Project Proposal: Dog Breed Classifier

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Domain Background

Dog breeds can be a confusing especially to anyone who is not a dog owner or a dog aficionado. This is even more so given the number of dog breeds in the world is around 500[1]. We hope that with the use of an application, identification of the breed of the dog would be fast and accurate and can be an educational tool.

Increasingly, people spend more and more time on their phone[2] and our application will return the result in a string along with the confidence of the model for other web developers to be able to consume this data and present this to the user. As proof of concept, we will create a stand-alone application to consume an image and produce a result along with the confidence level.

The applicable technology behind this problem falls in the realm of computer vision. In one of the imagenet competition, a Deep Neural Network as able to beat the human record of 4.94 error rate with their own of 3.5 classification error[3]. Needless to say, computer vision is an avenue where it could augment human's capability to perceive, recognise and detect certain objects in images. Its applicable range from the ubiquitous example of detecting medical anomalies[4] like tumour or other undesirables to the ever-inspiring object detection in self-driving cars and everything in between.

Clearly computer vision has high potential to drastically change human's progress, however it can be argued that computer vision is still in its infancy. Abstract images that can easily be discerned by a child to be just a block of black and yellow stripes is easily mis-classified by computer vision models to be a bus[5]. Nonetheless, its applications in recognising *intended* objects from a *clearly defined set of training images* is useful here in recognising the different breeds of dogs.

Problem Statement

I foresee some problems for this application:

Incorrect classification of dog/human: Dogs may be misclassified as humans or vice versa

Mis-classification of dog breeds: The breed of the dogs may be incorrect classified.

Datasets and inputs

The dataset is available from the Udacity notebook with 13,234 human faces and 8,351 dog faces.

Size of the images varies with the possibility of contamination of other dogs or humans.

Solution Statement

Our goal is to create an application that will output the breed of the dog in the image. If there fails to be something that our model can classify, it will return an error. For fun, we will also return a result even if a human face is presented. We intend to proceed with the following steps:

- Develop and algorithm to detect Humans
- Develop and algorithm to detect Dogs
- Create a Deep Neural Network (DNN) using Convolutional Layers to classify dog breeds
- Use a pre-trained DNN to classify dog breeds (transfer learning)
- Assess accuracy

Evaluation Metrics

Relevant metrics here are:

F1-score: F1 score is the harmonic mean of the precision and recall with a high F1 score only with both high precision and high recall.

Precision and recall both aim to capture the "wrongness" of the correct capture. Precision attempts to capture the "wrongness" as the false positive while recall captures it with a false negative.

Precision: Proportion of true labels over what is predicted true with 1 being all labels are correctly labelled and 0 means the classifier labelled all dog breeds incorrectly as false positives.

Recall: Proportion of true labels over what is actually true with 1 being all labels are correctly labelled and 0 means the classifier labelled all dog breeds incorrectly as positives.

Project Design

I intend to construct a neural network which is best suited for images to classify and label the images correctly. This includes making a human face and dog face detector, creating a CNN model and using a pre-built model to classify both in an image and then testing them.

Links

1-Dog breed: https://petkeen.com/how-many-dog-breeds-in-the-world/

2-Phone usage: https://www.bbc.com/news/technology-59952557

3-Computer vision error rates: https://venturebeat.com/2015/12/10/microsoft-beats-google-intel-tencent-and-qualcomm-in-image-recognition-competition/

4-Applications of computer vision in healthcare: https://www.himss.org/resources/value-computer-vision-healthcare

5-Misclassifications of state of the art AI models: https://www.wired.com/2015/01/simple-pictures-state-art-ai-still-cant-recognize/