DOG BREED CLASSIFIER

DOMAIN BACKGROUND

The aim of this project is to identify breeds of dogs from the images provided.Dog breed identification is representative of a set of fine-grained classification problems in which corresponding object parts exist across classes, but the geometry and appearance of these parts vary significantly. dogs are both the most morphologically and genetically diverse species on Earth.
The solution of this problem is also applicable to other fine grained classification problems as well.
The methods used can also help in classifying breeds of cats, horses and other species like birds and plants or even models of cars. In real world an identifier like this could be used in biodiversity studies. These studies may also help veterinarians in various ways like breed specific treatments for stray, unidentified dogs that need medical care.
A lot of work has been done in the field of fine-grained classification [1] [2] [4]. One of the earlier works in fine-grained classification was an attempt at identifying plant species by Belhumeur et. al[3]. This approach involved segmenting a leaf and then using shape to determine the species.More relevantly, however, a 2012 paper by Liu et. al attempted dog breed identification.
This project seems interesting to experiment with as dogs have immense diversity and a very loving natures, also I want to expand my understanding of Image Classification, Neural networks and computer vision.

PROBLEM STATEMENT

To identify an estimate of dog's breed given the image of the dog as input. Ideally our algorithm aims at predicting the breed of given image of a dog.If supplied an image of a human, the algorithm will identify resembling dog breed.

DATASETS AND INPUTS

The datasets and inputs can be downloaded from the links provided below:

1. Dog dataset - dog dataset
2. Human dataset - Human dataset

The dog dataset has total number of 8351 images of dogs with their specified breeds. This data is used to train our model for the dogs breeds.The Human dataset has a total of 13233 images of humans which are used to give the output the breed of dog which is most resembling.
The dogs dataset is split into training and testing datasets in the ratio of 70:30 and then the training dataset is further split into training and validation dataset in the ratio of 80:20.
To add more details to the input data we will also transform and rotate the input images in various directions to give improved results.
The images in the dataset are colored images and so the depth for the convolutional neural network will be 3. Also the classes in the dataset are balanced.

SOLUTION STATEMENT

First, we will train a convolutional neural network on images of dogs and their annotated facial keypoints i.e. eyes, nose, ears, etc. We will use this network to then predict keypoints on an unseen test set of dog images.We will divide the dataset into training and testing datasets for this purpose. The results of the convolutional network will be fed to a binary classifier for training purpose by changing the image array into a vector. The binary classifier will finally give us as output the breed of the dog in the image.

BENCHMARK MODEL

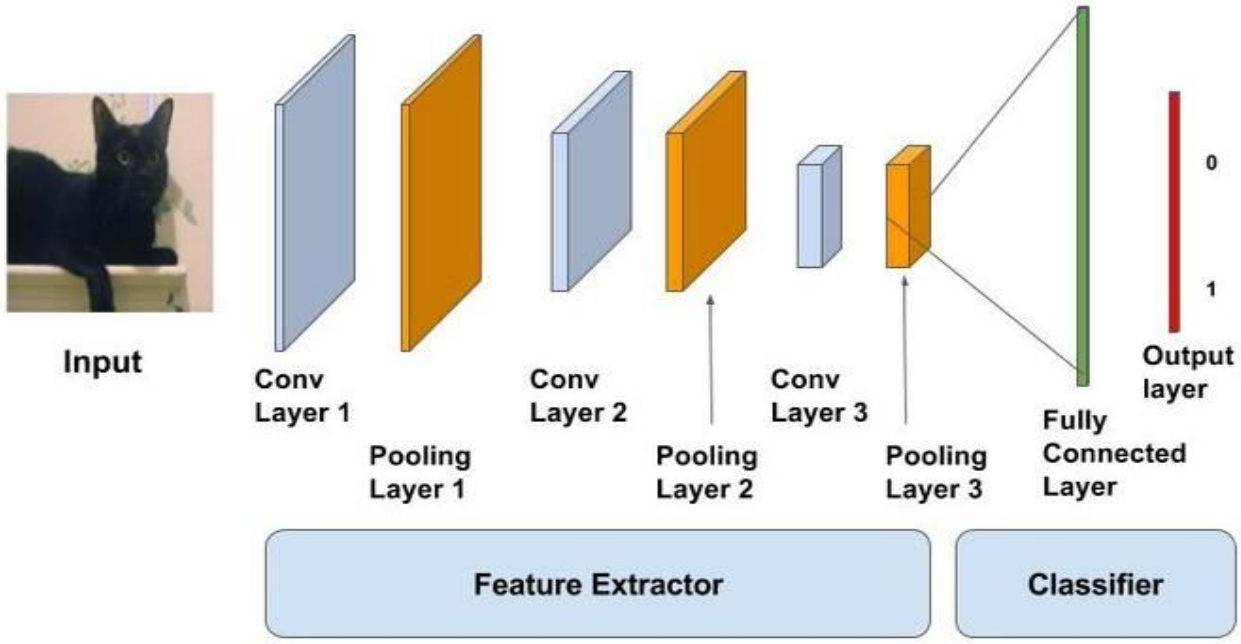
The benchmark model for Dog Breed Classifier is using CNN.
The benchmark model includes feeding the input image to a convolutional network in form of 2D array for grayscale images and for colored images it also includes a depth value of 3 for RGB values.
A convolutional network have three main layers namely convolutional layer, pooling layer and relu activation layer.
The Convolutional layer is the core building block of a Convolutional Network that does most of the computational heavy lifting.
The function of pooling layer is to progressively reduce the spatial size of the representation to reduce the amount of parameters and computation in the network, and hence to also control overfitting.
The relu activation layer standardize the input values by setting some minimum threshold.
The output of convolutional network is fed to the fully computational layer which takes as input the image representation in form of a vector and classifies the input into the specified class labels.

All the layers are defined in the __init__ method and how the data will be treated and forwarded among various layers is defined in the forward method of the model. This function is responsible for defining the feedforward behavior of the model.
This is the basic benchmark model of our project.

EVALUATION METRICS

The evaluation metrics that can be used to quantify the performance of the model is accuracy score on the test dataset.

PROJECT DESIGN



The workflow will go as follows :

1. Data Preprocessing - In this step we do all the changes that are required for the image data to be fed as input to the CNN. This involves resizing the image to a specified square size, changing it into a tensor image and normalizing the image.
2. Data Visualization - This step includes visualizing the dataset for better understanding of the input data. Data is visualized in forms of bar graphs and pie charts using matplotlib library.
3. Training the model - After preprocessing and visualizing the data, we feed this data to the convolutional neural network for feature extraction. Convolutional neural network is designed using three layers i.e. Convolutional layer(extracts the main features of the image in different filters), pooling layer(responsible for minimizing the dimensions of the image by extraction the important pixels from the 2D image array) and relu activation layer(standardize the input using the minimum threshold). The output from the CNN which is in the form of 2d arrays is flattened to provide a vector representation of the image so that this data can be fed to the fully computational neural network. The fully computational neural network then classifies the image data as per the class labels provided.

REFERENCES

[1] N. Z. et al. Deformable part descriptors for fine-grained recognition and attribute prediction. 2013 IEEE International Conference on Computer Vision, 2013.
[2] O. M. P. et al. Cats and dogs. 2012 IEEE Conference on Computer Vision and Pattern Recognition, 2012.
[3] P. N. B. et al. Searching the world's herbaria: A system for visual identification of plant species. 2008.
[4] E. Gavves. Fine-grained categorization by alignments, 2013.