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Machine Learning Engineer Nanodegree **Feb 11, 20207**

Proposal

Dog breeds Classification

Domain Background:

Automated classification is a very important task to work on and it has been the working field of many people. Classification problems are very interesting since they can appear anywhere and in any field.

When it comes to images, images are one of the most used form of data that people love to use and share. In order to accomplish the task of image classification, we need to use images best friend, Convolutional Neural Networks.

Convolutional Neural Networks (CNNs) are very powerful and robust when it comes to image classification problems and ever since they been introduced they become the standard technique for working with image data.

The goal of this capstone project is to apply Deep Neural Networks techniques specifically CNNs to classify different types of dog breeds.

My personal motivation for working on image classification is my background in image processing and computer vision since I have worked on imaginary data (especially MRIs) in my graduation project. I'm keen to apply my machine learning knowledge to this domain.

Problem Statement:

The main objective of this project will be to use Deep Learning techniques(i.e. Convolutional Neural Networks) to classify dog breeds.

When given an image, first we want to determine if the image contains a dog, if so, we need to return the type of this dog breed. But if the image has human in it we need to return the resembling dog breed for this human. If neither dog nor human was detected, we need to return a message telling so.

Datasets and Inputs:

For this project, we will use the dog dataset. The dataset contains 8351 RGB colored dog images of 133 types (classes, breeds) with **different sizes.**

These images are already split into train, validation, and test subsets where the train and validation folders contain 133 folders each one represents a single dog breed.

And for the test folder, it contains 133 folders too but each one with 5 to 10 images for testing purposes.

Solution Statement:

The proposed solution to this problem is to use and apply Convolutional Neural Network techniques that have proved to be very successful in the field of image classification.

The first step in the solution will be to read the data into data containers(called loaders in PyTorch) so we can access the data whenever we need and supply it to the model for training. The next step will be to train a CNN on these datasets and make it able to predict different dog breeds.

We will use the evaluation metrics described in later sections to compare the performance of these solutions against the benchmark models in the next section.

Benchmark Model:

For the benchmark model, I have used two different models. The first one is the VGG16 model which can detect dogs, and the other model is the ResNet101 model which is trained on the ImageNet dataset. So here we have used transfer learning and I have made some changes to the ResNet101 model so it suits the dataset we have.

Both of these two models have shown that they are very powerful and capable of doing a great job in classification tasks.

Evaluation Metrics:

The evaluation metric for this problem is simply the accuracy scored on the test dataset.

Project Design:

Data Preprocessing (Data augmentation):

Here I have applied several random transformations to the training data in order to add variety to the dataset, reduce overfitting, and make the model regularized.

two transformations will be applied to any image that the model will encounter are normalization which will keep the model's weights small and regularized, and resizing the images to be 224px by 224px.

The dataset was already split into a train, validation, and test datasets, so there is no need to split the data.

Model training and evaluation:

I will start with the simple model architecture first before training and evaluating it. Then iterate this process trying different architectures and hyper-parameters to reach an accuracy score we are happy with.