

# Machine Learning Nanodegree Capstone

## Dog Breed Classifier

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29-Oct-2020

### 1. Domain Background

Classification is a well-known problem in Machine Learning environment. It could be applied in many different areas such as cars type/model classification, dog breed classification etc...

In this project the problem is to identify a breed of dog after an dog image input. Given an image of a dog, algorithm is supposed to identify an estimate of the dog breed.

### 2. Problem Statement

The algorithm has to perform two main tasks:

- **Dog face detector:** The algorithm is supposed to identify breed of a dog which is given as input.
- **Human face detector:** The algorithm is supposed to identify breed of a dog even if the input is a human image.

### **3. Datasets & Inputs**

Udacity provides Datasets. There two main datasets:

- Dog dataset: contains 133 breeds and total 8351 dog images. The images are of different sizes and different backgrounds and data is not balanced because the number of images provided for each breed varies.
- Human dataset: contains 13233 total human images and first and last name of the person in the image.

The human dataset will be used to detect human faces in images using OpenCV's implementation of Haar feature-based cascade classifiers. The dog dataset is used to detect dogs in images using a pre-trained VGG-16 model.

### **4. Solution Statement**

Convolutional Neural Network (CNN) has been used to perform a multiclass classification. CNN is a Deep Learning algorithm where we need to feed high amount of image as input so that differentiate one image from another. Solution steps as below:

- To detect human images by using OpenCV and Haar feature based cascade classifier.
- To detect dog images by using pre-trained VGG16 model.
- After identification of dog/human, CNN process the image and give a prediction among 133 dog breeds.

## **5. Benchmark Model**

For our benchmark model, we will use the Convolutional Neural Networks (CNN) model created from scratch with an accuracy of more than 10%. This should be enough to confirm that our model is working because random guess would be 1 in 133 breeds which are less than 1% if we don't consider unbalanced data for our dog images.

## **6. Evaluation Metrics**

Accuracy will be the main metric used to test both the benchmark model and the solution model.

## **7. Project Design**

The solution designed for this project will follow these steps:

- Step 0: Dataset exploration (import necessary datasets)
- Step 1: Detect Humans using Haar feature-based cascade classifiers (OpenCV)
- Step 2: Detect Dogs using a pre-trained network (VGG16 model)
- Step 3: Create a CNN to classify dog breeds (train, validate and test the model)
- Step 4: Create a CNN to classify dog breeds using Transfer Learning architecture.
- Step 4: Write a custom algorithm that accepts an image and determines if image contains a human or a dog.

- Step 5: Test the algorithm with some random images.

## 8. References

- [https://en.wikipedia.org/wiki/Convolutional\\_neural\\_network](https://en.wikipedia.org/wiki/Convolutional_neural_network)
- <https://www.kaggle.com/c/dog-breed-identification/overview/description>
- <https://github.com/udacity/dog-project>
- <https://www.kdnuggets.com/2018/04/right-metric-evaluating-machine-learning-models-1.html>
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