Dog Breed Identification

Kaitlyn Mulligan
Marist College

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Overview

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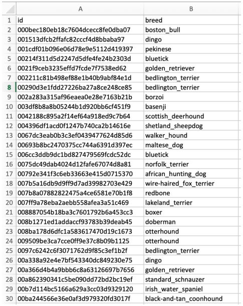
Motivation

- Learn how to use a classification tool on images in order to classify the image
  - CNN
  - Xception
  - MLP
- In this project, the goal is to input an image of a dog and output the dog breed represented in the image.

Data

- Kaggle Dog Breed Identification
- 10,222 images
- 120 dog breeds
- CSV file of ID numbers of images for respective dog breeds



	A	B
1	id	breed
2	000bec180eb18c7604dcecc8fe0dba07	boston_bull
3	001513dfcb2ffafc82cccf4d8bbaba97	dingo
4	001cdf01b096e06d78e9e5112d419397	pekinese
5	00214f311d5d2247d5dfe4fe24b2303d	bluetick
6	0021f9ceb3235effd7fcde7f7538ed62	golden_retriever
7	002211c81b498ef88e1b40b9abf84e1d	bedlington_terrier
8	00290d3e1fdd27226ba27a8ce248ce85	bedlington_terrier
9	002a283a315af96eaea0e28e7163b21b	borzoi
10	003df8b8a8b05244b1d920bb6cf451f9	basenji
11	0042188c895a2f14ef64a918ed9c7b64	scottish_deerhound
12	004396df1acd0f1247b740ca2b14616e	shetland_sheepdog
13	0067dc3eab0b3c3ef0439477624d85d6	walker_hound
14	00693b8bc2470375cc744a6391d397ec	maltese_dog
15	006cc3ddb9dc1bd827479569fcdc52dc	bluetick
16	0075dc49dab4024d12fafe67074d8a81	norfolk_terrier
17	00792e341f3c6eb33663e415d0715370	african_hunting_dog
18	007b5a16db9d9ff9d7ad39982703e429	wire-haired_fox_terrier
19	007b8a07882822475a4ce6581e70b1f8	redbone
20	007ff9a78eba2aebb558afea3a51c469	lakeland_terrier
21	008887054b18ba3c7601792b6a453cc3	boxer
22	008b1271ed1addaccf93783b39deab45	doberman
23	008ba178d6dfc1a583617470d19c1673	otterhound
24	009509be3ca7cce0ff9e37c8b09b1125	otterhound
25	0097c6242c6f3071762d9f85c3ef1b2f	bedlington_terrier
26	00a338a92e4e7bf543340dc849230e75	dingo
27	00a366d4b4a9bbb6c8a63126697b7656	golden_retriever
28	00a862390341c5be090dd72bd2bc19ef	standard_schnauzer
29	00b7d114bc5166a629a3cc03d9329120	irish_water_spaniel
30	00ba244566e36e0af3d979320fd3017f	black-and-tan_coonhound

Initial Ideas

Convolutional Neural Network

1. 2 convolutional layers, 5 full connection layers
    - Full connection layers consisting of: relu, sigmoid, and dropout
    - Batch size of 512, 500 epochs
    - 10% accuracy rate

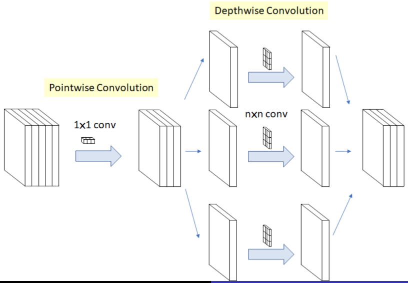
Initial Ideas

Convolutional Neural Network

1. 2 convolutional layers, 5 full connection layers
    - Full connection layers consisting of: relu, sigmoid, and dropout
    - Batch size of 512, 500 epochs
    - 10% accuracy rate
2. Variation of initial CNN, no convolutional layers
    - Wasn't working well
    - Decided to try Logistic Regression with Xception

