Classification of Bird Species

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Problem Statement

- Numan Bird Watch needs a robust model which can identify and classify various species of birds
- Model must be able to be trained on new data

Predicting Birds using Machine Learning

HOW CAN MACHINE LEARNING HELP PREDICT DIFFERENT SPECIES OF BIRDS?

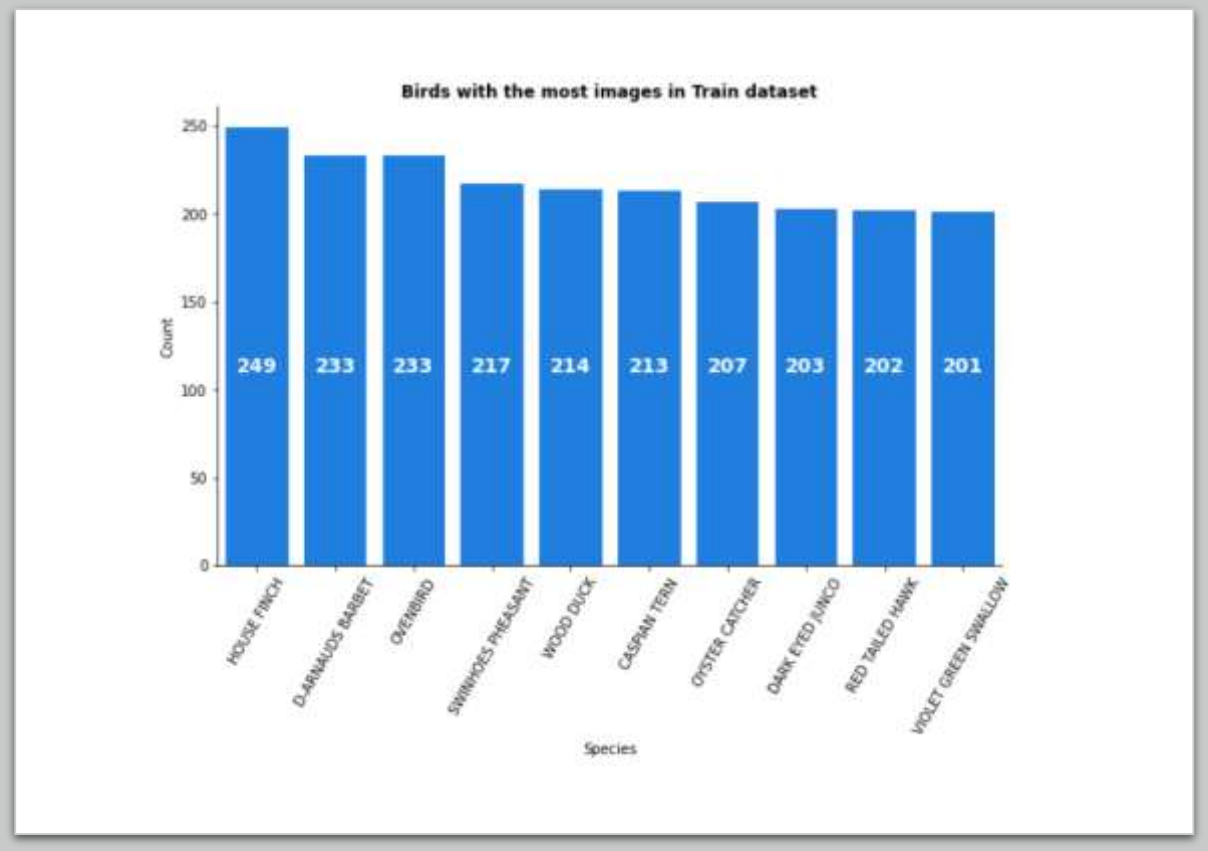
NEURAL NETWORKS

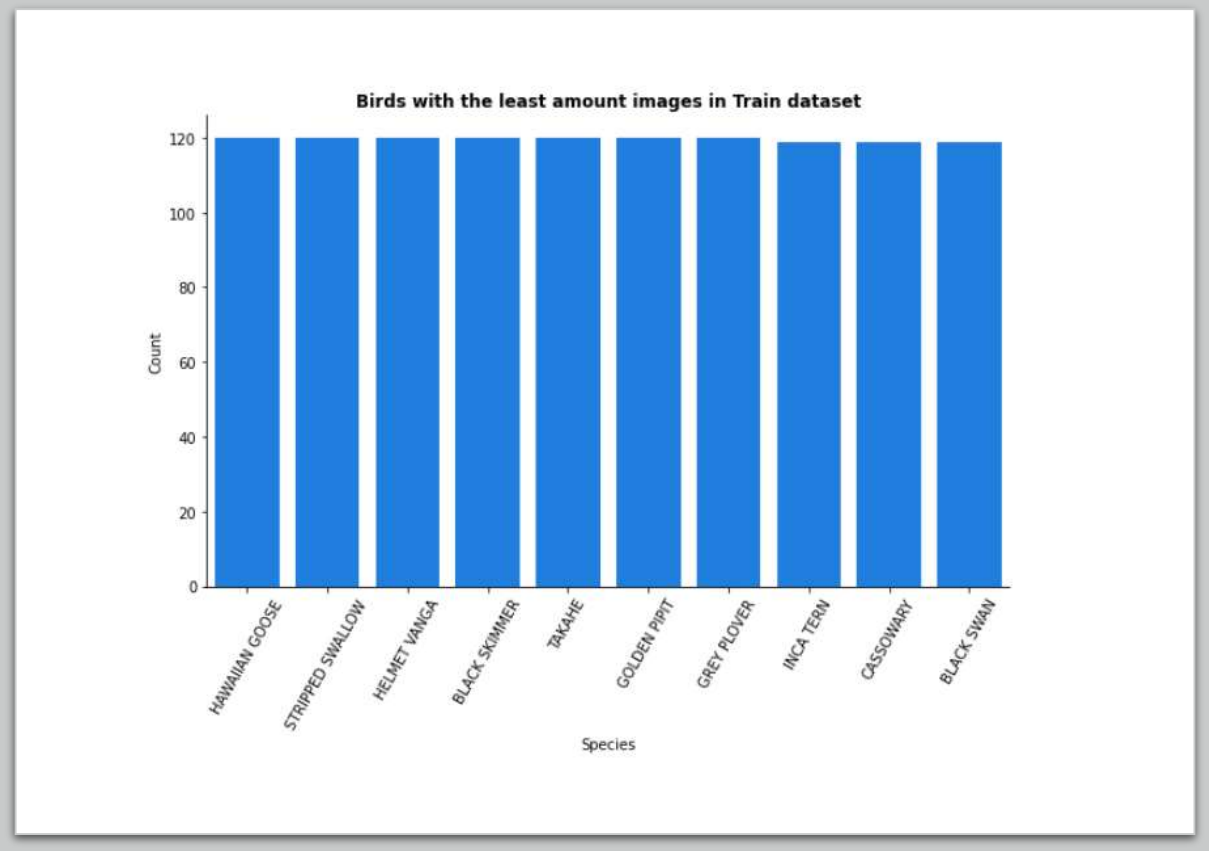
Dataset

- Data set consist of 45980 training, 1575 validating, and 1575 testing images
- Each image is 224X224X3 in JPG
