Duck Duck Choose:

Pecking at Pixels with Machine Learning

Sprint 3: Using Pre-trained CNN Model

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Dataset

Birds 525 SPECIES - Kaggle

- 84,635 training images
- 2,625 test images
- 2,625 validation images

across 525 bird species.

*images sourced from Google

Data dictionary

labels: bird species associated with the image file

scientific label: scientific name for the bird species

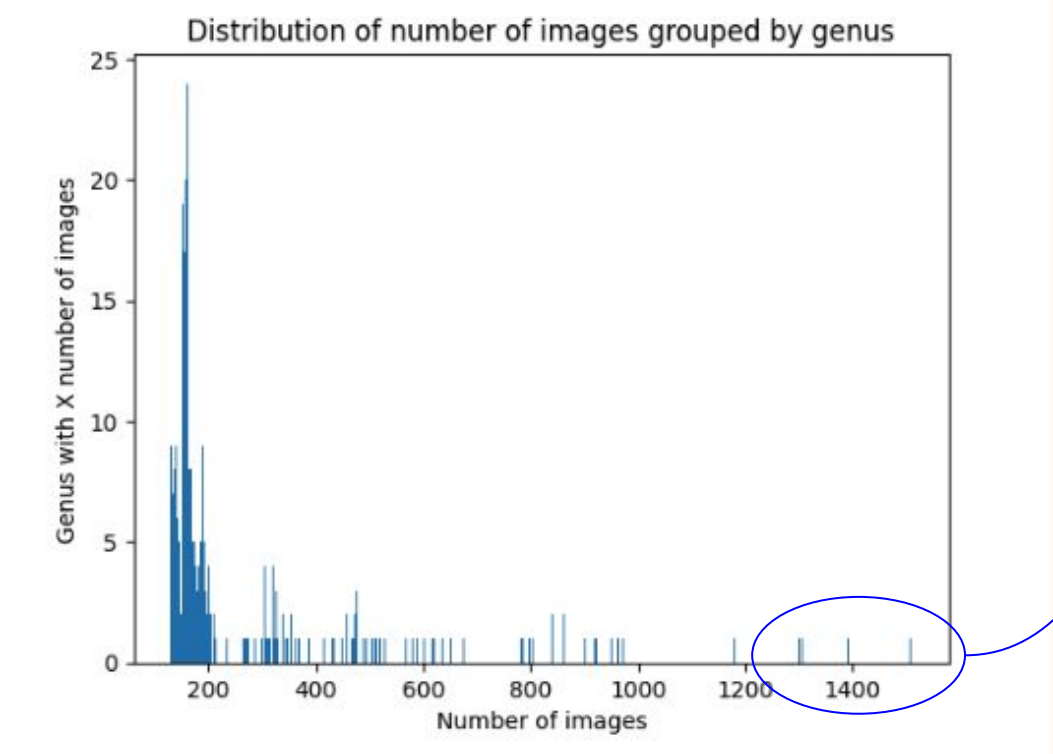
filepaths: the relative file path to an image file

data set: which dataset (train, test or valid) the image filepath belongs to

class_id: the class index value associated with the image file's class

	class id	filepaths	labels	data set	scientific name
0	0.0	train/ABBOTTS BABBLER/001.jpg	ABBOTTS BABBLER	train	MALACOCINCLA ABBOTTI
1	0.0	train/ABBOTTS BABBLER/007.jpg	ABBOTTS BABBLER	train	MALACOCINCLA ABBOTTI
2	0.0	train/ABBOTTS BABBLER/008.jpg	ABBOTTS BABBLER	train	MALACOCINCLA ABBOTTI
3	0.0	train/ABBOTTS BABBLER/009.jpg	ABBOTTS BABBLER	train	MALACOCINCLA ABBOTTI
4	0.0	train/ABBOTTS BABBLER/002.jpg	ABBOTTS BABBLER	train	MALACOCINCLA ABBOTTI

Checking distribution of images by genus



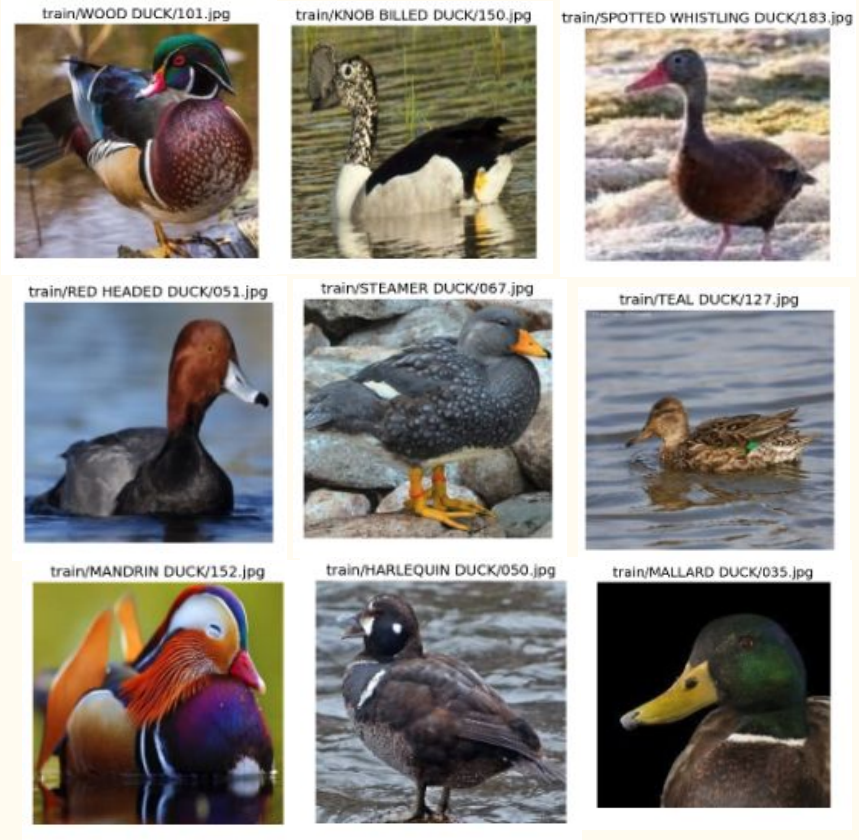
We can keep the genera with the highest image counts:

	genus	count
91	DUCK	1510
298	WARBLER	1391
217	PHEASANT	1303
161	KINGFISHER	1298
93	EAGLE	1179
102	FINCH	970
123	GOOSE	962
41	BUNTING	952
204	OWL	923
270	TANAGER	921

Ducks

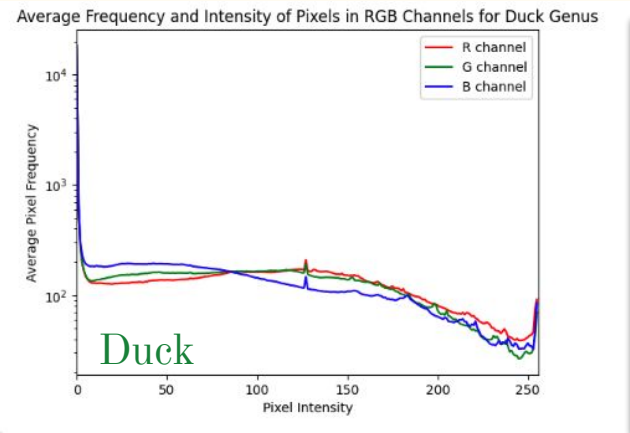
intra-genus variability

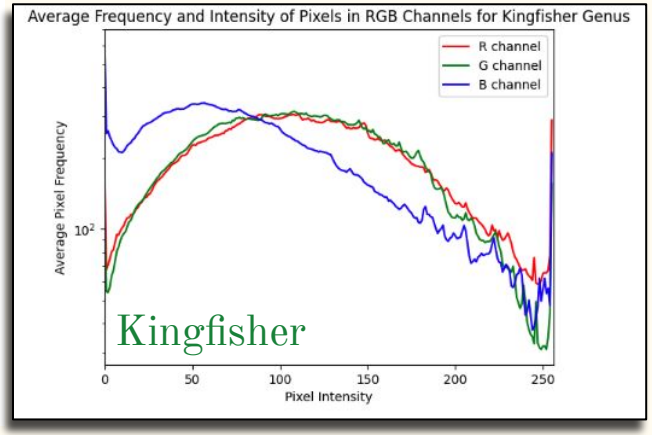
genus	species	count
DUCK	WOOD DUCK	214
DUCK	KNOB BILLED DUCK	197
DUCK	SPOTTED WHISTLING DUCK	184
DUCK	RED HEADED DUCK	160
DUCK	STEAMER DUCK	160
DUCK	TEAL DUCK	155
DUCK	MANDRIN DUCK	154
DUCK	HARLEQUIN DUCK	151
DUCK	MALLARD DUCK	135



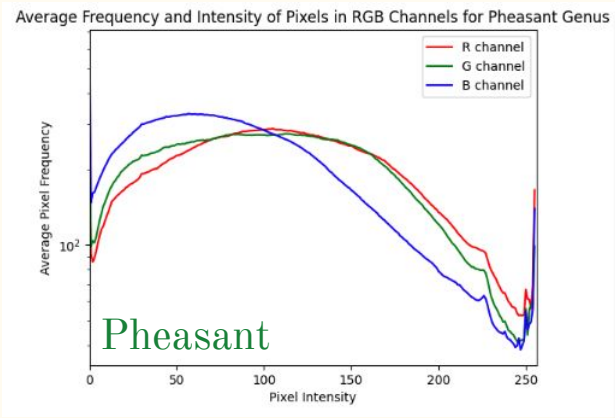
Average RGB Pixel Histogram Values By Genus

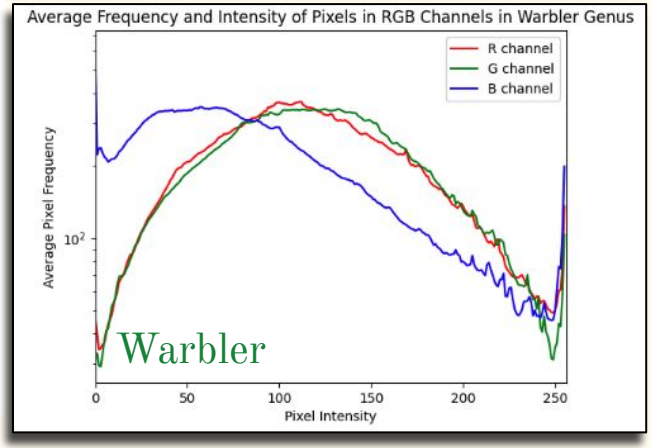
Shows dominant distribution of color intensities across a genus, useful for highlighting common colour patterns and variations





*Kingfisher and Warbler have similar histograms. This might be a confusion point for the model.

