

Machine Learning Engineer Nanodegree

Capstone Proposal

Carlos Zapapata Huanca
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Dog Breed Classification (CNN)

Domain Background

Thanks to technological advancement in recent decades, increasing computer processing capacity, ML evolves using models that are more accurate and reliable than humans themselves. One of the areas where progress has been most notable is image recognition. It is a discipline that calls my attention by all to the different Applications that it is possible to build. Dog breed Identification was also treated in the ML Kaggle community, launched in 2017 (<https://www.kaggle.com/c/dog-breed-identification>), basically it must be able to identify the breed of the dog according to a provided image, for this applies techniques of classification of images based on CNN. These Convolutional Neural Networks need to be trained with a significant number of samples in order to capture unique characteristics.

After this project, I plan to continue research in order to develop projects that contribute to Health and Medicine, imaging based on comparison of previous diagnoses such as Deep Learning for the Detection of Diabetic Eye Disease:

<https://ai.googleblog.com/2016/11/deep-learning-for-detection-of-diabetic.html>

Problem Statement

The problem consist to determine the breed of a Dog where an image is the input data. It's a problem of Supervised Learning for which Convolutional Neural Network (CNN) how classification model will be used.

The first thing is to make a distinction between a human face and a dog image based on detection and classification algorithms.

The second thing is to be able to determine the breed of a dog given the previous condition, that is to say, firstly to recognize that the image is about a dog.

Datasets and Inputs

The dataset is provided by Udacity, where the Original repo is possible to find on GitHub. It contains 2 directories, associates with Dog Images and human faces.

The Dog images dataset contains 8351 total dog images that are separated into directories to train(80%), test(10%) and valid(10%). Each directory has 133 Sub-directories and each sub-directory is associated with a breed of Dog. Image have different sizes and different backgrounds. Thus also, the number of images in each sub-directory varies (unbalanced).

The Human image dataset contains 13233 total faces of human images, 5749 directories with human names, and each directory can have a different number of images (unbalanced). These images are 250x250 px in size.

The input must also be a image type in order to predict and determine the breed of a dog.

Solution Statement

The first is to be able to determine whether the image is human or not based on Face Detection model of OpenCV, its implementation of Haar feature based cascade classifier.

Then to detect images of dogs is pre-trained using the VGG16 Model.

Once determined that image is about a dog, it proceeds to be classified by Breed, basing in CNN classification Model which process the images and predict matching with one of the 133 breeds provided in dataset.

Benchmark Model

For Benchmark Model, the Convolutional Neural Networks model created from scratch require an accuracy of more than 10%.

The Convolutional Neural Networks model created using Transfer Learning must have an accuracy of more than 60%.

Evaluation Metrics

Accuracy will be used to measure the performance of our algorithm:

$$\text{Accuracy} = (\text{Number of images classified correctly}) / (\text{Total Number of Images})$$

Is a way to test our Model, since we have multiple categories associated to dog breeds. However our dataset is unbalanced, whereby Log Loss will help in evaluate the model.

Project Design

Following we present a general scheme for the implementation of the project:

1.-Dataset.

Udacity provided a repo in GitHub where we find folders of Human faces and dog images

separately (/dogImages and /lfw) , since here we will obtain the dataset for train,validation and test our Model.

2.-Human Face Detection.

We are going to use OpenCV model to Human image recognition, model based in Haar Cascade Classifiers to detect human face. It tell us is the image is human or not.

3.-Dog Detection.

In this case we use a pre-trained model (VGG16) to detect Dogs images. Something important is to use GPU for better performance.

4.-Dog Breed Classification.

CNN will be created to Classify Dog Breeds from Scratch. Test accuracy must be of at least 10%.

CNN will be created to Classify Dog Breeds using Tansfer Learning. We will use ResNet152 as Model Arquitecture and obtain at least 60% of accuracy.

5.-Predict results.

After having provided a set of images, we should be able to conclude that:

- a.-If the image provided is a dog, the breeds is predicted.
- b.- If the image provided is a human, human is predicted and most similar breed of dog returns.
- c.-Otherwise indicates error.

Then we will be trying to experiment with different model parameters to get better results.

References:

- Project Repo in GitHub: <https://github.com/udacity/deep-learning-v2-pytorch/tree/master/project-dog-classification>
- ResNet152: <https://pytorch.org/docs/stable/modules/torchvision/models/resnet.html#resnet152>
- Pytorch docs: <https://pytorch.org/docs/master/>
- CNN: https://en.wikipedia.org/wiki/Convolutional_neural_network
- Kaggle-Dog breed identification: <https://www.kaggle.com/c/dog-breed-identification/overview/description>