DOG BREED IMAGE CLASSIFICATION

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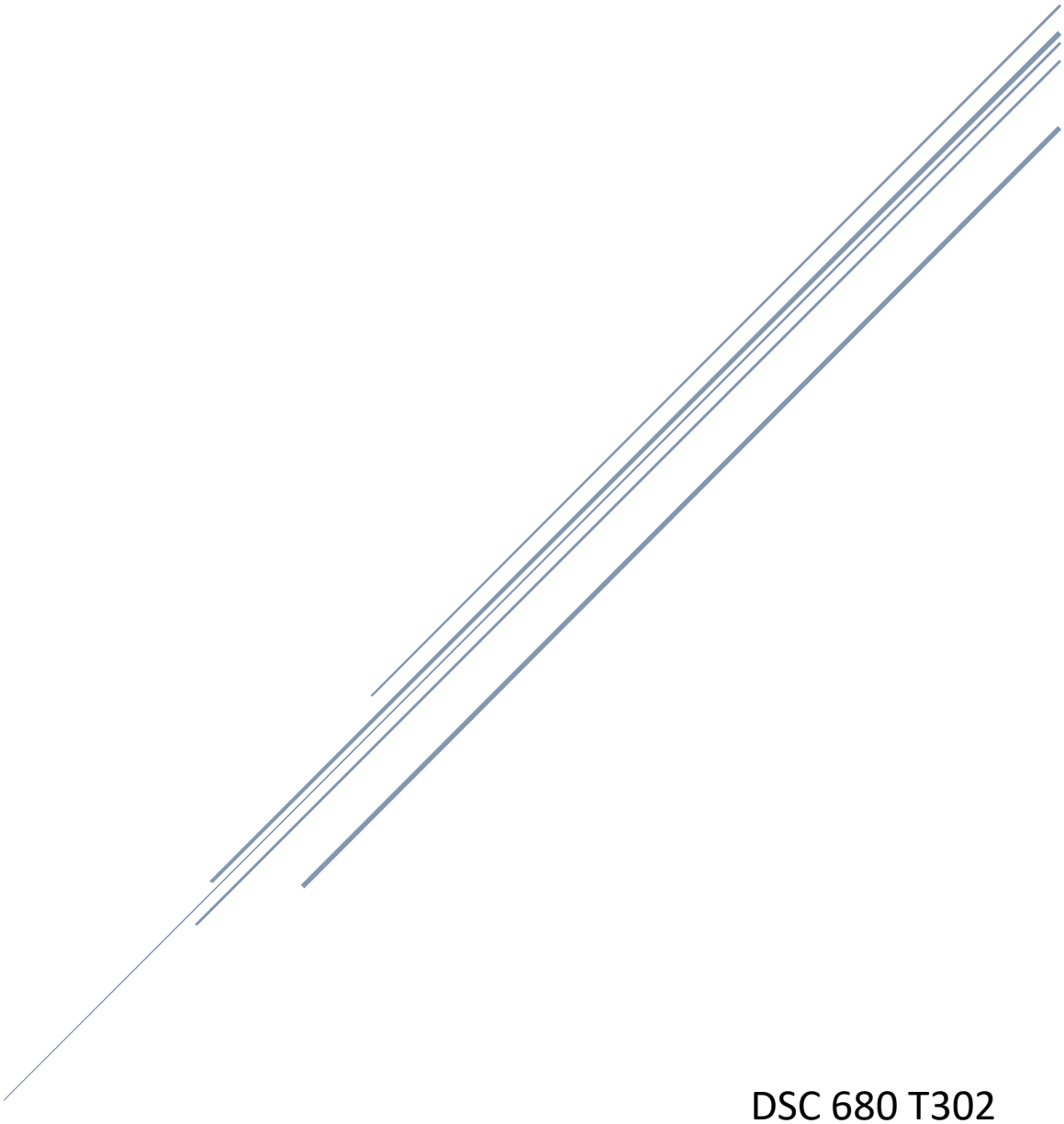


DSC 680 T302
Summer 2021

Abstract

This project will construct an image classification model through neural network modeling. The data set is comprised of 14 dog breeds, with a total of about 700 images of dogs. The model uses Keras through TensorFlow to construct the classification model, that was run with 30 epochs and batch sizes of 32.