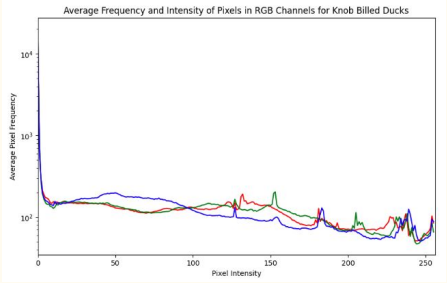


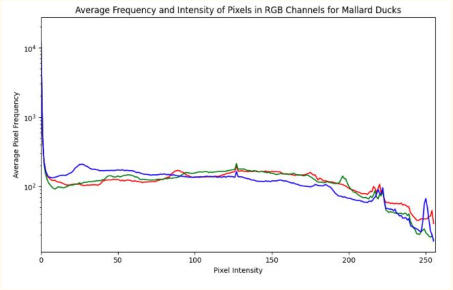


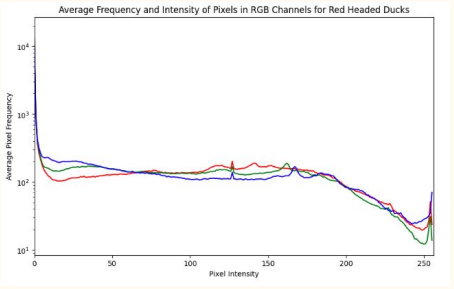
Duck Genus: Average Histograms of 9 Species

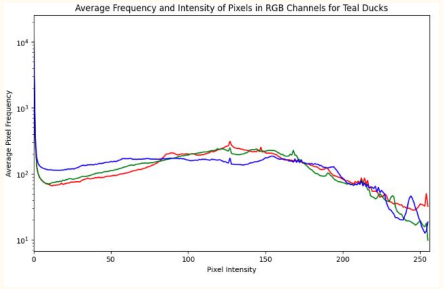
X-axis:
Brightness of the pixel
0 = Black | 255 = White

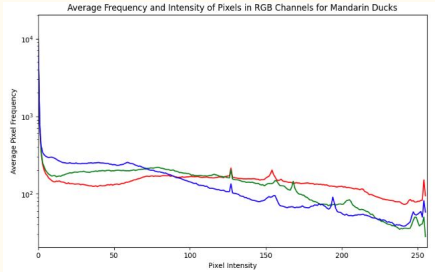
Y-axis:
A higher peak means more of that RGB channel.

