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Dog Breed Classifier with CNN

Capstone Project

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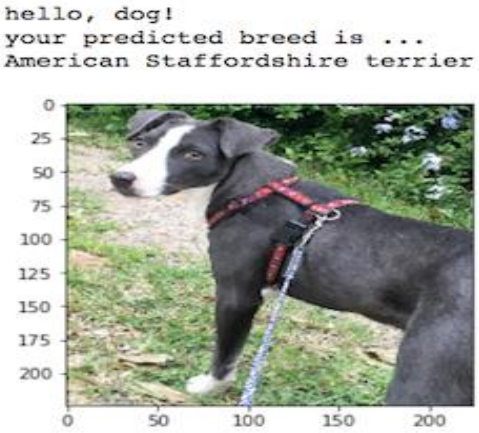
Project Overview

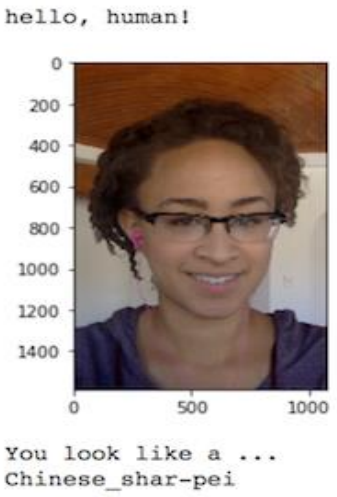
The goal of the project is to build a machine learning model that can be used within web app to process real-world, user-supplied images.

The algorithm has to perform two tasks:

1. Given an image of a dog, the algorithm will identify an estimate of the canine's breed.

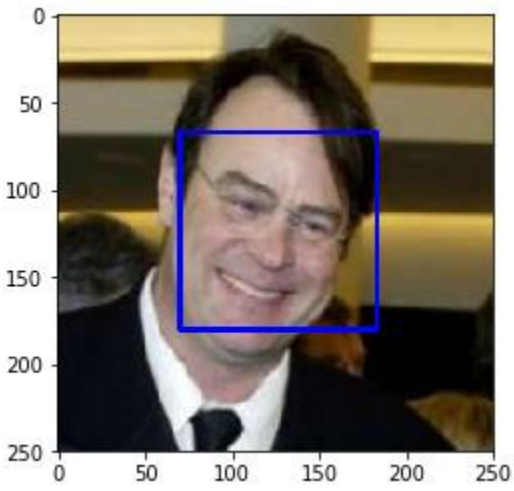


2. If supplied an image of a human, The code will identify that it is a human and find the corresponding dog breed that the human is associated with



Convolutional Neural Networks are used to classify the breeds of dogs and humans. The solution involves three steps:

1. To detect human images, we can use existing algorithm like OpenCV's implementation of Haar feature based cascade classifiers.
2. To detect dog-images we will use a pretrained VGG16 model.
3. After the image is identified as dog/human, we can pass this image to an CNN model which will process the image and predict the breed that matches the best out of 133 breeds.



Dataset Import

- Download the dog dataset here : https://s3-us-west-1.amazonaws.com/udacity-aind/dog-project/dogImages.zip
- Download the human dataset here : https://s3-us-west-1.amazonaws.com/udacity-aind/dog-project/lfw.zip

Problem Statement

The goal of this project is to create an app that can classify the images of dogs and predict their corresponding breeds. This can be particularly helpful in identifying stray dogs and helping them find foster homes.

Metrics

The metric of measure is multi class log loss or cross entropy. Once we have the prediction of classes, accuracy is used as a metric to let us know the degree of correct predictions.

Data Exploration

For this project, the input format must be of image type, because we want to input an image and identify the breed of the dog. The dataset has pictures of dogs and humans.

- ***Dog images dataset:*** The dog image dataset has 8351 total images which are sorted into train (6,680 Images), test (836 Images) and valid (835 Images) directories. Each of this directory (train, test, valid) have 133 folders corresponding to dog breeds. The images are of different sizes and different backgrounds, some images are not full-sized. The data is

not balanced because the number of images provided for each breed varies. Few have 4 images while some have 8 images.

- ***Human images dataset:*** The human dataset contains 13233 total human images which are sorted by names of human (5750 folders). All images are of size 250x250. Images have different background and different angles. The data is not balanced because we have 1 image for some people and many images for some.

Refinement

The CNN created from scratch have accuracy of 13%, Though it meets the benchmarking, the model can be significantly improved by using transfer learning. To create CNN with transfer learning, I have selected the Resnet architecture which is pre-trained on ImageNet dataset. The last convolutional output of Resnet is fed as input to our model. We only need to add a fully connected layer to produce 133-dimensional output (one for each dog category). The model performed extremely well when compared to CNN from scratch. **The model accuracy improved to 67%**

Model Evaluation and Validation

Human Face detector: The human face detector function was created using OpenCV's implementation of Haar feature based cascade classifiers. 98% of human faces were detected in first 100 images of human face dataset and 17% of human faces detected in first 100 images of dog dataset.

Dog Face detector: The dog detector function was created using pre-trained VGG16 model. 100% of dog faces were detected in first 100 images of dog dataset and 1% of dog faces detected in first 100 images of human dataset.

CNN using transfer learning: The CNN model created using transfer learning with ResNet101 architecture was trained for 5 epochs, and the final model produced an accuracy of 81% on test data. The model correctly predicted breeds for 680 images out of 836 total images.

Accuracy on test data: 81% (680/836)

Justification

I think the model performance is better than expected. The model created using transfer learning have an accuracy of 67% compared to the CNN model created from scratch which had only 13% accuracy.

Improvement

The model can be improved by adding more training and test data, currently the model is created using only 133 breeds of dog. Also, by performing more image augmentation, we can avoid overfitting and improve the accuracy. I have tried only with ResNet 101 architecture for feature extraction, May be the model can be improved using different architecture.

References

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