- Data is clean with no anomalies and duplicates
- Data set consist of 315 different species of birds

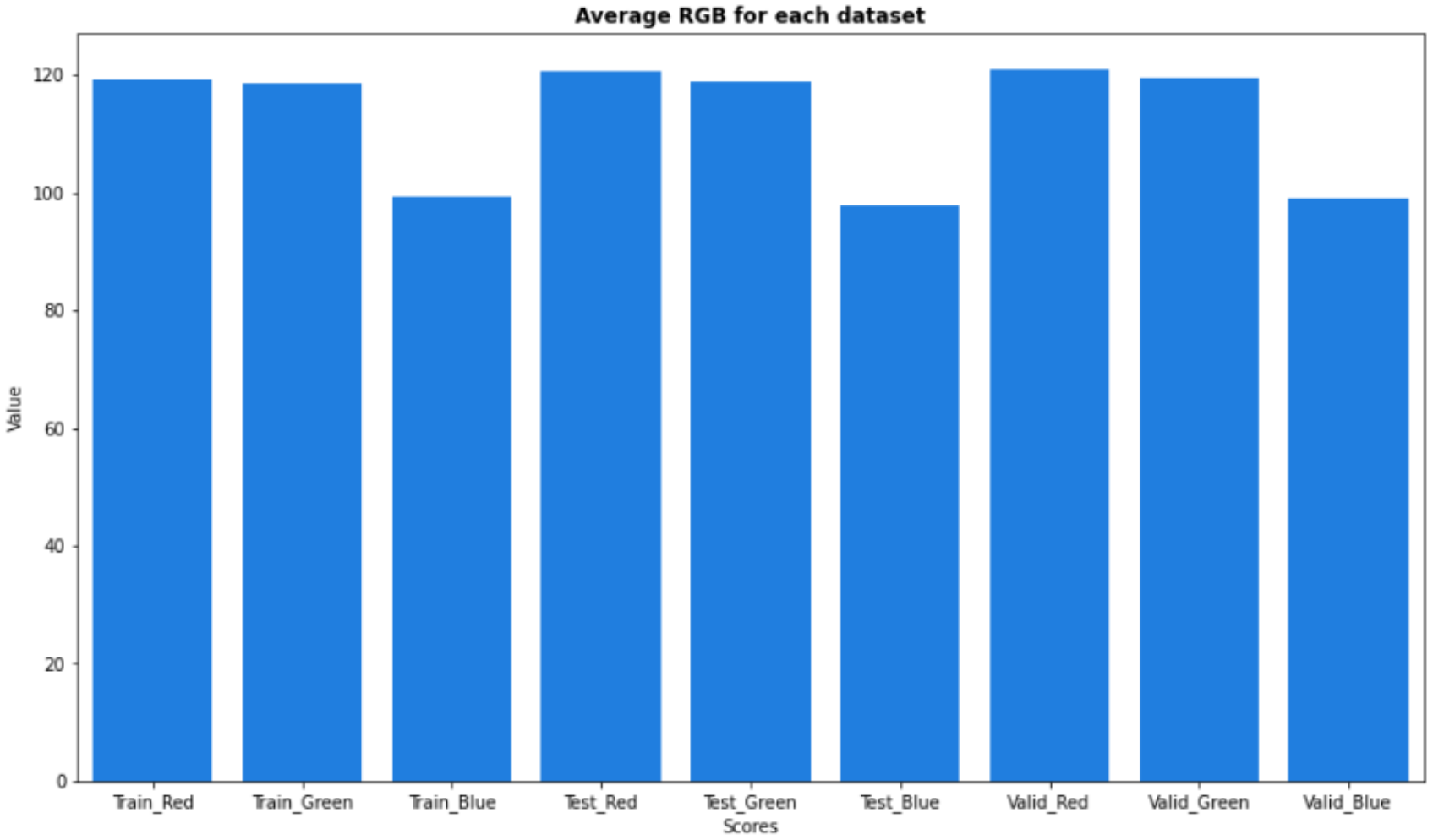
Distribution of birds

- Testing and validating set has equal number of images per bird species which is 5
- Minimum number of images for any given specie is 120





RGB Distribution



Word Cloud


NORTHERN
RED
BLACK
WARBLER
PHEASANT
FINCH
DUCK
AMERICAN
KINGFISHER
BEARDED
THROATED
EASTERN
BLUE
SWALLOW TAILED
SPARROW
OWL
CROWNED
PURPLE
CRESTED
SCARLET
COMMON
GOLDEN
WHITE
MAGPIE
GREEN
WOODPECKER
IBIS
YELLOW