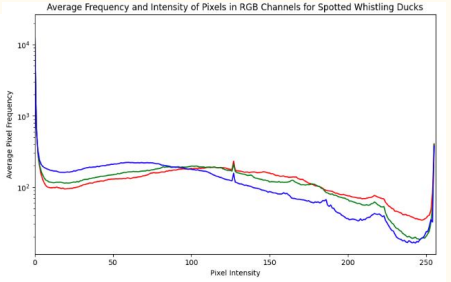


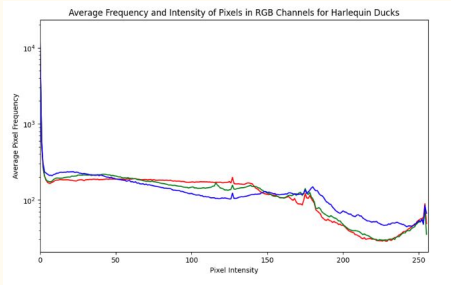


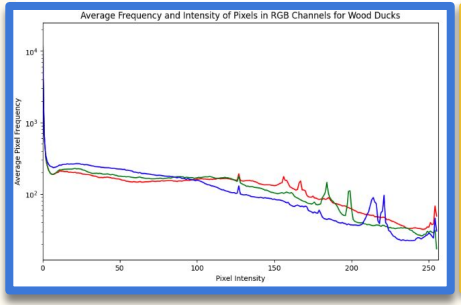


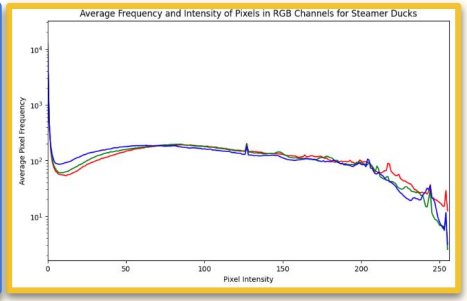








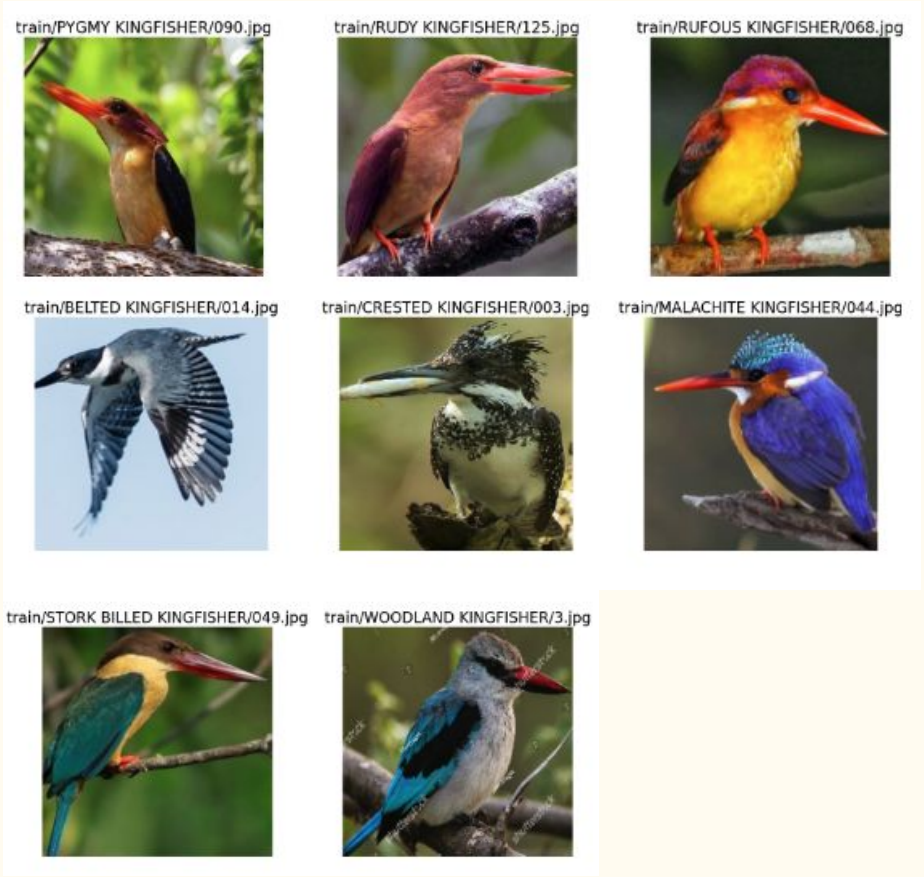




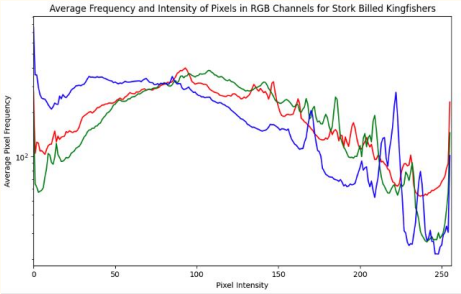
Kingfishers

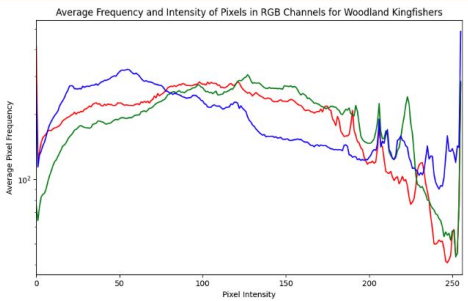
intra-genus variability

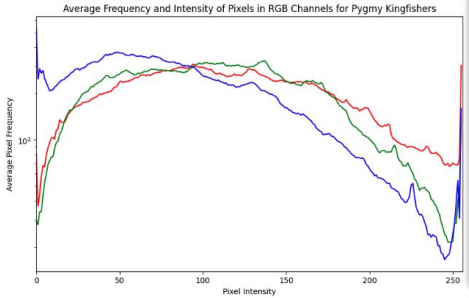
genus	species	count
KINGFISHER	WOODLAND KINGFISHER	194
KINGFISHER	PYGMY KINGFISHER	173
KINGFISHER	CRESTED KINGFISHER	163
KINGFISHER	MALACHITE KINGFISHER	163
KINGFISHER	RUDY KINGFISHER	160
KINGFISHER	RUFOUS KINGFISHER	156
KINGFISHER	BELTED KINGFISHER	154
KINGFISHER	STORK BILLED KINGFISHER	135

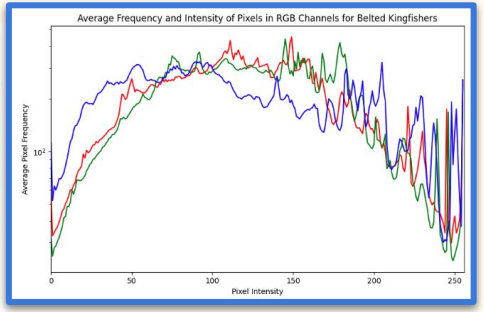


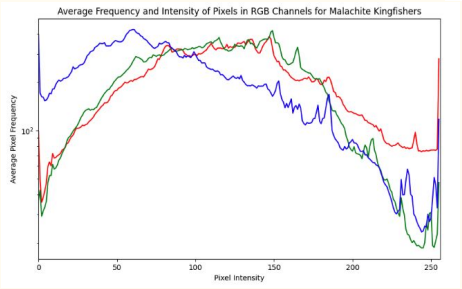
Kingfisher Genus: Average Histograms of 8 Species

