Machine Learning Engineer Nanodegree

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Dog Breed Classification

Capstone Proposal

Domain Background

The requirement of this project is the classification of the different dog breeds. I've chosen the dog breed identifier amongst the proposed projects, because it attracted me the most also is a known topic amongst the community for machine learning .The benefit of the dog breed problem is the high availability of labeled datasets which can be used for training and validation of the model. A quick search on github. and kaggle provide lots of sources.Also I must admit that it is the most supported task on Udacity's site.And i also searched for an academic research related to this problem and found this amazing paper it called "Dog Identification using Soft Biometrics and Neural Networks " you can read it from here

Problem Statement

The aim of the project is to build a pipeline to process real-world, user-supplied images detects whether the image contains a human, dog, or neither After a detection process, we could have the following: 1-If the detected image is a dog , return the predicted breed. 2-If the detected image is a dog , return should identify the human. 3-Neither detection in the provided image, provide an output that indicates an error

Datasets and Inputs

The data consists of two different sets, provided by **Udacity** are described as follows: Dog dataset is already divided into three different datasets (folders) for test, training and validation. Each folder contains sub directories of the specific formating DDD.breed name, where DDD represents a 3 digit number, followed by the breed name after a dot. Each subfolder contains a hand full of images of the specific breed. 1Overall there are 133 different dog breeds, and 835 images provided for validation, 6680 images for training and 836 images for testing. The images within the training dataset are **unbalanced**, the amount of images per breed varies from 26 for the Norwegian Buhund and the Xoloitzcuintli to 77 for the Alaskan Malamute. So some breeds are represented roughly 3 times more often. The dog images contain a singular dog each, mostly of the whole dog, sometimes only of the snout, but they are not equally sized, they vary from 5 kB up to 5 MB. Their aspect ratios cover all ranges between portrait, landscape and quadratic. Human dataset consists of 13233 images of 5749 persons, which are stored in a separate directory named after each celebrity. The images of the people are already cropped and centered around their face and all of the same size of 250x250, but the backgrounds vary. Sometimes there are additional people in the background.

Solution Statement

The project will first use OpenCV's implementation of Haar feature-based cascade classifiers to detect human faces from the pictures supplied. Next, a pretrained VGG-16 model with trained weights on ImageNet, an outsized popular dataset for image classification, are going to be wont to detect dogs within the user-supplied images.A CNN model is then built from scratch to classify dog breeds, that is, transfer learning cannot be used just yet. This model should surpass a test accuracy of **10%** set by Udacity because the model is being built from scratch so classifying similar breeds can be a challenge however transfer learning will greatly improve this. Finally, a transfer learning will be used with a ResNet50 model to significantly boost the accuracy of the CNN model. It should be better than the **60%** test accuracy set by **Udacity**.

Benchmark Model

Pre-trained VGG-16 model can be a benchmark model. VGG-16 model, with weights that have been trained on ImageNet (a well-known very large and popular dataset used for image classification and other computer vision problems). Although The CNN model created from scratch must have accuracy of at least 10%. The CNN model created using transfer learning must have accuracy of 60% and more

Evaluation Metrics

In order to work and deal with a multi-class classification problem, the negative log-likelihood loss function will be used as the evaluation metrics. Using the negative log-likelihood loss function as evaluation metrics, the algorithm will calculate each iteration and the distance of a predicted output to the corresponding label. In this manner, the algorithm will learn from it and it will adjust the predictions in order to minimize this distance (that is loss).

Project Design

The solution designed for this project will follow these steps: Step 1: Datasets exploration and check. Step 2: Determines and detect Humans using a Haar feature-based cascade classifiers Step 3: Determines and detect Dogs using a pre-trained network Step 4: Create a CNN for Classification of Dog Breeds (from Scratch) using a LeNet like architecture. Step 5: Create a CNN for Classification of Dog Breeds using Transfer Learning and using a ResNet50 architecture. Step 6: Write a custom Algorithm that accepts a file path to an image and first of all it will determine whether the image contains a human, dog, or neither. Step 7: Test the Algorithm with some random sample images found online.

References

[1] udacity/dog-project: https://github.com/udacity/dog-project [2] Dog Breed Identification | Kaggle, 2021 https://www.kaggle.com/c/dog-breed-identification/overview/description