Image Recognition

Course Name:
Machine learning 1(Spring 2022)
Group Name:
Group2
Group members:
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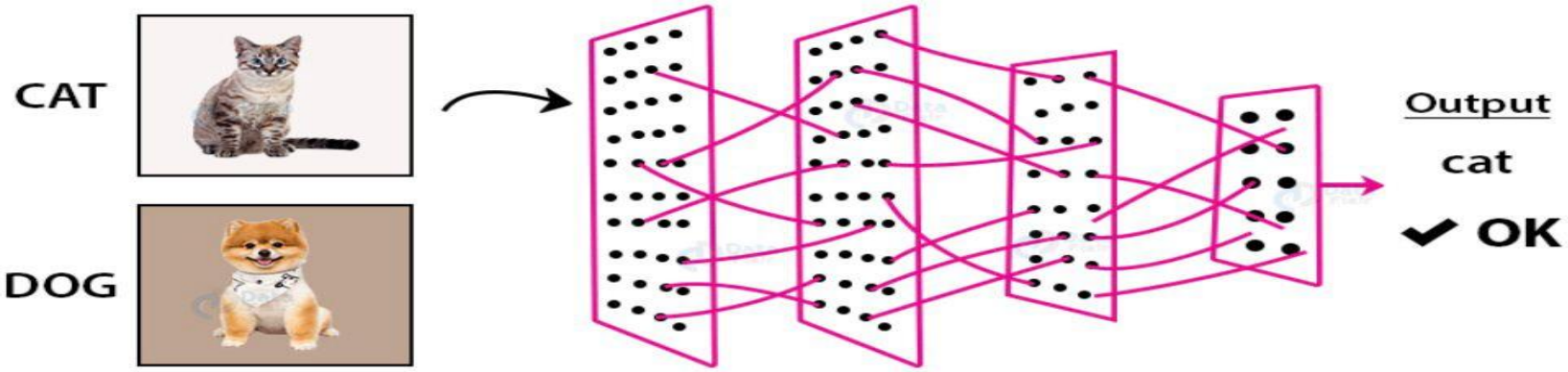


Introduction

- Dataset
- Convolutional Neural Network
- Models
- Results

Dataset

This is the built in dataset='https://www.tensorflow.org/datasets/catalog/stl10' which is an image recognition dataset for developing algorithms. Each class has some labeled training and test examples and unlabelled examples as well, but we are not using the unlabeled ones as we are focusing on the supervised learning.

The Dataset is separated into the train, validation and test.

Total Number of Samples	13000
Train	3500
Validation	1500
Test	8000

Target Labels: 'airplane', 'bird', 'car', 'cat', 'deer', 'dog', 'horse', 'monkey', 'ship', 'truck'

