Dog breed Identifier Application

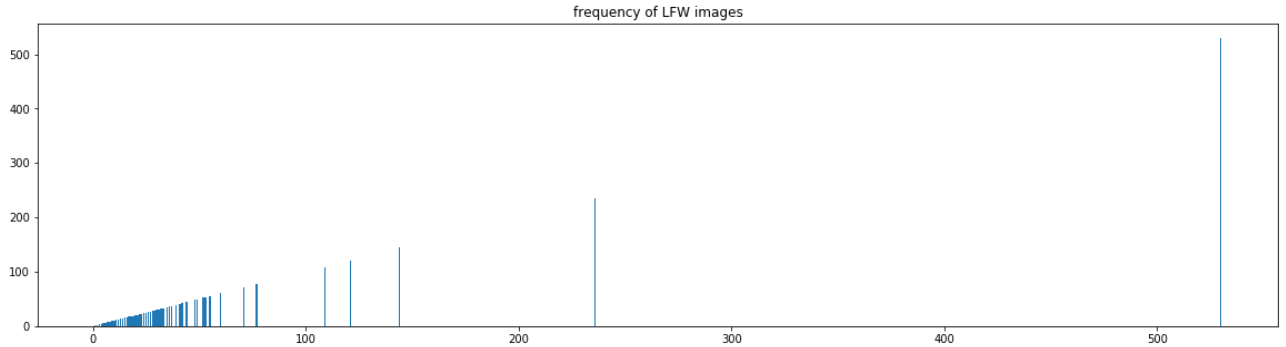
Domain Background: Image Classification and Transfer Learning. This work involves dog breed classification using some state of the art models of image classification algorithms trained on ImageNet dataset. The dog breed identifier algorithm is tested on different algorithms and their performance is compared.

Problem statement: This project involves classifying whether an image is that of a dog or not and if it is a dog, identify the breed of the dog.

Datasets and Inputs: This work would be carried out using pertained machine learning models (e.g. VGG16, RESNET, AlexNET, Inception v3 etc) trained on ImageNet dataset with up to 1000 classes. Also, the dog and human datasets available from the notebook workspace would be used to also train models from scratch and results and performance would be compared with existing state of the art pretrained models. The images of the dogs and humans are shown below in the next page. The shape of the human images are 224*224*3 while the shape of the dog images vary. The dog images shown below have been resized to be the same as 224*224*3 which is the expected input size for VGG16. The distribution of the count of unique faces is shown below.

Number of Human faces: 13233

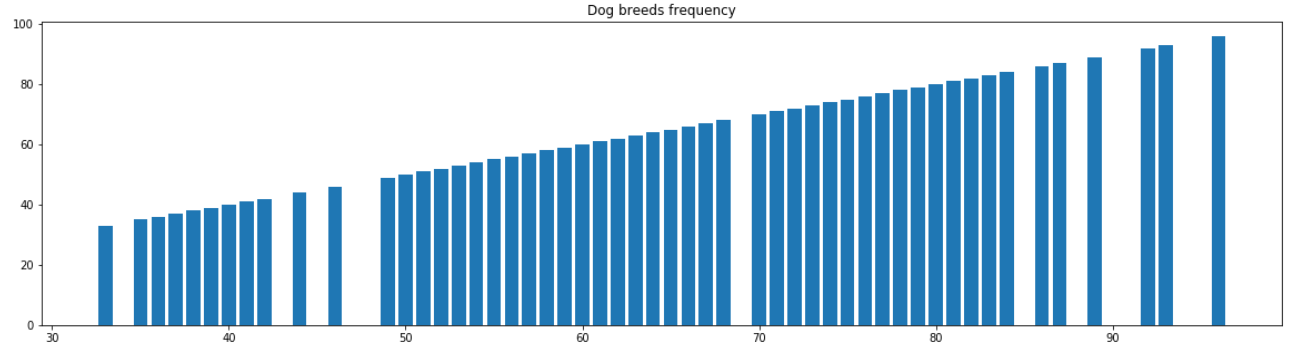
Count of Unique human faces : 5749



It was observed that the human faces is highly unbalanced and that **George Bush** has the highest number of available images of 536.

The dog images are distributed into three samples of train, test and validation sets. The total number of unique classes in the whole image is 133. The frequency distribution is as shown below.

Dog Images	**Frequency**
Train	6680
Validation	835
Test	836



Evaluation metric: The metric to measure performance should be finding the amount of correctly classified images. Basically, this is the accuracy. Other metrics like F1 score can also be used which is the weighted average of the precision and recall.

Solution Statement: The solution is to design an end to end computer vision popeline where users can upload an image to web interface and the use would et an output of the dog breed and if it is a human that is uploaded, the algorithm should tell that it is human and which particular dog breed it resembles.

A benchmark model: The benchmark to assess the quality of this work against is the modified deep neural network in a work by Aydin and Sahand as described here. The reported accuracy from the paper on different modified state of the art models vary from 82% to 89.66. State of the art models achieved the following for example: DenseNet-121:74.28% DenseNet-169:76.23% GoogleNet:72.11% ResNet-50: 73.28%. Thus, with data augmentation and fine tuning to be done in this work, it is expected that the accuracy that would be gotten would be more than 75% at least.

Project Design:

- Import Datasets
- Data Preprocessing: in this stage, an approach like data augmentation would be used to balance the datasets. This involves randomly rotating the same image, bluriing, translating it to cater for the highly underrepresented classes in the images.
- Fine tuning of the pretrained model. Since our pretrained model was trained on 1000 classes and we do not have up to that amount of data in this work, we would fine tune the last classification layer of the model by modifying the number of output, weights and biases of the feedforward layers.
- Detect Humans in Images: This can be done with Viola Jones algorithm using existing haarcascades classifiers. Pretrained models like VGG can also be used
- Detect Dogs
- Creating a CNN to Classify Dog Breeds from Scratch
- Create a CNN to Classify Dog Breeds using Transfer Learning

- Writing and testing the Algorithm to determine if human, find the dog breed it resembles, and if dog is classified, which breed is it