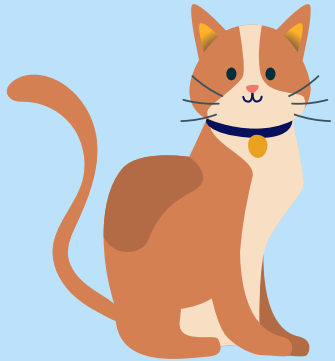
Cross-Species Transfer Learning

From Dog breed to Cat breed Classification using Deep Learning Techniques



Prodromos Kampouridis

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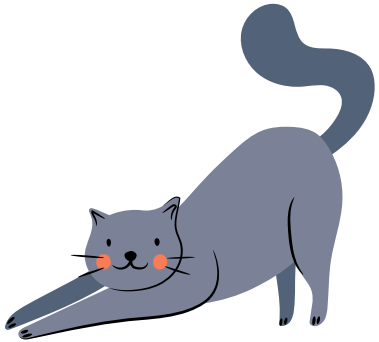
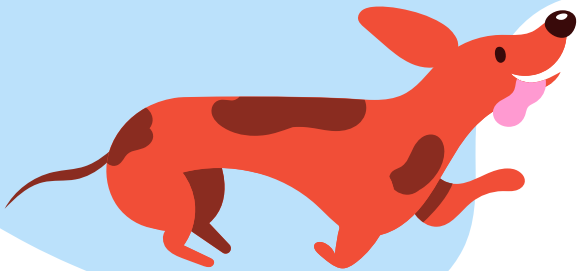


01
Introduction

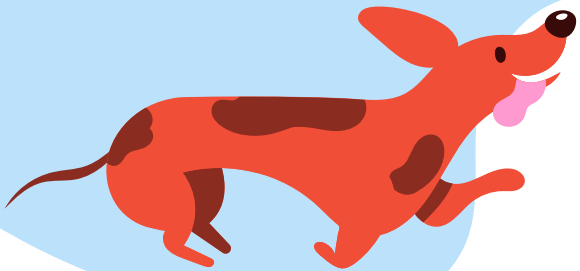
Introduction

The ability to accurately identify different breeds of dogs and cats has numerous applications, including in animal shelters, veterinary clinics and breeding programs.



Introduction

Due to the plenty physical characteristics and subtle variations among breeds it can be a challenge to classify them correctly.
Accurate breed classification can also help with understanding health issues and behavior traits related to specific breeds.