Image Samples

Train

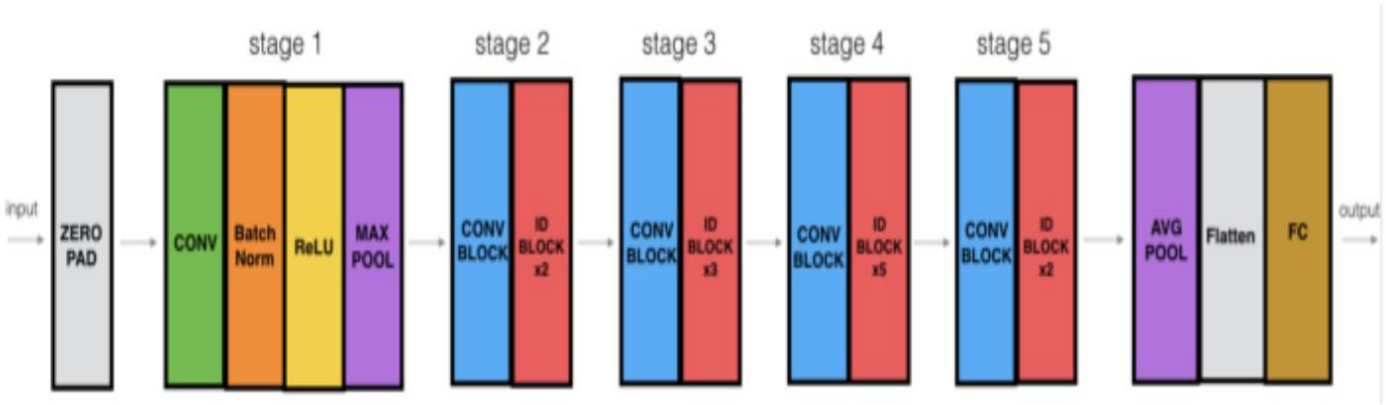
Validation

Test

CNN Basic Architecture

- Convolutional neural networks (CNNs) are deep neural network that have the capability to classify and segment images.
- CNNs can be trained using supervised or unsupervised machine learning methods, depending on what you want them to do.
- CNN architectures for classification and segmentation include a variety of different layers with specific purposes, such as a convolutional layer, pooling layer, fully connected layers, dropout layers, etc.

ResNet-50


stage 1
stage 2
stage 3
stage 4
stage 5
input
ZERO PAD
CONV
Batch Norm
ReLU
MAX POOL
CONV BLOCK
ID BLOCK x2
CONV BLOCK
ID BLOCK x3
CONV BLOCK
ID BLOCK x5
CONV BLOCK
ID BLOCK x2
AVG POOL
Flatten
FC
output

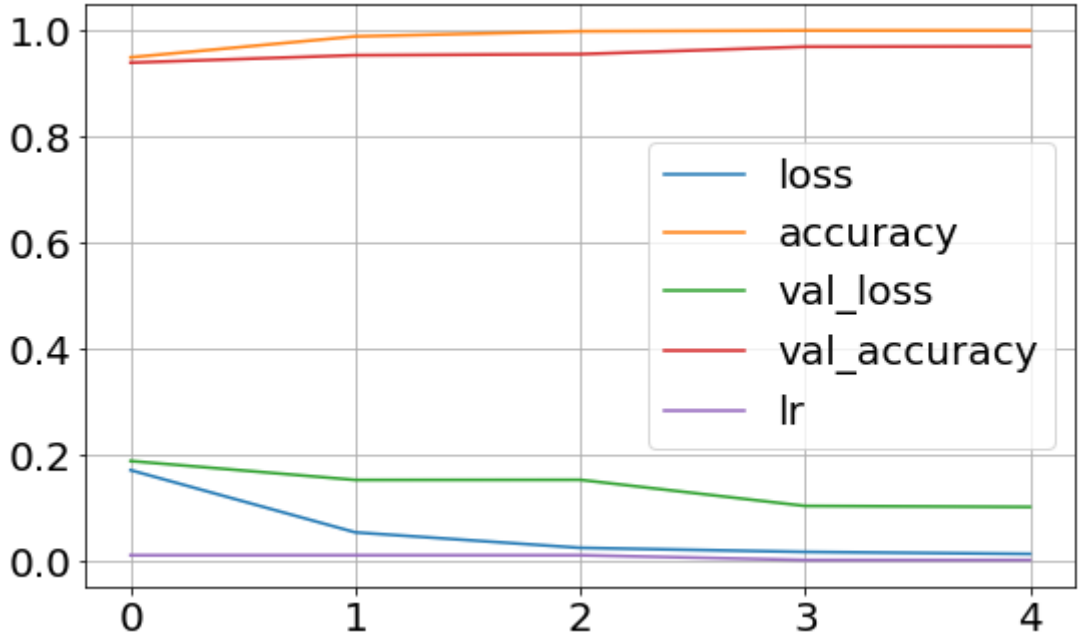
Models and Results

Model	Network	Optimizer	Accuracy	Loss
Model 1:	ResNet50	Adam optimizer (learning rate=1e-4)	88.20%	0.277
Model 2:	ResNet50	SGD optimizer (decay=1e-4)	96.03%	0.1234
Model 3:	ResNet50	SGD optimizer (decay=3e-4)	96.71%	0.1035
Model 4:	ResNet50	Adam optimizer(learning rate= 1e-3)	96.4%	0.1117