Preprocessing

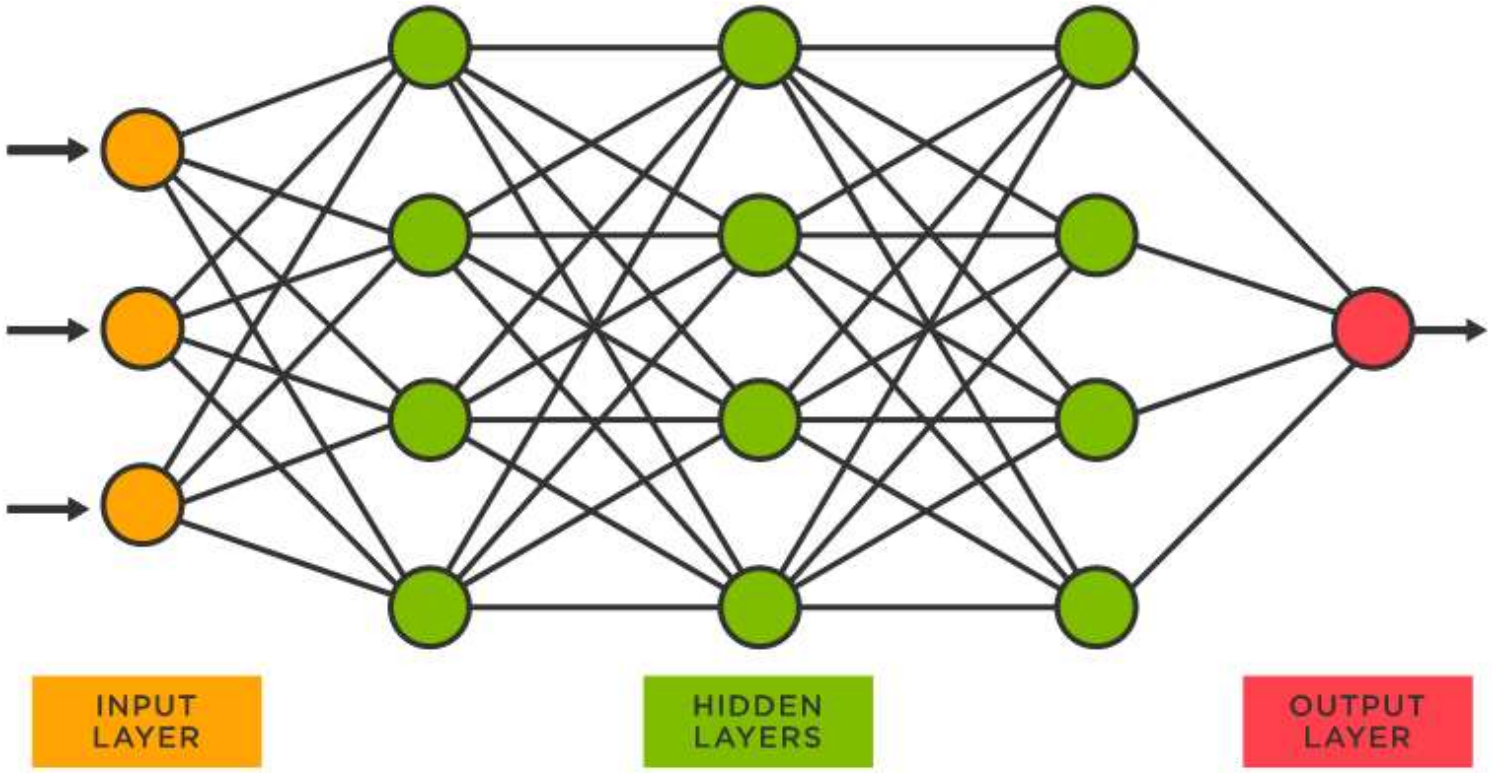
01

Rescaling data from 224x224 to 56x56

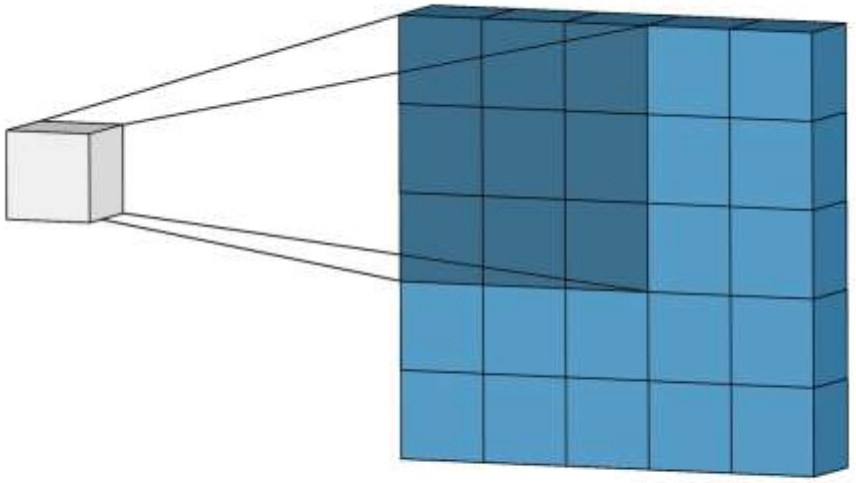
02

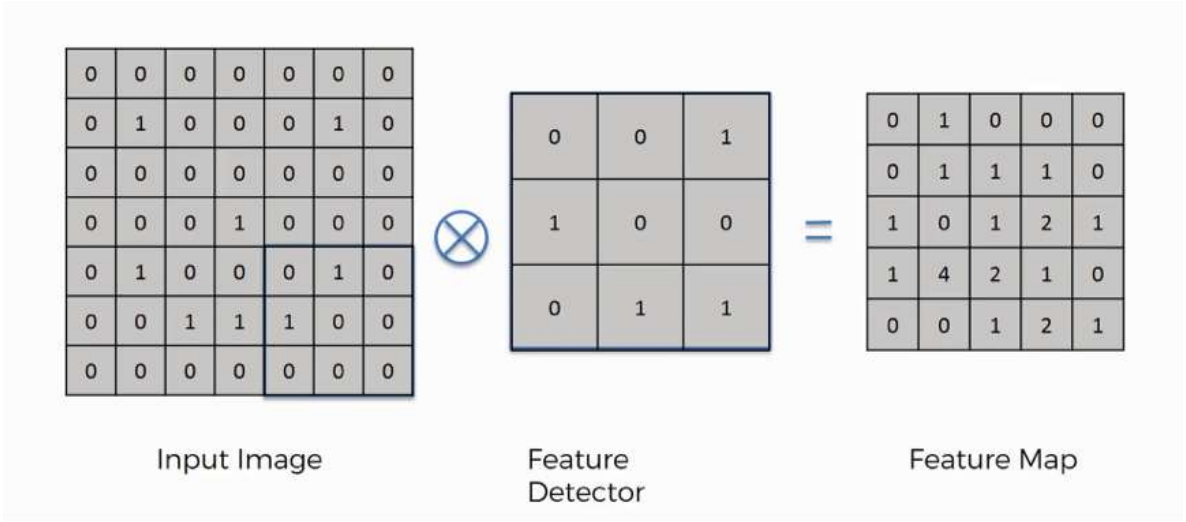
Normalizing data to have a mean of 0

Neural Networks