02

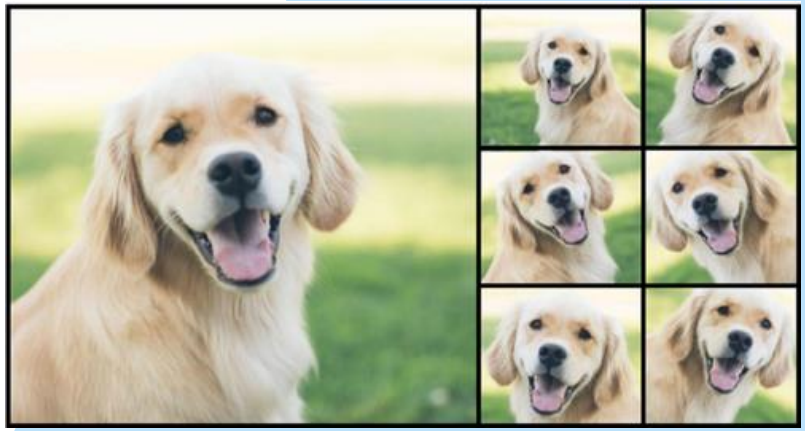
Dataset

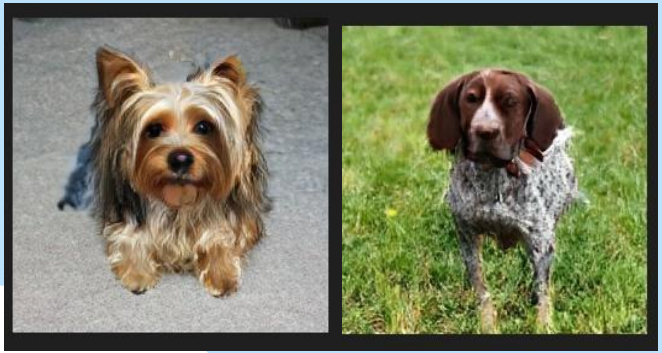
About the Dataset

- **Oxford-IIT (Dogs)**
  17 Classes
- **Oxford-IIT (Cats)**
  12 Classes
- **Stanford Dogs**

Data Preprocessing

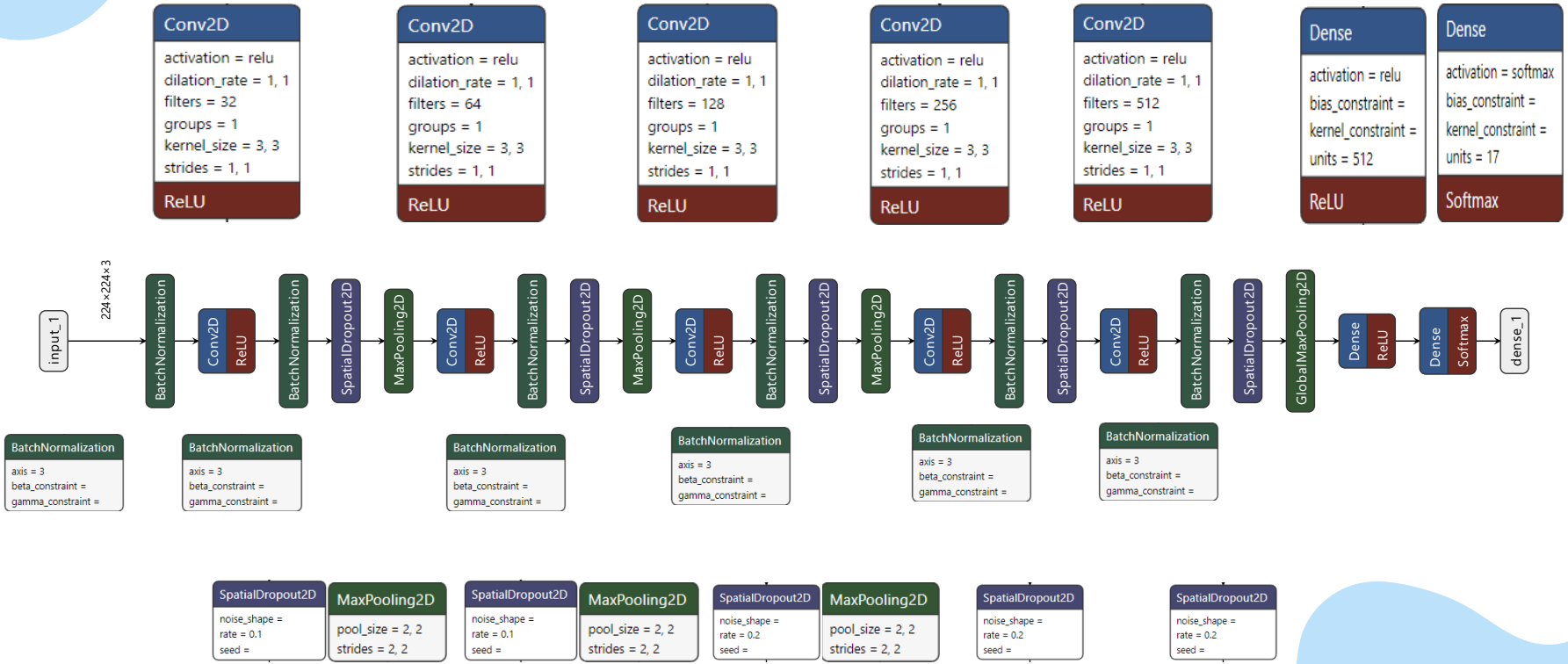
- Data Augmentation
  - ✓ Flipping
  - ✓ Rotating
  - ✓ Zooming
  - ✓ Cropping
  - ✓ Blurring
  - ✓ Noise
- Generative Adversarial Networks (GANs)