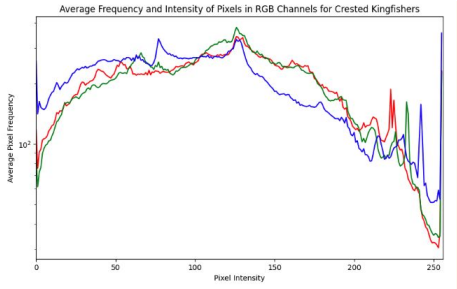


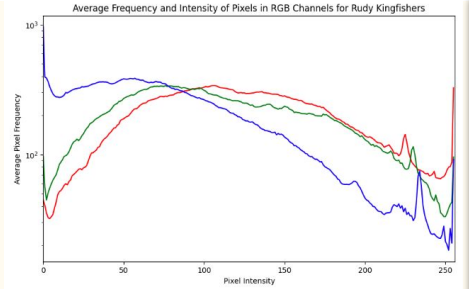


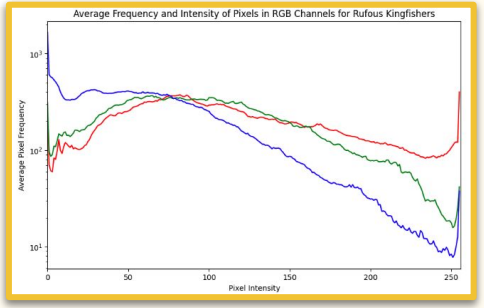








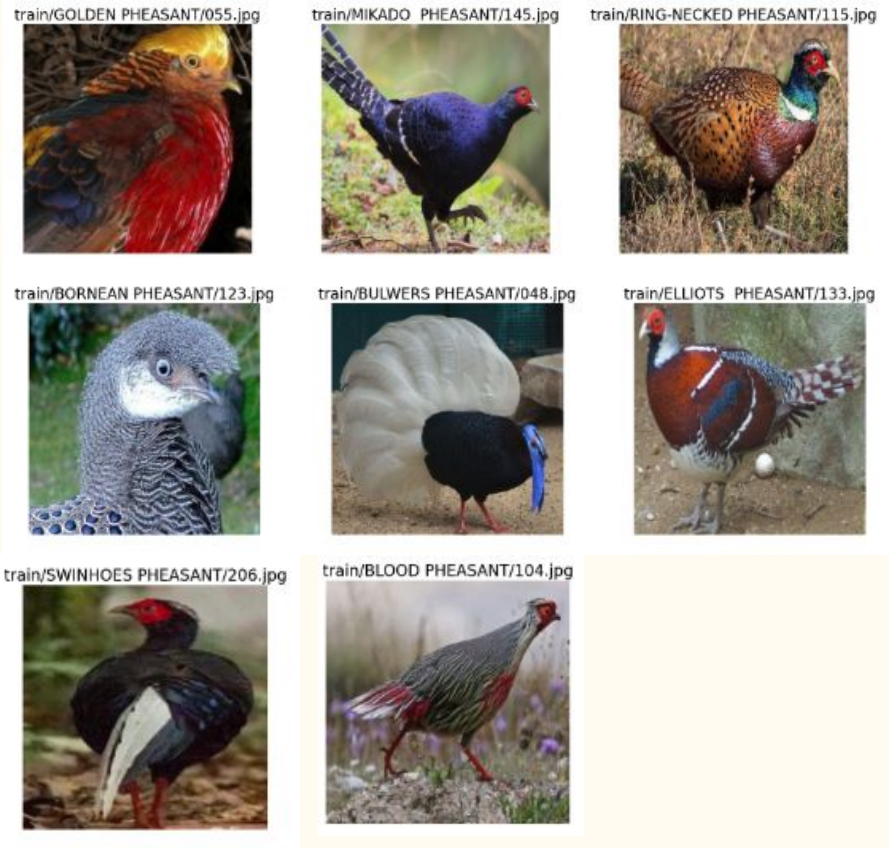




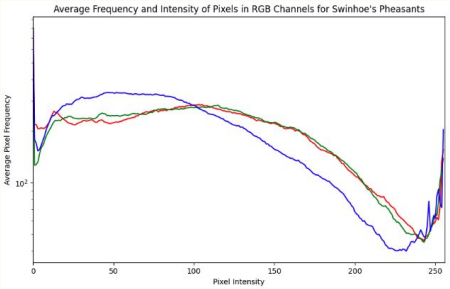
Pheasants

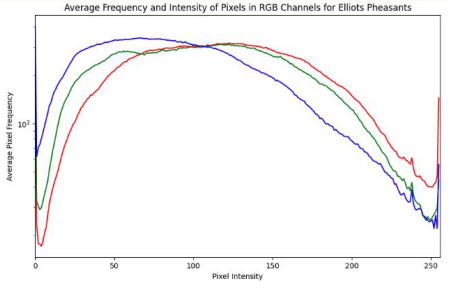
intra-genus variability

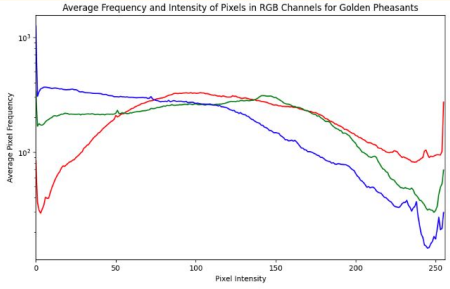
genus	species	count
PHEASANT	SWINHOES PHEASANT	216
PHEASANT	ELLIOTS PHEASANT	162
PHEASANT	GOLDEN PHEASANT	159
PHEASANT	BULWERS PHEASANT	155
PHEASANT	MIKADO PHEASANT	154
PHEASANT	BLOOD PHEASANT	153
PHEASANT	BORNEAN PHEASANT	152
PHEASANT	RING-NECKED PHEASANT	152