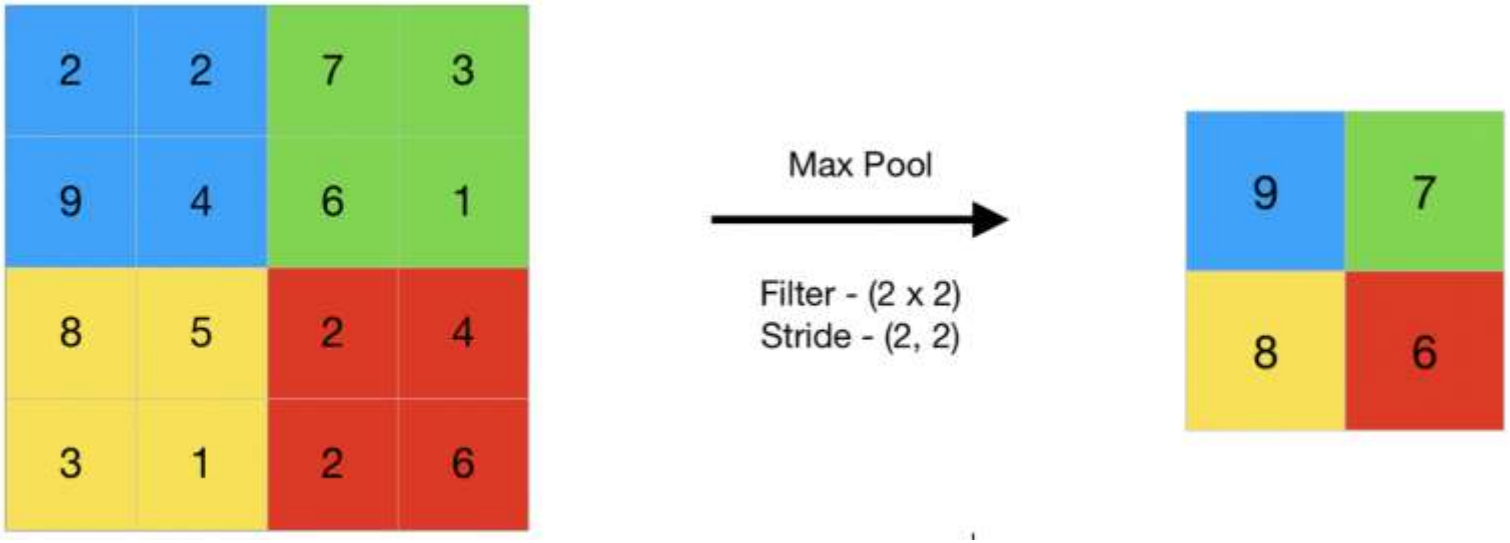
Convolutional Neural Network



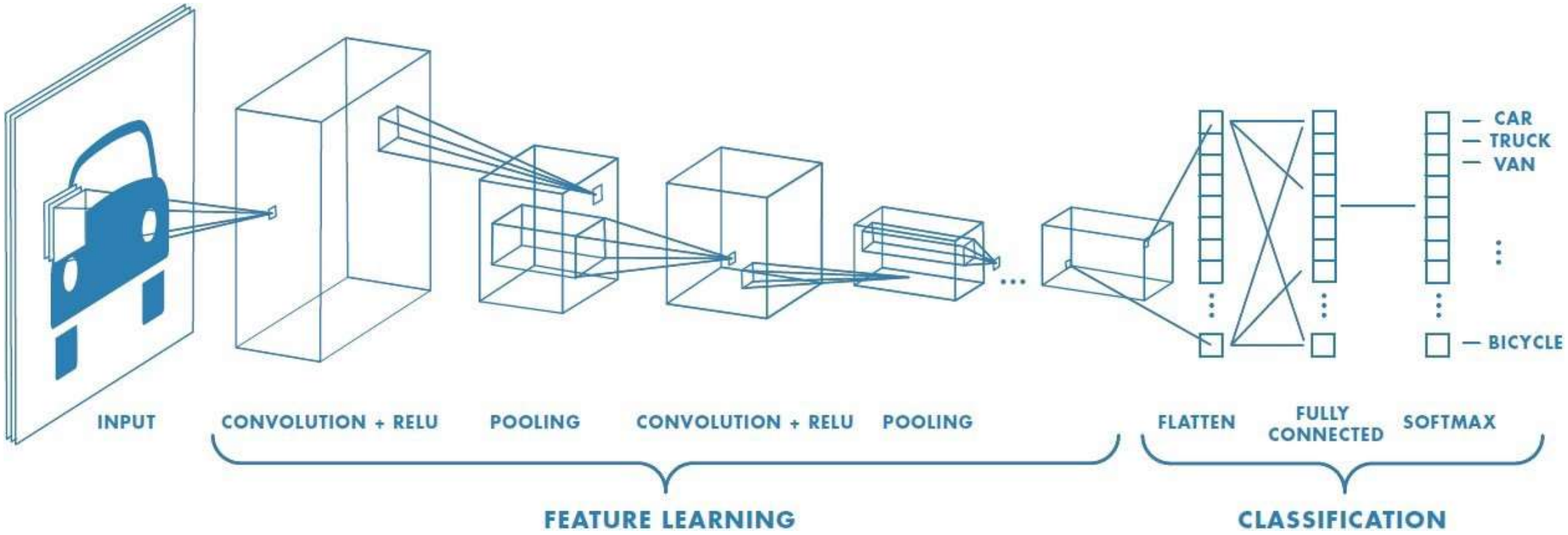


Max Pooling

- Allows for less computation needed for training
- Highlights the most important features