03
CNN

Model Structure

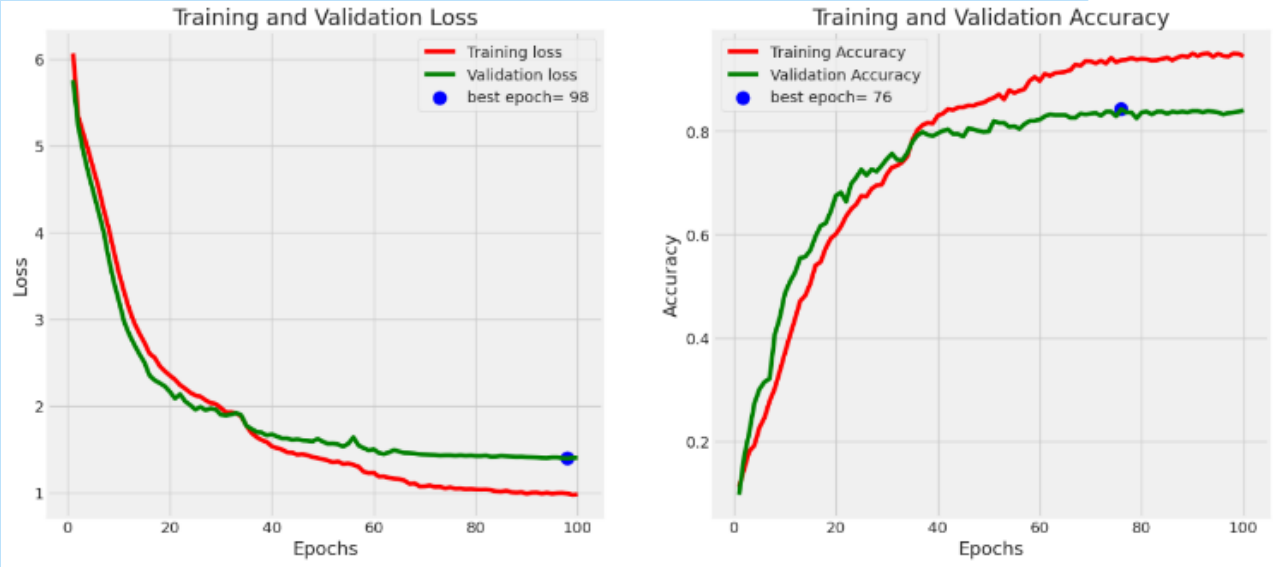


Hyperparameter Tuning

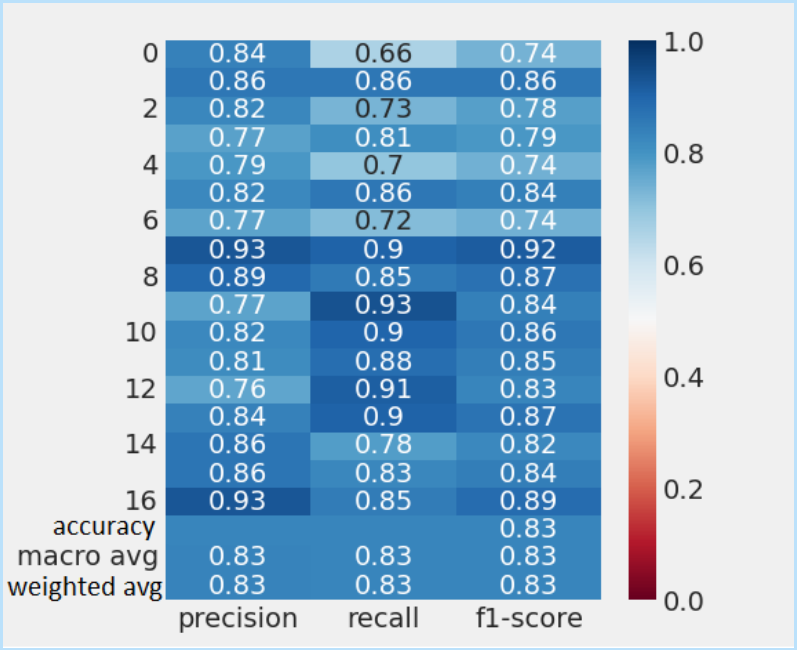
	Batch Size	Learning Rate	Regularization (L1 + L2)
	32	0.1	0.01
	64	0.01	0.001
	128	0.001	0.0001
Best Parameters	32	0.001	0.0001