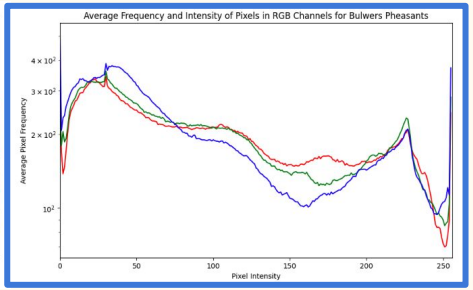


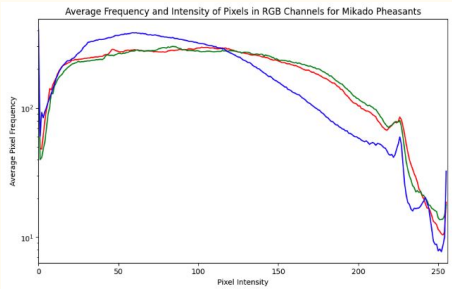
Pheasant Genus: Average Pixel Histograms of 8 Species

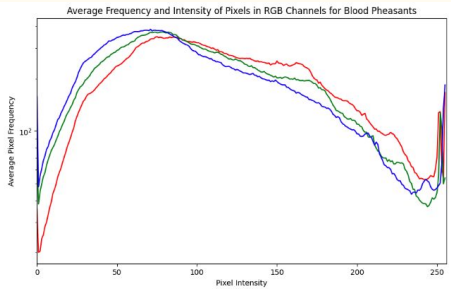


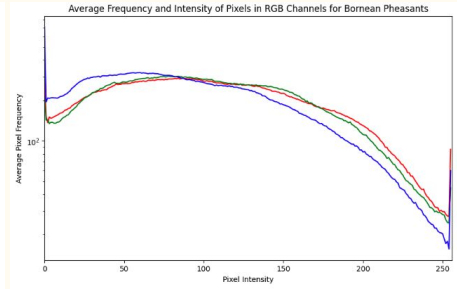


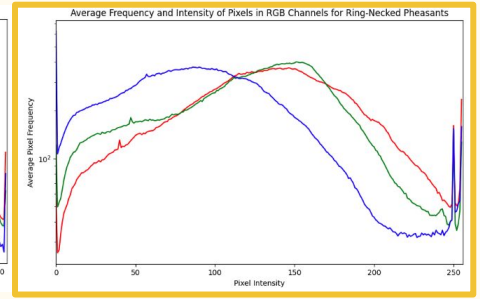












Warblers

intra-genus variability

genus	species	count
WARBLER	GOLDEN CHEEKED WARBLER	176
WARBLER	RED FACED WARBLER	167
WARBLER	TOWNSENDS WARBLER	165
WARBLER	CERULEAN WARBLER	163
WARBLER	GOLD WING WARBLER	159
WARBLER	CAPE MAY WARBLER	149
WARBLER	BAY-BREASTED WARBLER	143
WARBLER	BLACK THROATED WARBLER	135
WARBLER	BLACKBURNIAM WARBLER	134