Fully Connected CNN



Sequential Model

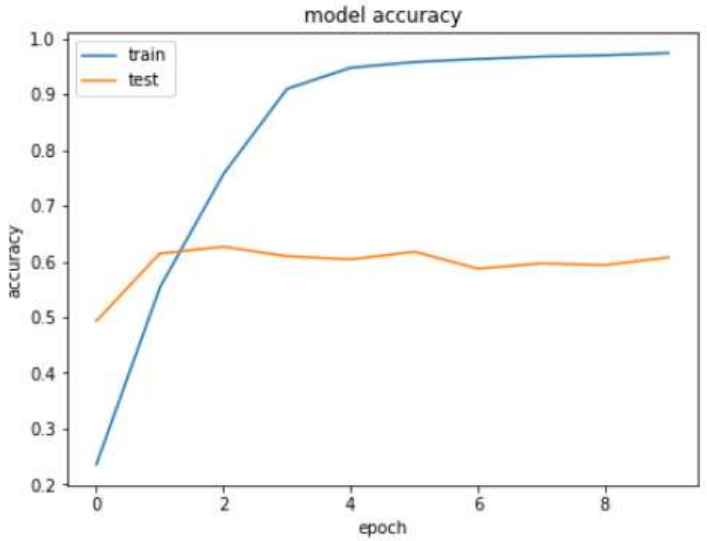
- Sequential Model allows to create models layer by layer
- Conv2D
  - Filters
  - Kernel Size
  - Strides