The model resulted with an accuracy of 96.9% and a loss of only 0.19, which is very favorable and better than the goal of 95% accuracy. The downside to the model is that it is only trained on 14 breeds of dogs, when there are 195 established breeds of dogs in America. If a user puts in an image of a dog that does not belong to these 14, then it will predict which breed the dog looks the most like out of the 14 breeds given in the data set.

Introduction

Man's best friend is quite a unique species. There are so many breeds of dogs, with many more breeds being established each year. The American Kennel Club currently has 195 established breeds. So, it is plausible that people have a hard time telling different breeds of dogs apart. Luckily, a neural network model can be constructed through data science that can help out with this issue.

This project will assess whether or not a classification model will be able to correctly identify a dog breed, with at least 95% accuracy. This data set is a bit different than other data sets that the realm of data science usually deals with. The data set for this project contains dog images that belong to various breeds. The goal of the model is to assess the image and then determine, based on the training images, what breed that dog in the image belongs to. The data set can be found on Kaggle at the following link: https://www.kaggle.com/abhinavkrjha/dog-breed-classification

Exploratory Data Analysis

Looking at the data, there are only 14 breeds that are included from the download. Some of those breeds contained in the set are Akita, Alaskan Malamute, the American Bulldog, Beagle, Boxer and Bichon Frise. Each of the breeds contains a folder that holds about 50 images of different dogs of that same breed. The images all have the dog at the center focus of the image with a clear view of the dog, and no other notable features in the frame. This is to help the model correctly identify the dog, rather than detect somethings else that is in the image. The images in the data set will be separated into training and test sets to train the model. The worrisome thing about this data set is that it only trains the model on a small portion of the total number of breeds that are established in the United States, with other countries having different breeds and standards of defining breeds.

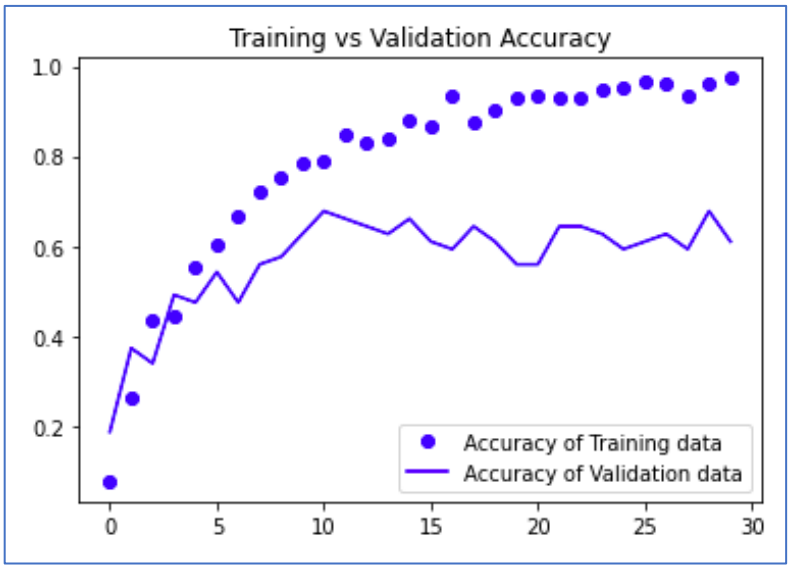
Methods

The method that will be used in this project is a classification model, an image classification model, to be specific. The model will use Keras from TensorFlow to run the data and classify the images in the data set. Some packages from scikit-learn will also be used to make the model run more efficiently and smoothly. The model has dense layers, as well as a pretrained model incorporated to help learn the images that it is running. It is also complied for accuracy. When the model was run, it ran 30 epochs, or rounds of tests, with a batch size of 32 images each for both training and validation data images.

