 63.82 %

Test Accuracy: 63.84 %

Validation Loss: 1.38

Test Loss: 1.38

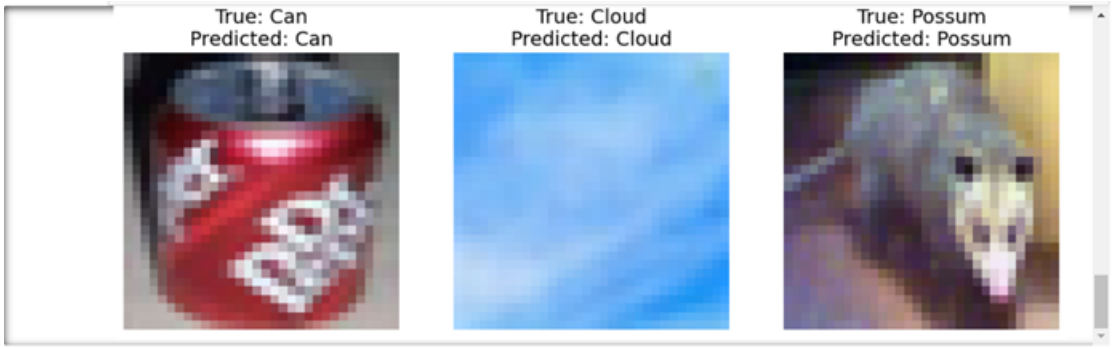


Glimpse of prediction scores in each class:

```
313/313 [==============================] - 4s 13ms/step
              precision    recall  f1-score   support

  Category 0       0.89      0.71      0.79       100
  Category 1       0.66      0.73      0.69       100
  Category 2       0.41      0.42      0.42       100
  Category 3       0.52      0.16      0.24       100
  Category 4       0.52      0.13      0.21       100
  Category 5       0.36      0.51      0.42       100
  Category 6       0.57      0.59      0.58       100
  Category 7       0.63      0.41      0.50       100
  Category 8       0.72      0.76      0.74       100
  Category 9       0.71      0.65      0.68       100
 Category 10       0.62      0.31      0.41       100
 Category 11       0.48      0.24      0.32       100
 Category 12       0.68      0.51      0.58       100
 Category 13       0.63      0.56      0.59       100
 Category 14       0.57      0.44      0.50       100
 Category 15       0.50      0.56      0.53       100
```

Sampled Outputs



Conclusion

This project has successfully developed a (CNN) for image classification trained on Cifar-100 and was able to achieve an accuracy of 63.84%. This is a good result, given the complexity of the task. The CNN was able to correctly classify a wide variety of images, including animals, objects, and scenes. The project also investigated the use of data augmentation to improve the performance of the CNN.