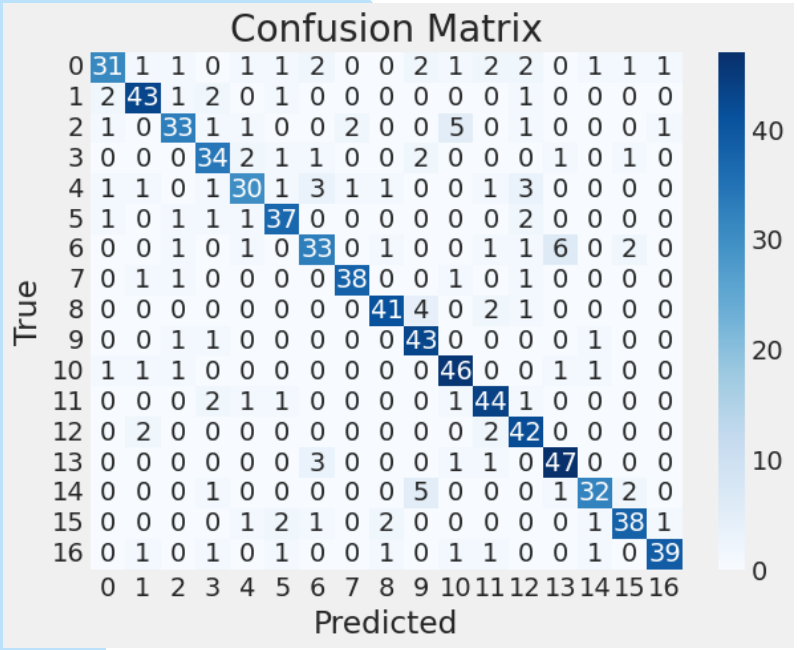
Trainable Parameters	Validation Accuracy	Validation Loss	Test Accuracy	Test Loss
1.841.368	83.6%	1.397	83%	1.468

Results


Training and Validation Loss
Training loss
Validation loss
best epoch= 98
Loss
Epochs
Training and Validation Accuracy
Training Accuracy
Validation Accuracy
best epoch= 76
Accuracy
Epochs