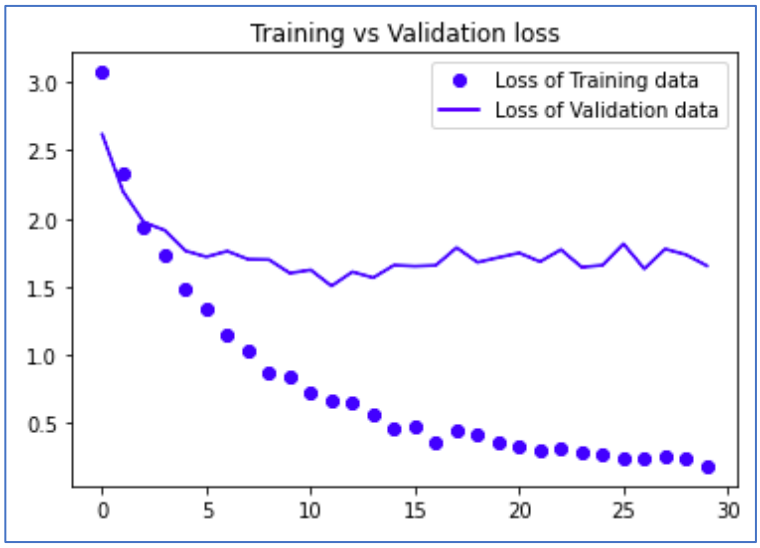
Results

I was very pleased with the results of this model. The model started out at detecting the images with about a 10% accuracy and a loss of 3.12. However, it ended with an accuracy of 96.9% and a loss of 0.19. This is a huge improvement. After running a classification report, each breed had a different value

of accuracy with regards to how it was identified by the model. The total accuracy results, with both the training and validation data, can be shown below:



The total loss results of the model on both the training and validation data can be shown in the graph below:



When testing the model against actual images, one by one, it was able to get the dog images correct by predicting the correct breed that they belong to. This is exactly what the model is supposed to do. I additionally tested an image of a cat to see how the model would react to this type of image. It did take a longer time to classify it than others. When the model was able to produce a prediction, it

identified the cat as part of the Bulldog breed! This was because it was based off of the facial characteristics of a dog.

The same results were produced when the cat image was run against the model again. This means that the model is not pulling a random breed; it is actually analyzing the image and predicting the same breed. It was super interesting to see which breed the model picked due to its analysis because I personally would not have picked the bulldog breed to be the closest looking to the cat.

Conclusion

Overall, this is a successful execution of an image classification model. The model was able to come to an accuracy rate of 96.9% and a loss of only 0.19. All 14 breeds of dogs were run through the model. With the success of this model, users will be able to put in images of dogs to see what kind of breed it belongs to. However, this has some restrictions due to the fact that the model is only trained on 14 breeds, out of the 195 established through the American Kennel Club. So in order for the model to run properly, the dog image must have some resemblance to the 14 types of breeds that the model is trained on.

References

Dog Breed Classification. (2020). Kaggle. https://www.kaggle.com/abhinavkrjha/dog-breed-classification

Dog Breeds. American Kennel Club. https://www.akc.org/dog-breeds/

Keras Applications. Keras. https://keras.io/api/applications/#classify-imagenet-classes-with-resnet50

Questions to be asked from presentation:

1. What benefits from this project?
    a. The benefits to running this classifier can be translated over to any other image recognition software. Even today, some classifiers have a hard time distinguishing between images because it has not been trained off the correct images. Running more classifications models like this can help work out errors found in other models.
2. Why is this project significant?
    a. Along with the benefits to this project, the model produced by this project can assist with owners figuring out what kind of dog that they have for a variety of reasons. This would include health issues that are associated with the breed and personality characteristics. Although this method is not 100% accurate all the time, dog parents can upload their image to this model to get an idea of what kind of breed their dog is to understand those reasons further.
3. What are the risks?
    a. The risk to this project is that an image of a dog is uploaded to the model and it is not one of the 14 breeds that the model is currently trained on. Again, it would not be difficult to train the model on more breeds; however, I do not have the means to include them at this point in the project. There is also the risk of someone accidentally putting in an image that is not a dog, and the model would still return the breed of a dog after an analysis.
4. Would this model be beneficial to other types of data?
    a. Yes, the same structure of the model can be put towards other types of animals like cats, horses, or birds. However, it is not possible to put an image of another type of

animal in this current model of analyzing dog breeds, because it will classify it as a type of dog breed that it has been trained on.