Xception

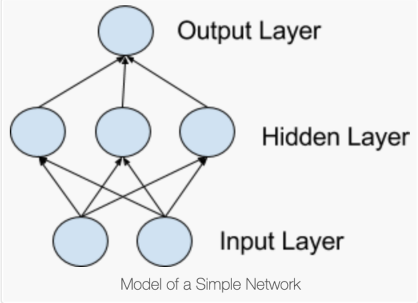
- 36 convolutional stages
- Depthwise separable convolutions
- Better performance due to more efficient use of model parameters
- Performs 1 by 1 convolution first, then the channel wise spatial convolution
- No intermediate ReLU non-linearity
- Without intermediate activation it has the highest accuracy compared to others



MLP

Multilayer Perceptron

- Deep, artificial neural network
- Composed of:
  1. Input layer which receives the signal
  2. Arbitrary number of hidden layers
  3. Output layer makes the decision/prediction regarding the input
- Trains on the data to learn the model
- Goal is to minimize the error by adjusting parameters



Implementation

1. Load Xception
2. Split into training and testing
3. Run training and testing through Xception

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1. Load Xception
2. Split into training and testing
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In order to find the best model, I needed the best set of neurons and best value of eta. Therefore, I made for-loops to save the best values for each of these. Before running it with everything, I wanted to make sure it all worked.

Implementation

Problems run into:

- Takes a long time to run
- Errors in code
- No time left

Based on these problems, my current model is not optimal. The program is now working, but I did not have time to run it with all of the neurons and values of eta.

Implementation

Based on what I have run so far:

- Best set of neurons: (500,)
- Best value of eta: 0.001

Implementation

Based on what I have run so far:

- Best set of neurons: (500,)
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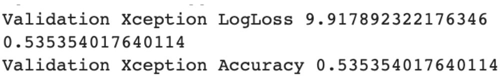
Using these values, I ran an MLPClassification to obtain a model. This resulted in:



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Validation Xception LogLoss 9.917892322176346
0.535354017640114
Validation Xception Accuracy 0.535354017640114
```

Confusion Matrices

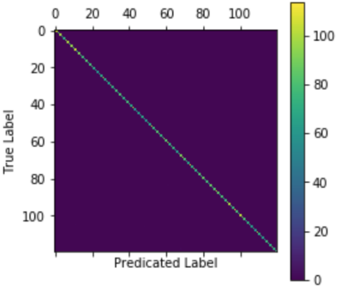


Figure 1: Training Confusion Matrix

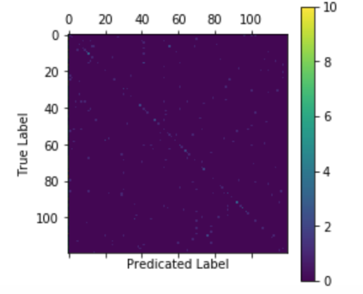
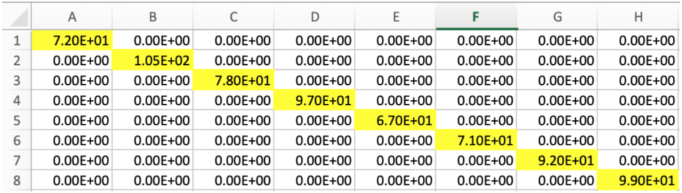


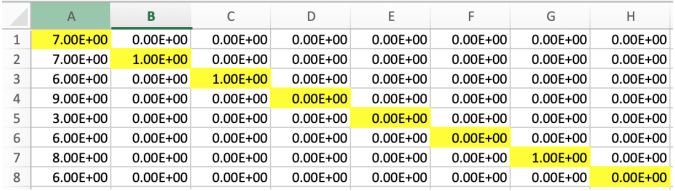
Figure 2: Testing Confusion Matrix

Confusion Matrices



	A	B	C	D	E	F	G	H
1	7.20E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	0.00E+00	1.05E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3	0.00E+00	0.00E+00	7.80E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4	0.00E+00	0.00E+00	0.00E+00	9.70E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.70E+01	0.00E+00	0.00E+00	0.00E+00
6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.10E+01	0.00E+00	0.00E+00
7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.20E+01	0.00E+00
8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.90E+01

Figure 3: Training Confusion Matrix



	A	B	C	D	E	F	G	H
1	7.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	7.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3	6.00E+00	0.00E+00	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4	9.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5	3.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6	6.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7	8.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	0.00E+00
8	6.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Figure 4: Testing Confusion Matrix

Predictions with Test Data

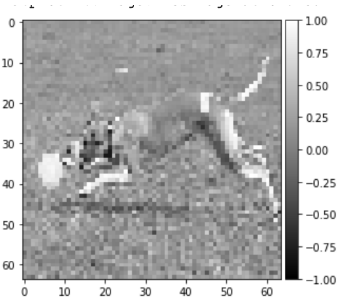
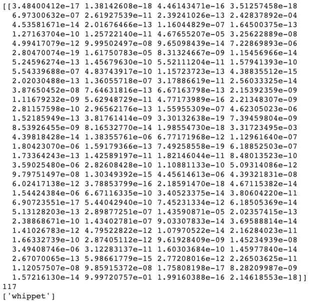


Figure 5: Whippet



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  4.99417079e-12 9.99502497e-08 9.65098439e-14 7.22869893e-06
  2.80470074e-19 1.61750783e-05 8.31324667e-09 1.15456966e-14
  5.24596274e-13 1.45679630e-10 5.52111204e-11 1.57941393e-10
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  2.02030488e-13 1.36055718e-07 3.17886619e-11 2.56033325e-14
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  9.79751497e-08 1.30349392e-15 4.45614613e-06 4.39321831e-08
  6.02417138e-12 3.78853799e-16 2.18591470e-18 4.67115382e-14
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117
['whippet']
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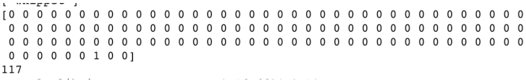
Figure 6: Prediction



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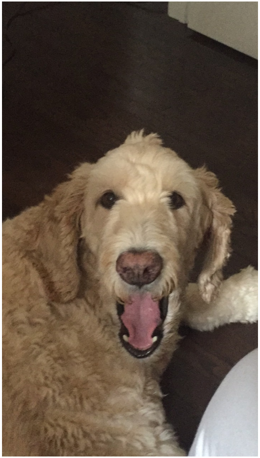
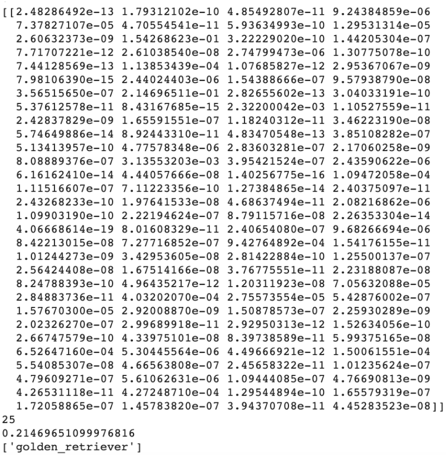
117
```