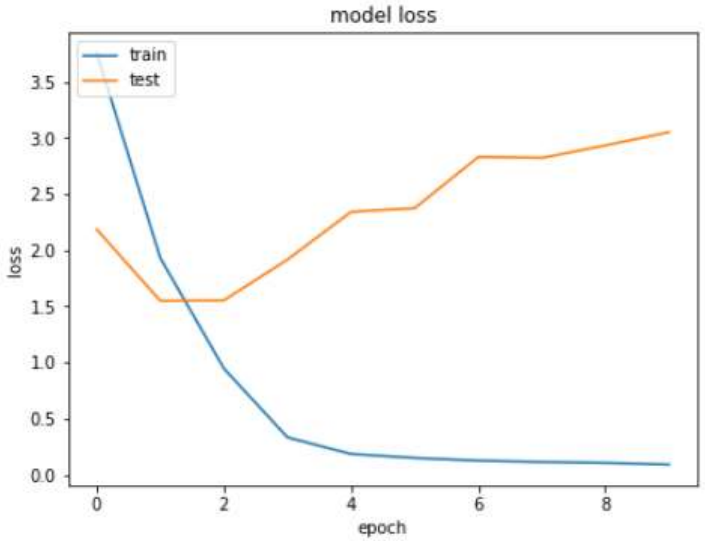
Sequential Model

- MaxPool2D
- Flatten
- Dense
- Dropout
- Optimizer
- Loss
- Metric
- Epoch

Basic Model

60% Accuracy rate





Hyperparameter Tuning

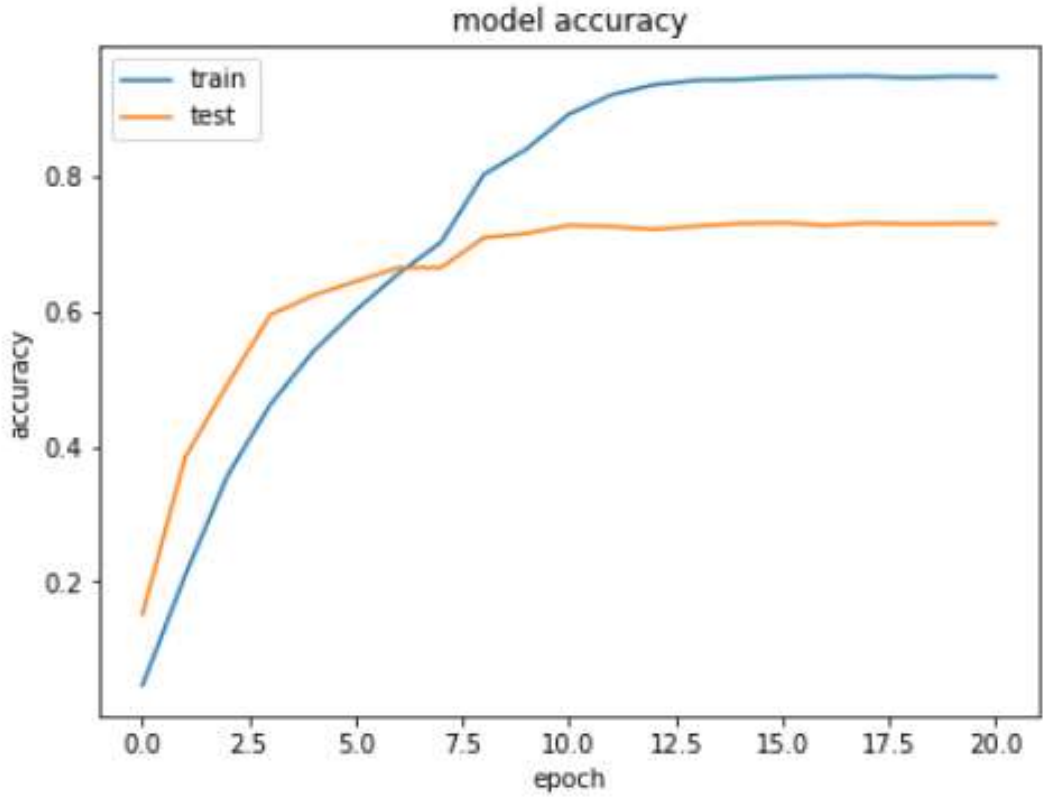
RandomSearch

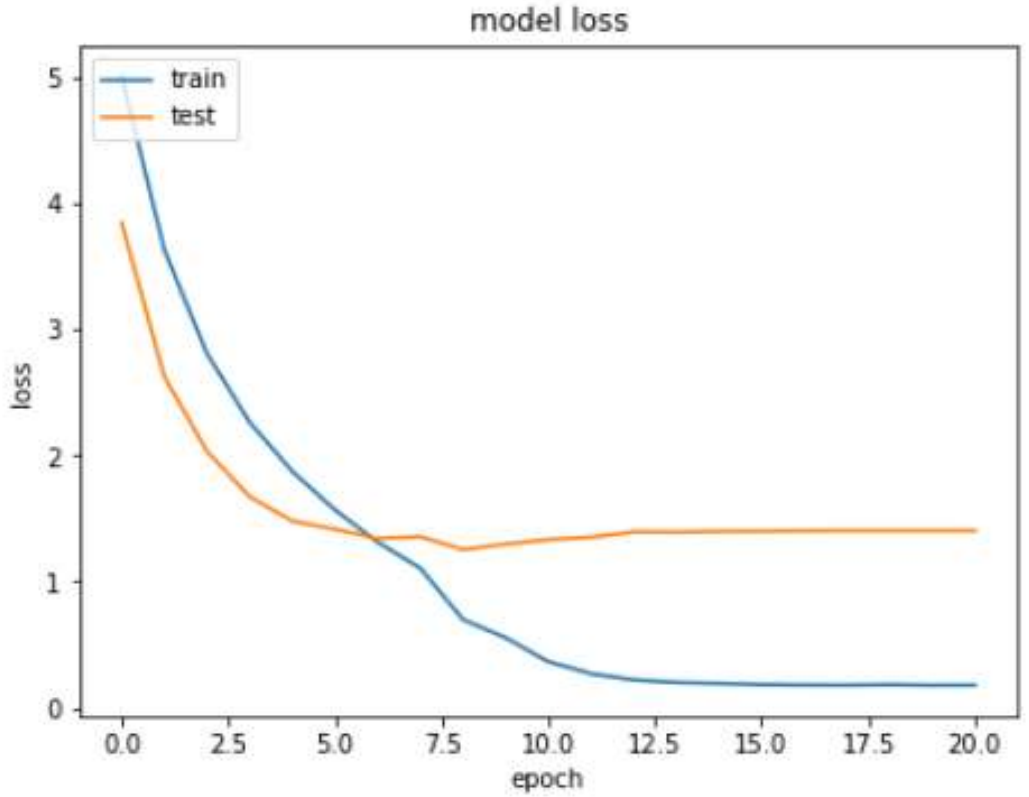
Hyperband

Bayesian Optimization

Best Model without Transfer Learning

- After Tuning achieved 73.2% accuracy score





Transfer Learning

- Transfer learning is using past models knowledge to increase the learningcapabilities of new models. Pre-Trained models are models created by someoneor others to solve a similar problem but rather than building a model fromscratch you utilize and tweak their already built model to your own problem.