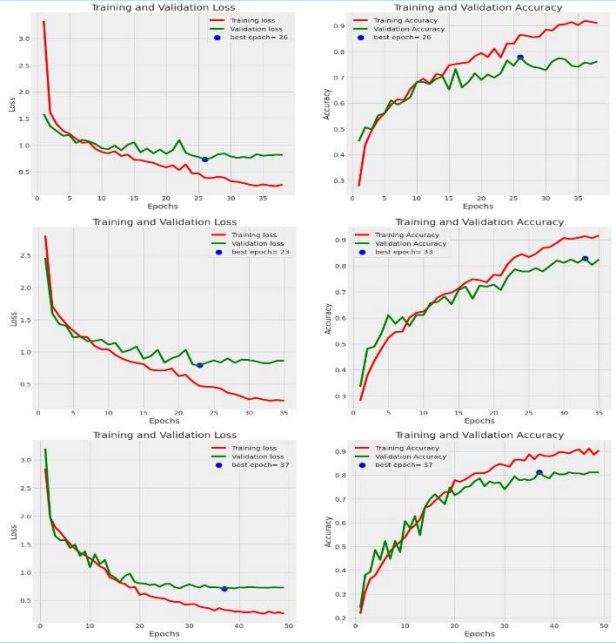
Results


precision
recall
f1-score
0 0.84 0.66 0.74
0.86 0.86 0.86
2 0.82 0.73 0.78
0.77 0.81 0.79
4 0.79 0.7 0.74
0.82 0.86 0.84
6 0.77 0.72 0.74
0.93 0.9 0.92
8 0.89 0.85 0.87
0.77 0.93 0.84
10 0.82 0.9 0.86
0.81 0.88 0.85
12 0.76 0.91 0.83
0.84 0.9 0.87
14 0.86 0.78 0.82
0.86 0.83 0.84
16 0.93 0.85 0.89
accuracy 0.83
macro avg 0.83 0.83 0.83
weighted avg 0.83 0.83 0.83
1.0
0.8
0.6
0.4
0.2
0.0


Confusion Matrix
True
Predicted
0 31 1 1 0 1 1 2 0 0 2 1 2 2 0 1 1 1
1 2 43 1 2 0 1 0 0 0 0 0 0 1 0 0 0 0
2 1 0 33 1 1 0 0 2 0 0 5 0 1 0 0 0 1
3 0 0 0 34 2 1 1 0 0 2 0 0 0 1 0 1 0
4 1 1 0 1 30 1 3 1 1 0 0 1 3 0 0 0 0
5 1 0 1 1 1 37 0 0 0 0 0 0 2 0 0 0 0
6 0 0 1 0 1 0 33 0 1 0 0 1 1 6 0 2 0
7 0 1 1 0 0 0 0 38 0 0 1 0 1 0 0 0 0
8 0 0 0 0 0 0 0 0 41 4 0 2 1 0 0 0 0
9 0 0 1 1 0 0 0 0 0 43 0 0 0 0 1 0 0
10 1 1 1 0 0 0 0 0 0 0 46 0 0 1 1 0 0
11 0 0 0 2 1 1 0 0 0 0 1 44 1 0 0 0 0
12 0 2 0 0 0 0 0 0 0 0 0 2 42 0 0 0 0
13 0 0 0 0 0 0 3 0 0 0 1 1 0 47 0 0 0
14 0 0 0 1 0 0 0 0 0 5 0 0 0 1 32 2 0
15 0 0 0 0 1 2 1 0 2 0 0 0 0 0 1 38 1
16 0 1 0 1 0 1 0 0 1 0 1 1 0 0 1 0 39
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
40
30
20
10
0