Warbler Genus: Average Pixel Histograms of 9 Species

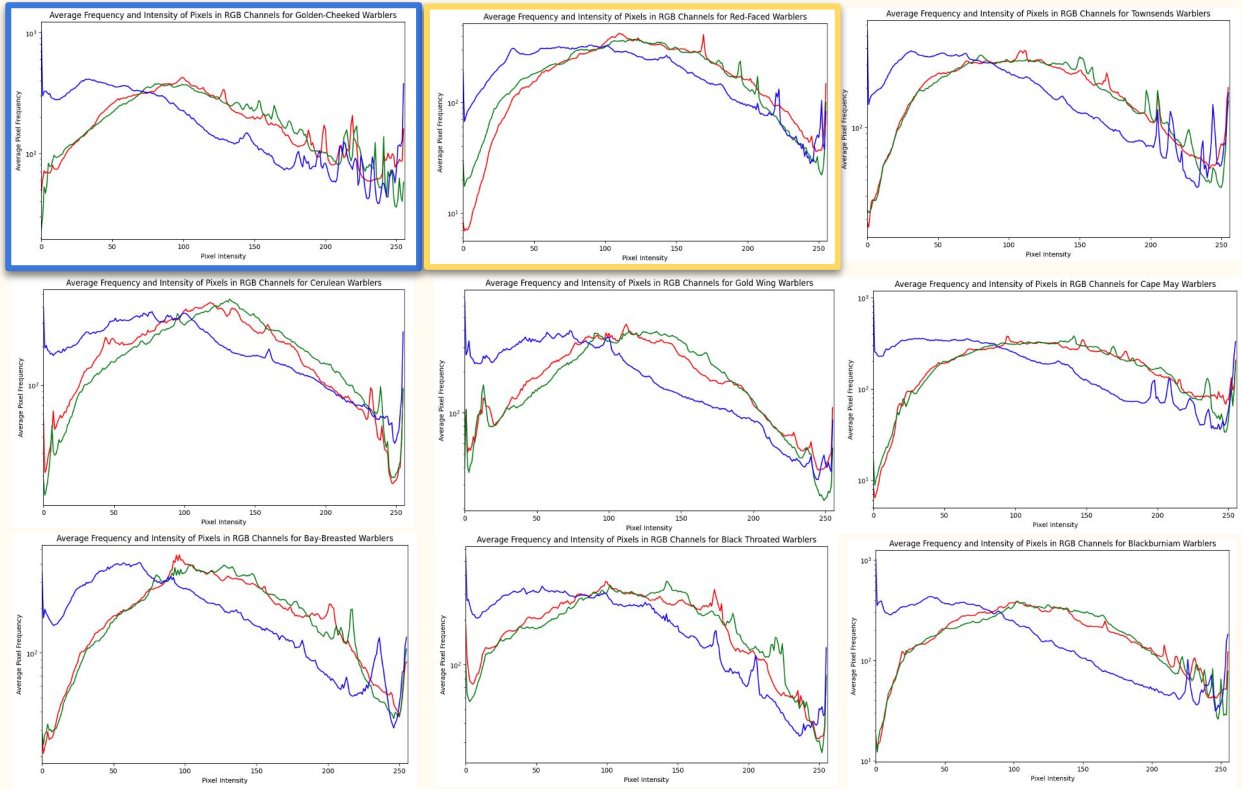
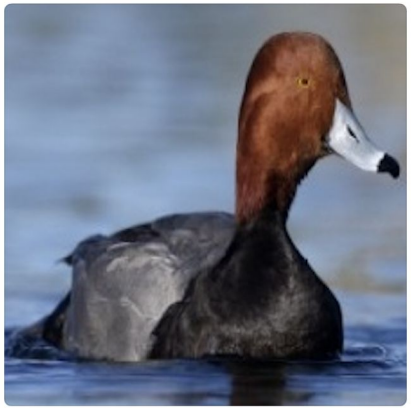
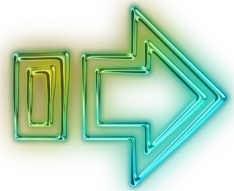