➔ Model 3 has the highest accuracy score

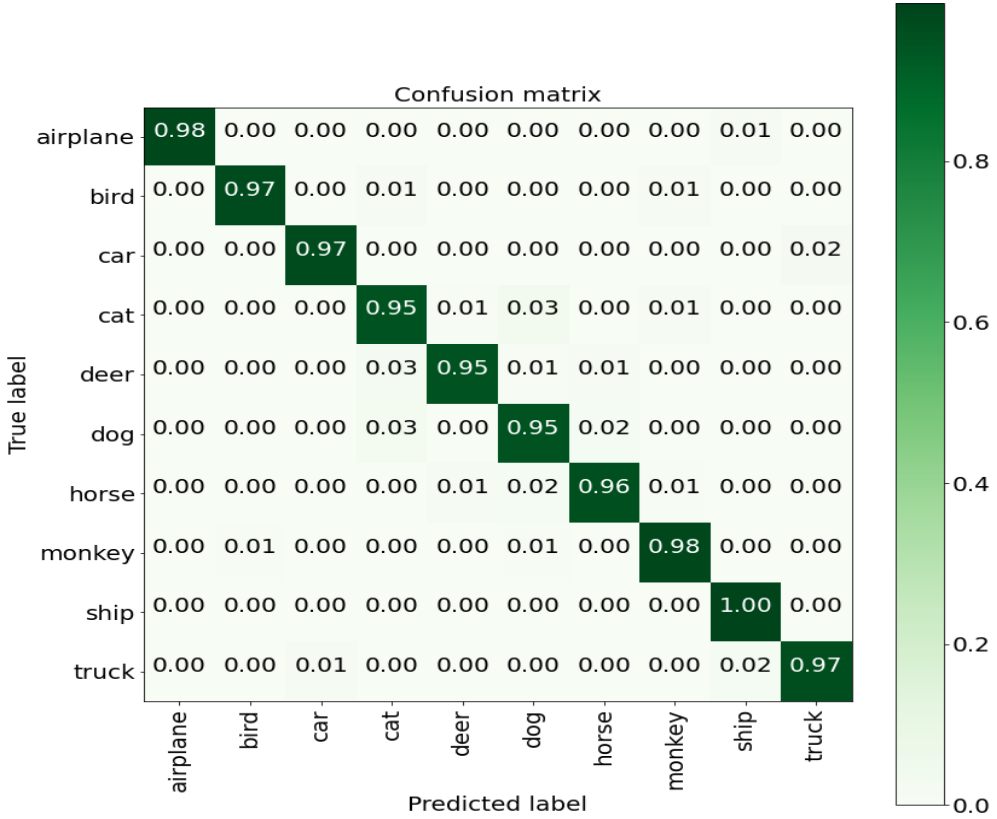
Models & Results

Final model learning curve:



Confusion Matrix

- Overall the model can detect objects very accurately
- Model is best at detecting ship
- Cat, deer and dog has the lowest accuracy



Conclusion

Final Model:

- 96.7% accuracy on CNN-ResNet50 with Stochastic Gradient Descent Optimizer and decay rate 3e-4

Use of our model:

- Detect animals and reduce self driving car accidents on suburban highways
- Create drone to identify animals in nature/forests
- Detect ships in marine transportation system

Future Work:

- Perform unsupervised learning with the unlabelled data

References

- Pictures https://becominghuman.ai/building-an-image-classifier-using-deep-learning-in-python-totally-from-a-beginners-perspective-be8dbaf22dd8?gi=f6870d48e6b6
- CNN Architecture https://vitalflux.com/cnn-basic-architecture-for-classification-segmentation/#:~:text=The%20CNN%20architecture%20for%20classification%20includes%20convolutional%20layers%2C,detection%2C%20max-pooling%20layers%20are%20meant%20for%20feature%20selection
- Resnet-50 https://machinelearningknowledge.ai/keras-implementation-of-resnet-50-architecture-from-scratch/#:~:text=The%20ResNet-50%20model%20consists%20of%205%20stages%20each,The%20ResNet-50%20has%20over%2023%20million%20trainable%20parameters.