Freezing/Unfreezing Layers

Save time training models

Avoid re-learning early steps like detecting edges and lines

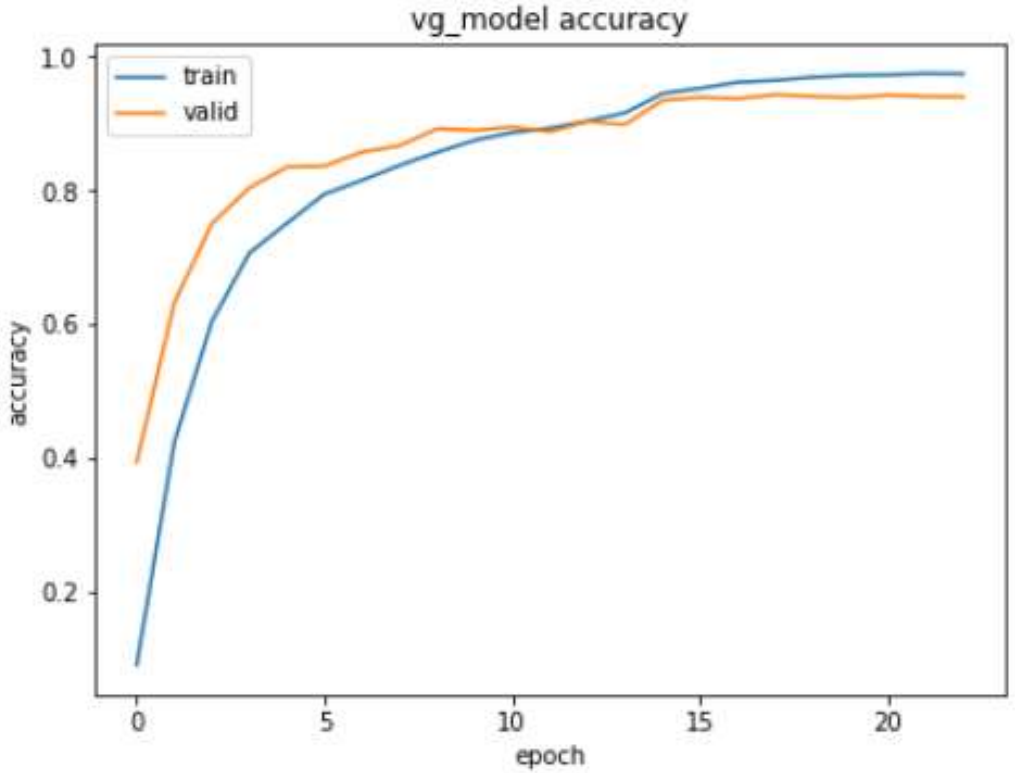
Pre-trained Models

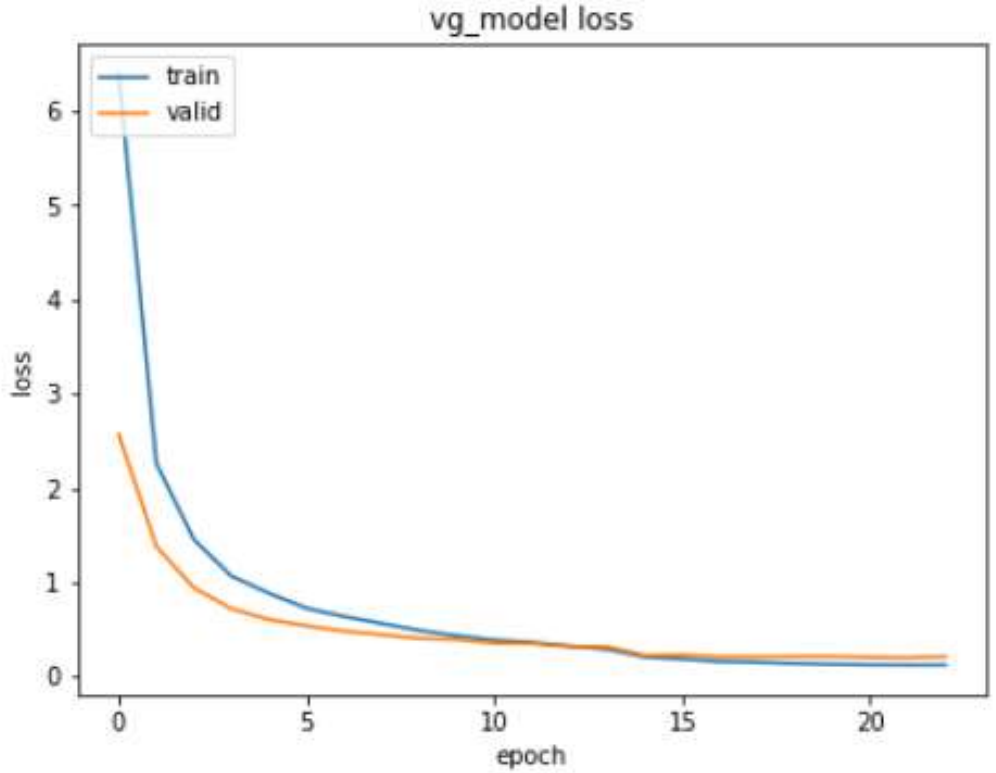
EfficientNet - a CNN architecture where the scaling method uniformly scalesthe dimensions of depth, width and resolution using a compound coefficient

VGG16 - invented by the Visual Gemoetry Group of Oxford University andproposed by Karen Simonyan and Andrew Zisserman, it was used to win 1stplace at 2014 ILSVRC callenge

VGG16 Model

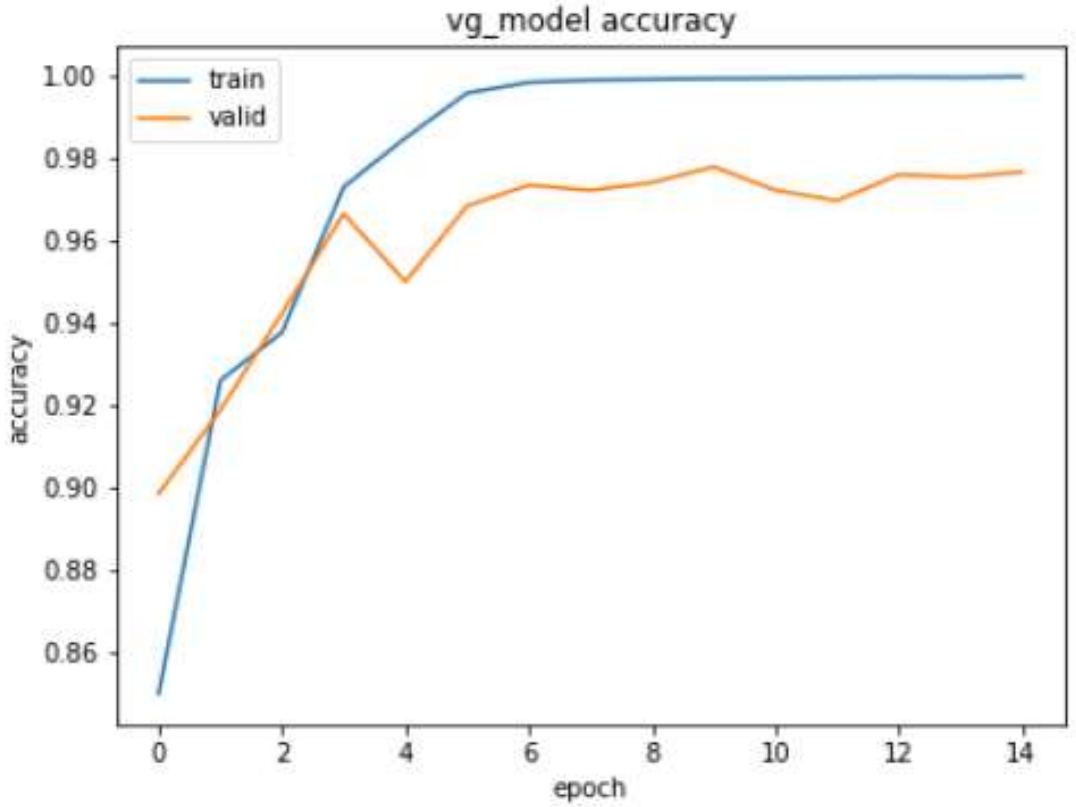
- A key distinction with VGG16 is rather than have large number of hyper-parameters they instead focused on having many convolution layers of 3v3 filters and always used same padding with a maxpool layer of 2x2.
- Has approximately 138 million parameters.
- Able to get 94% accuracy score after 23 epochs