Figure 7: Actual

Predictions with Outside Data





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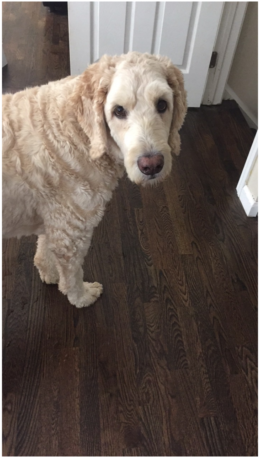
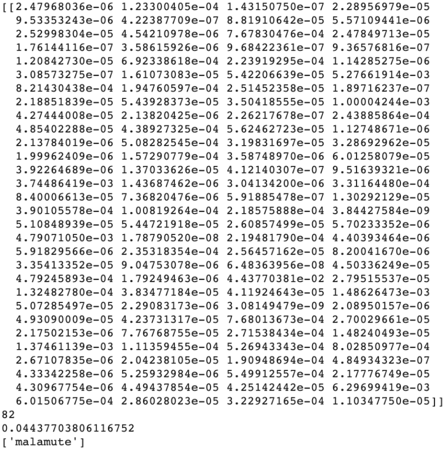
Predictions with Outside Data





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  4.33342258e-06 5.25932984e-06 5.49912557e-04 2.17776749e-05
  4.30967754e-06 4.49437854e-05 4.25142442e-05 6.29699419e-03
  6.01506775e-04 2.86028023e-05 3.22927165e-04 1.10347750e-05]]
82
0.04437703806116752
['malamute']
```

Goal

Continuing forward:

- Run it with all sets of neurons and values of eta
- Out of these, find and save the best values
- Run the MLPClassification again and obtain a higher accuracy rate (hopefully!)
- See how these new results compare to the current results

References

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Thank you!

Questions?