04
TRANSFER LEARNING

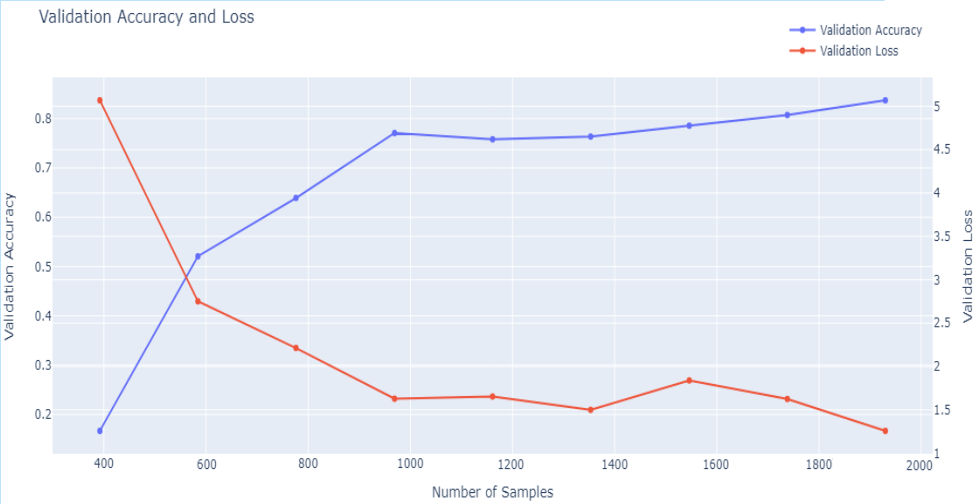
CNN Model



Block	Trainable Parameters	Validation Accuracy	Validation Loss	Test Accuracy	Test Loss
1	1.449.996	77.8%	1.826	75.1%	1.815
2	1.745.676	78.6%	1.511	75.8%	1.400
3	1.819.788	81.1%	1.364	80.5%	1.331
Output Layer	6.156	51%	2.216	57.6%	2.126

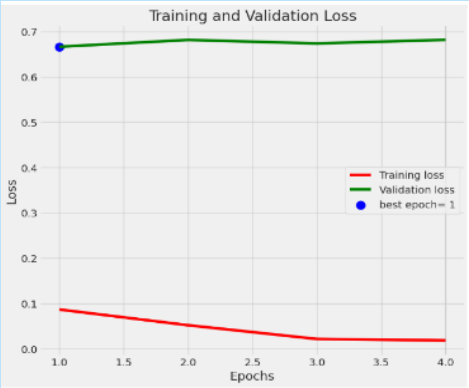
CNN Model Learning Curve

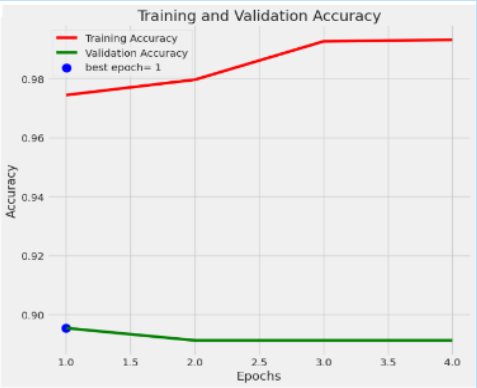
Percentage	Accuracy
20	16.6%
30	46.8%
40	62.5%
50	77%
60	75.8%
70	76.4%
80	78.6%
90	80.7%
100	81.1%



EfficientNet Model

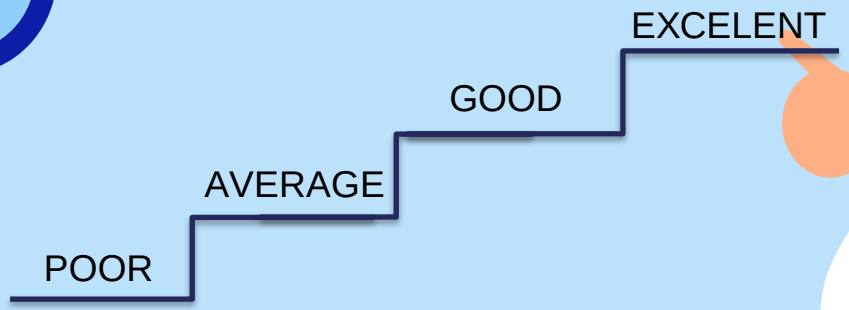
	Trainable Parameters	Validation Accuracy	Validation Loss	Test Accuracy	Test Loss
Efficient Net	1.720.332	89.5%	0.665	91.2%	0.312





