

Dog Breed Classifier Using CNN

Capstone Proposal

Submitted By

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1. Domain Background

It requires years of experience to recognizing and identify dogs breed accurately, in order to identify dogs' s breed most of people need to consult with an expert. But today we have an alternative, we don't need to consult an expert to identify dog's breed. In computer vision we have lot of emerging technologies for carrying out these classification task.

Here we can use convolutional neural network for the classification of dog's breed. By using computer vision techniques and convolution neural network, we can even defeat a human expert in terms of accuracy (It depends on quality of dataset and model).

There is an interesting paper on Dog Breed Identification with Fine tuning of Pre-trained models in International Journal of Recent Technology and Engineering (IJRTE). This paper describes how the classifier perform VGG-16, Inception V3, Xception in terms of accuracy and loss. In our proposed we are using VGG-16 for dog detection model. And also this paper describes how we can improve the accuracy of our dog breed prediction model.

2. Problem Statement

We are building an ML pipeline to process and classify real-world, user-supplied images. While a user uploading an image (Dog image or human image), the algorithm will identify an estimate of the canine's breed. If supplied an image of a human, the code will identify the resembling dog breed.

3. Datasets and Inputs

Here we are using data from Udacity. There are 13233 human images and 8351 dog images are available in our dataset.

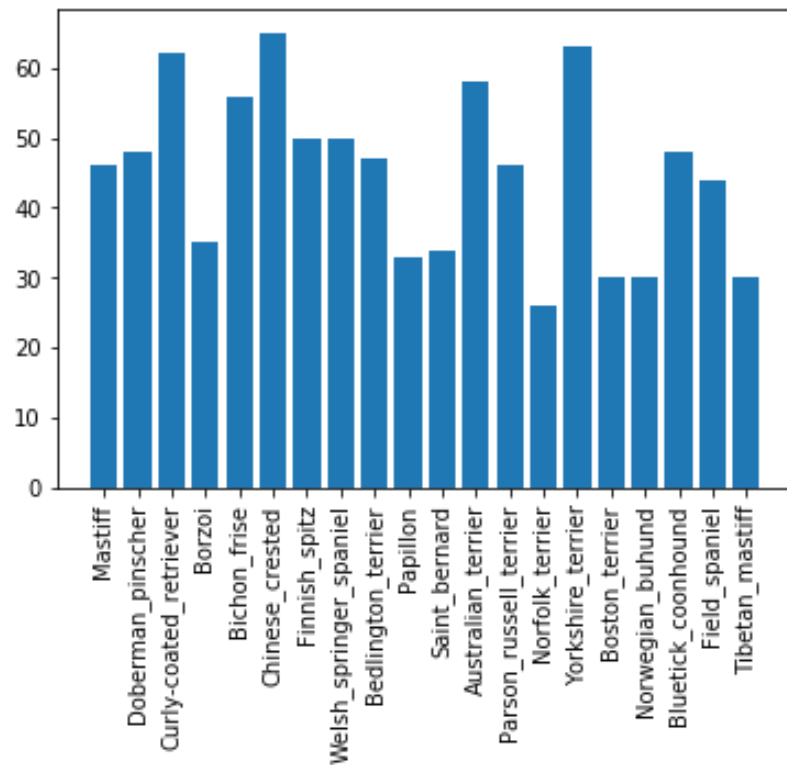
Dog images:

- Train set 6680
- Test set 836
- 835 images for validation
- It contains 133 different breeds

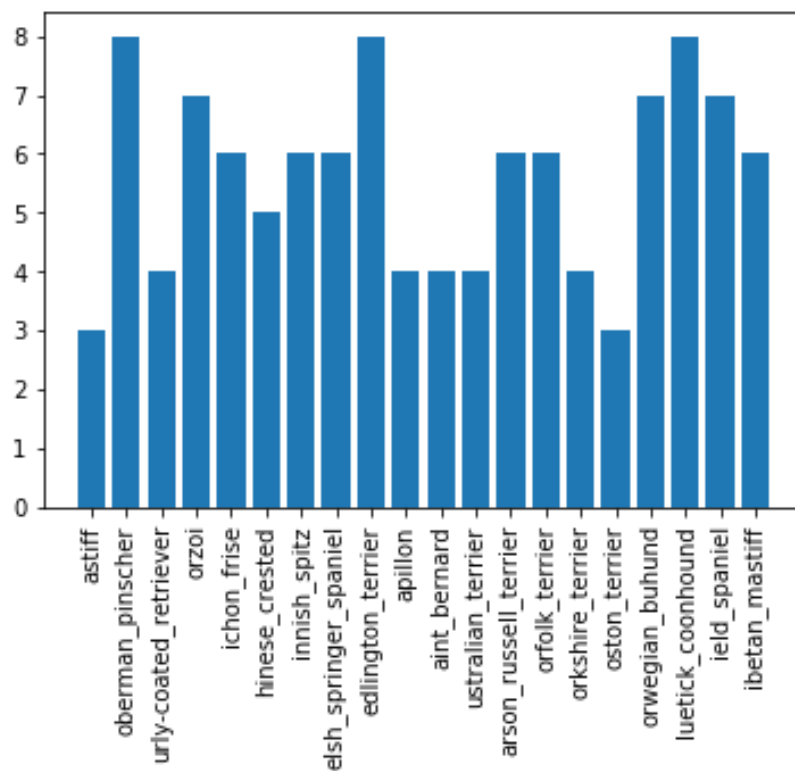
Human Images:

- 5750 folders, each folder contains different pictures of a person
- Data is not balanced

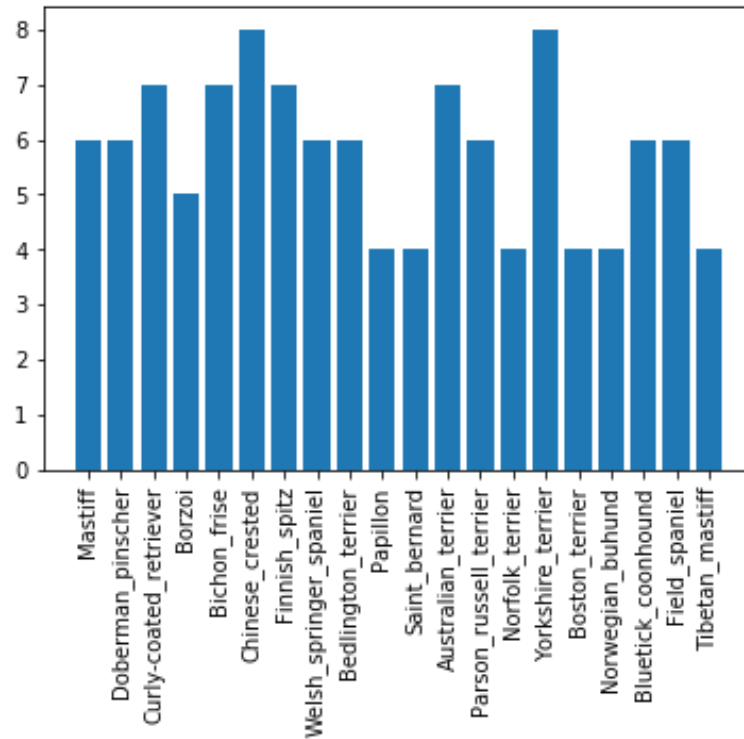
3.1. Bar charts



Number of images of first 20 dog breeds (Train set)



Number of images of first 20 dog breeds (Test set)



Number of images of first 20 dog breeds (Validation set)

3.2. Shannon entropy as a measure of balance

Shannon entropy,

$$H = - \sum_{i=1}^k \frac{c_i}{n} \log \frac{c_i}{n}.$$

Where k = numbers of classes (here dog breeds),

c_i = number of instances in individual classes (In our case number of images which belongs to a breed)

n = Total number of instances (total images available in dataset)

$$\text{Balance} = \frac{H}{\log k} = \frac{- \sum_{i=1}^k \frac{c_i}{n} \log \frac{c_i}{n}}{\log k}.$$

Here we are analysing imbalance in our dataset by using the above balance formula

The range of the balance function is between 0 and 1(0 and 1 are included), 0 implies imbalanced data, 1 implies balanced data

3.3. Statistical analysis result over dataset

Dataset	mean	Standard deviation	Balance
Test	6.28	1.71	0.99
Train	50.22	11.82	0.99
Validation	6.28	1.34	0.99

4. Solution Statement

Here we are using convolutional neural network for classification of dog's breed. We can start with measuring the accuracy of our model. If it is not acceptable, we can improve our model accuracy by using transfer learning (ResNet50). And also, we are proposing two models for recognition. One using haas cascade feature-based model for identification of human face. For other one we are using VGG16 model(pretrained) for identification of dogs.

5. Benchmark Model

- The convolution neural network must keep accuracy of at least 10%. In our case probability of getting correct answer by a random prediction is 1/133 which is less than 1%.
- The CNN model created by using transfer learning (using ResNet50) must keep 60% above accuracy.

6. Evaluation Metrics

Here the dataset is not properly balanced, some categories of breeds has more images compared to others, so It's an imbalanced classification problem. Here I'm using F1 score, F1-score is the harmonic mean of Precision and Recall and gives a better measure of the incorrectly classified cases than the Accuracy Metric. F1-score is a better metric when there are imbalanced classes as in the our case.

7. Project Design

1. Importing required libraries, and dataset
2. Implement a human face detection model using haarcascades feature based classifier
3. Importing VGG16 model(pretrained), and creates a classifier for dog detection
4. Create a CNN from scratch for classification of Dog breeds
5. For increasing the accuracy of predication, we are creating a CNN using Transfer learning, here it using pretrained model ResNet50 for transfer learning.
6. While user uploading images, it checks three condition
 - i. Is it dog?
 - Predicting the breed
 - ii. Is it human?
 - Predicting the dog breed according to face similarity
 - iii. Neither dog or human?
 - Raising an error

8. Reference

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5. <https://www.pyimagesearch.com/2017/03/20/imagenet-vggnet-resnet-inception-xception-keras/>
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