Image Preprocessing



051.jpg



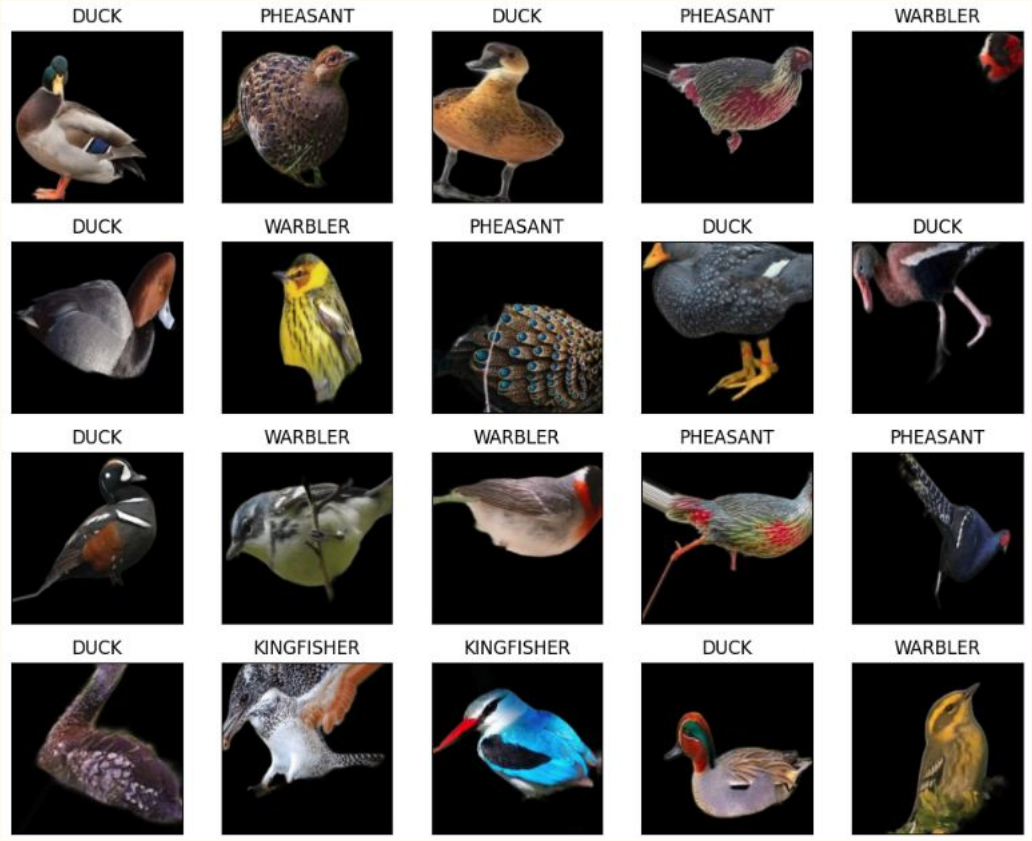
RED HEADED DUCK_051.png

image background removal using Python library `rembg`

Visualize Images After Data Augmentation

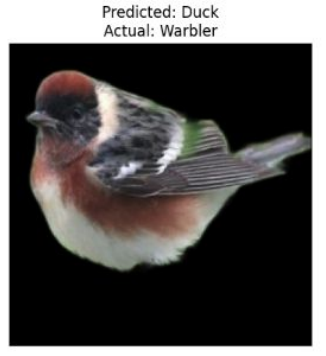
(built into ImageDataGenerator)

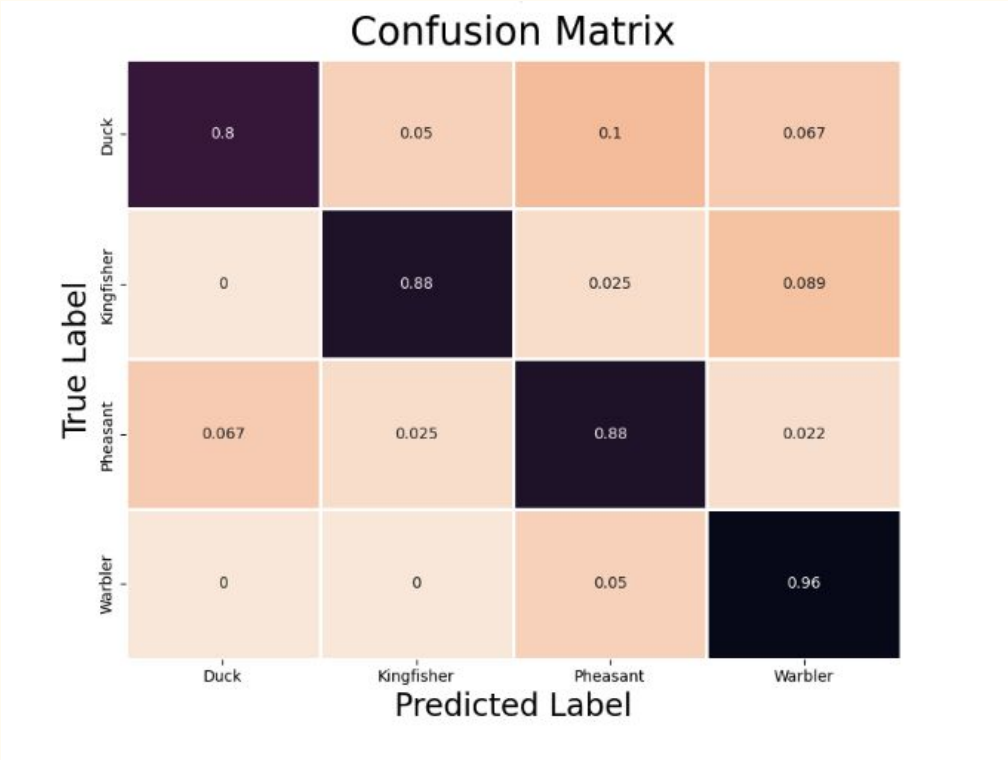
- scale pixel values to between 0 and 1
- rotate images
- shift images off-center
- slant images
- zoom in or out
- flip images horizontally



CNN Base Model Accuracy: 87.6%

incorrectly predicted images





Next steps

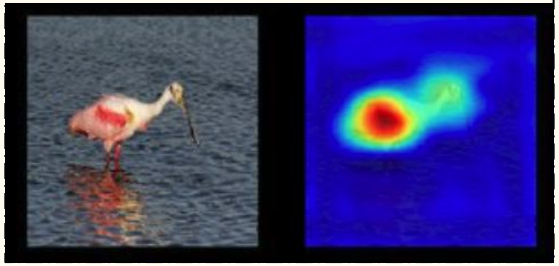
- Include all genuses and species

- Improve base model with Transfer Learning using a pre-trained CNN

- Optimize hyperparameters for higher accuracy

- Implement a **saliency map** to show which image features were crucial

In a saliency map, the brightness of a pixel is directly proportional to its saliency. They can present as heatmaps.



The saliency map for a Bulwers Pheasant would look like a hot banana.