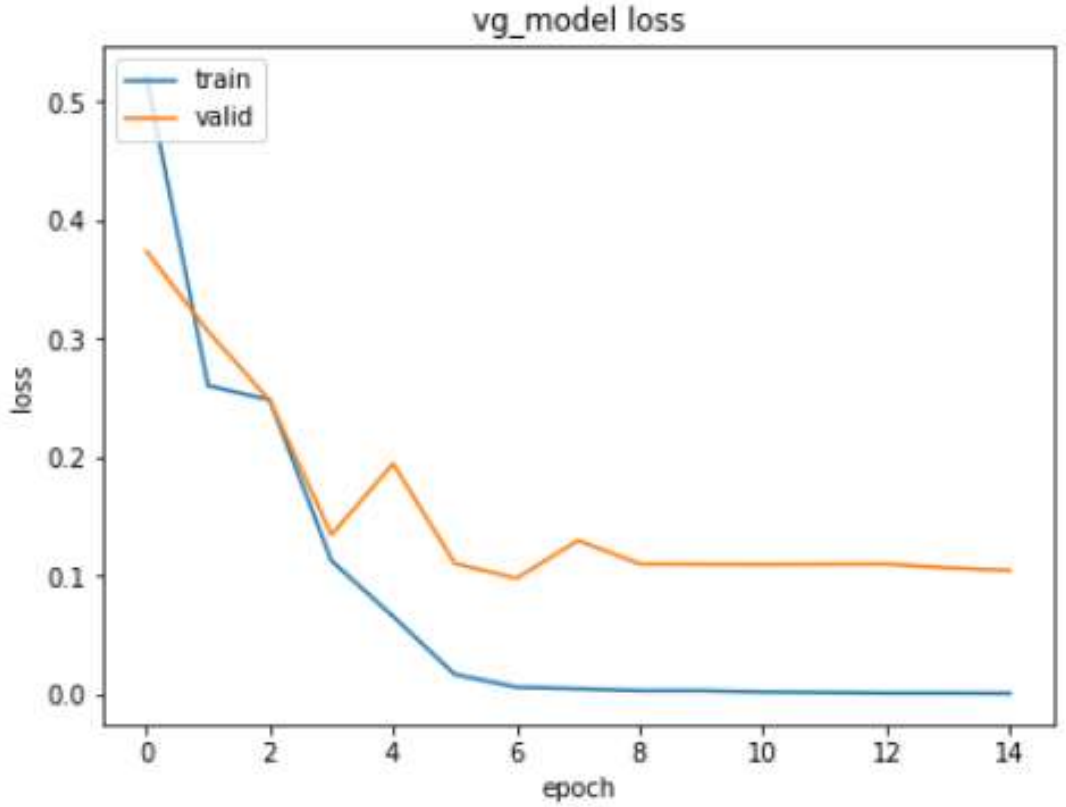




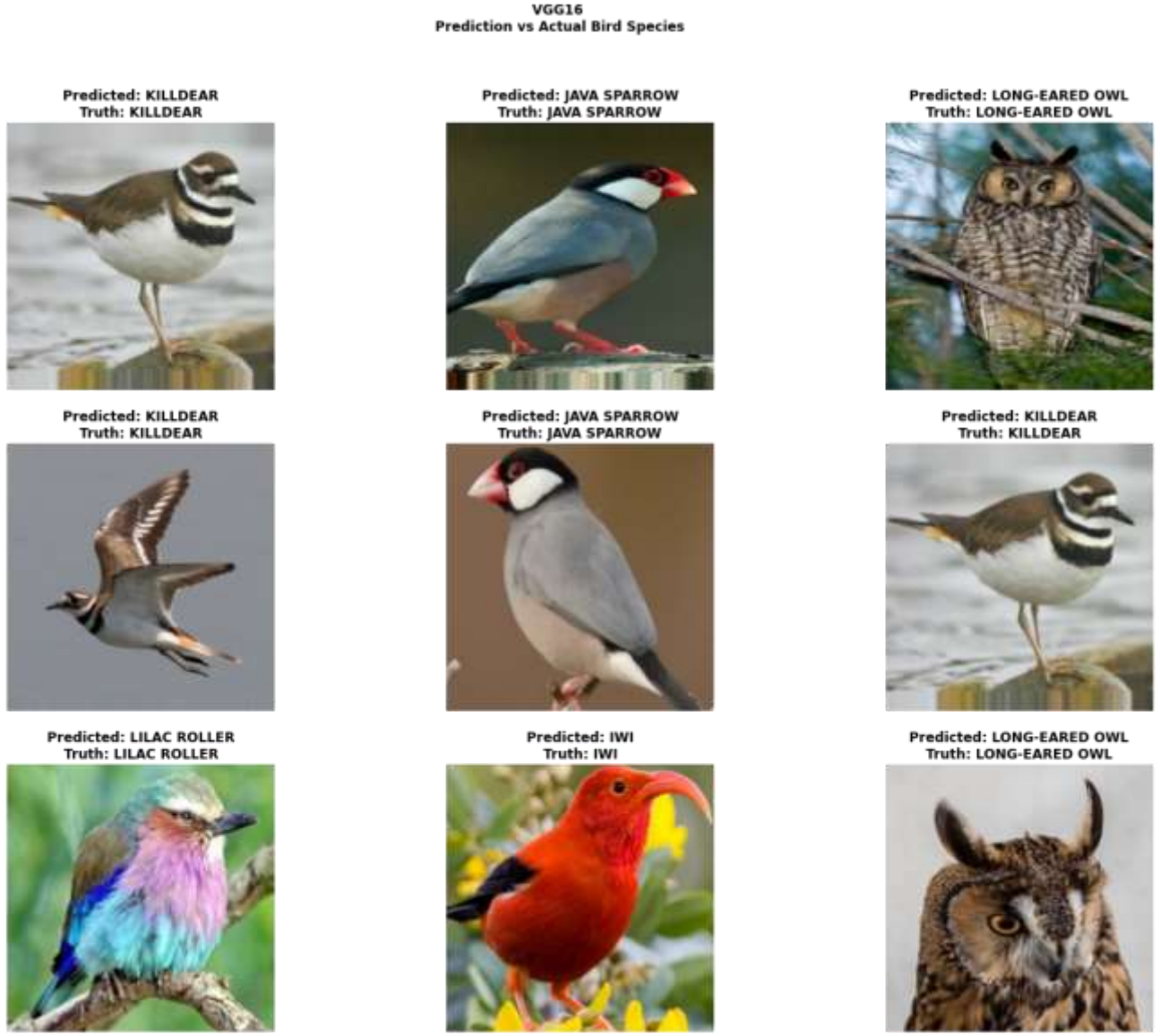
Tuning VGG16

- Freezing lower layers
- 97.5% accuracy on unseen data





Predictions



Takeaways

- Achieved 97.5% accuracy
- Can distinguish even almost identical looking birds but are different species
- Can be easily trained on new data
- CNN is a challenging topic when diving into the math
- Future work, object and facial recognition