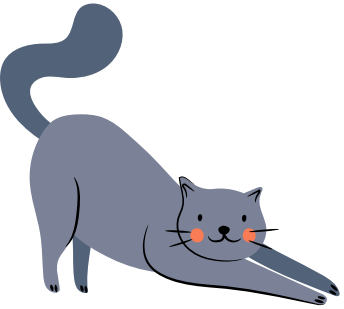
05

CROSS-DATASET EVALUATION

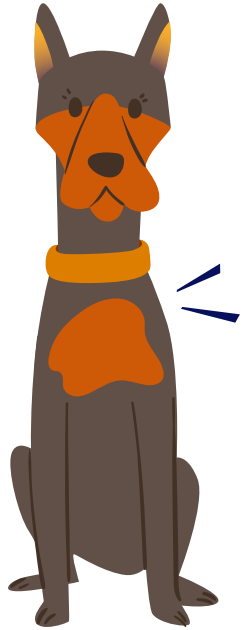


Cross-dataset Evaluation for Cats

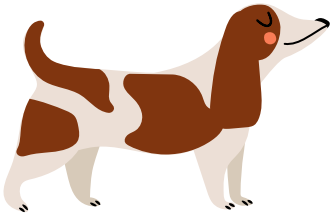
	Trainable Parameters	Validation Accuracy	Validation Loss	Test Accuracy	Test Loss
Fully Trained	1.843.933	56.9%	2.227	62.2%	2.107
Transfer Learning	1.819.788	81.1%	1.364	77.5%	1.331
Output Layer	6.156	51%	2.216	57.6%	2.126



Cross-dataset Evaluation for Dogs

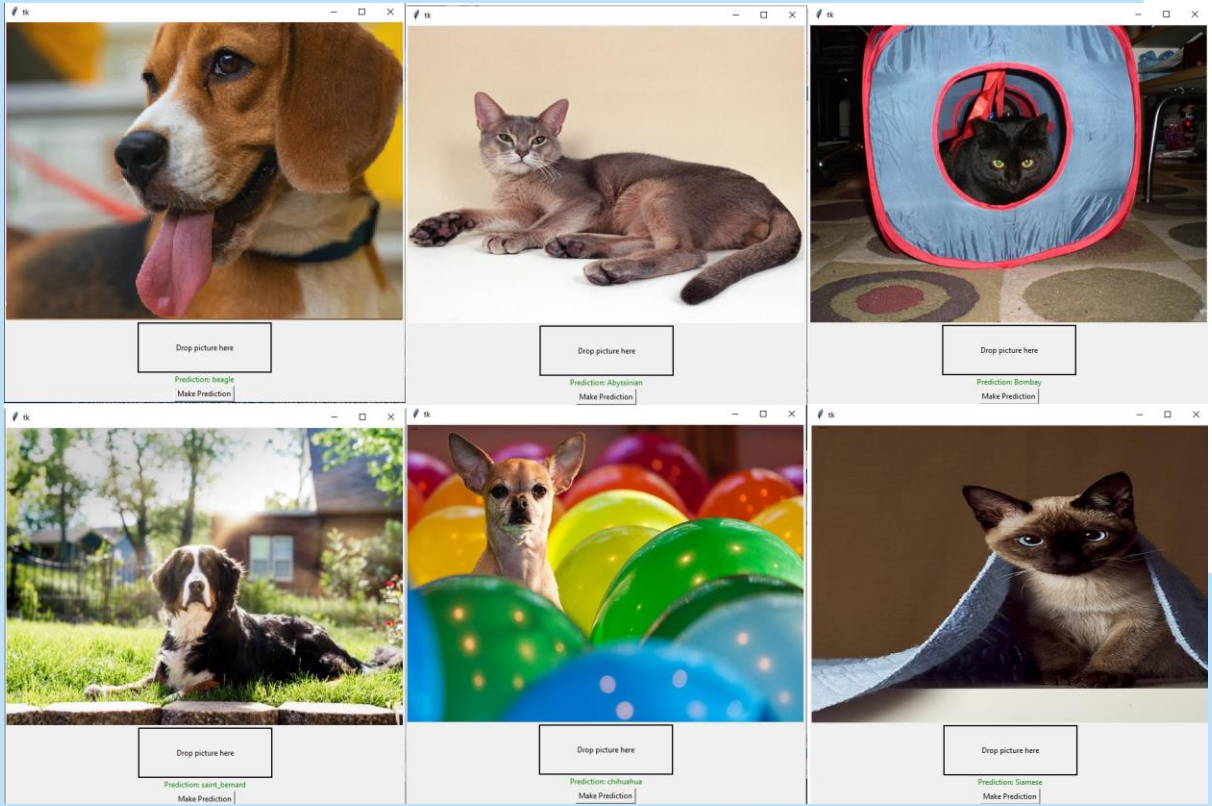


	Trainable Parameters	Validation Accuracy	Validation Loss	Test Accuracy	Test Loss
Fully Trained	1.841.368	83.6%	1.397	83%	1.468
Transfer Learning	1.819.788	83.1%	1.436	80.9%	1.557

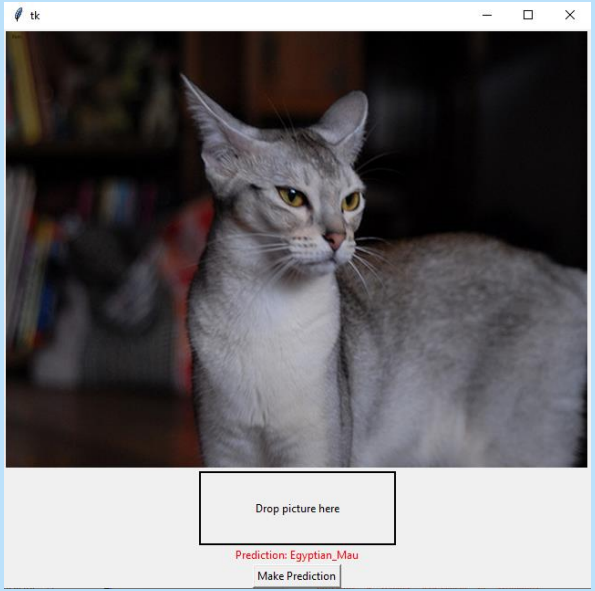


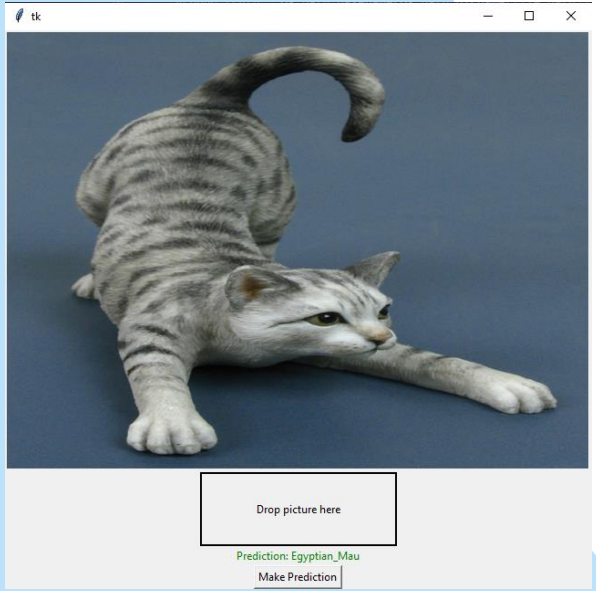
06
DEMO

DEMO


tk
Drop picture here
Prediction: beagle
Make Prediction
tk
Drop picture here
Prediction: Abyssinian
Make Prediction
tk
Drop picture here
Prediction: Bombay
Make Prediction
tk
Drop picture here
Prediction: saint_bernard
Make Prediction
tk
Drop picture here
Prediction: chihuahua
Make Prediction
tk
Drop picture here
Prediction: Siamese
Make Prediction

DEMO


tk
Drop picture here
Prediction: Egyptian_Mau
Make Prediction


tk
Drop picture here
Prediction: Egyptian_Mau
Make Prediction


THANK
YOU!!!