CAPSTONE PROPOSAL

Domain Background

There are governmental forest maintenance organizations in many countries such as IFS in India. These are multi-tier forest Administration whose main job is effective management of forest resources. These organizations would always keep a check on the count of various species of fauna in that specific forest. For this, they will have cameras installed at various locations of the forest, where a personnel would actually sit and watch these camera streams and learn the animal behavior, keep an account on the species living in that forest, count the number of individuals of a species living in that forest. Sometimes these cameras would be damaged by animals. These cameras would be hard-cased. But, that is a different problem. In this proposal we will be proposing an ML method to automate the process of fauna count.

Related Academic Research

Shivaprakash, K.N.; Swami, N.; Mysorekar, S.; Arora, R.; Gangadharan, A.; Vohra, K.; Jadeyegowda, M.; Kiesecker, J.M. Potential for Artificial Intelligence (AI) and Machine Learning (ML) Applications in Biodiversity Conservation, Managing Forests, and Related Services in India. Sustainability 2022, 14, 7154.
https://doi.org/10.3390/su14127154

Problem Statement

With these domain backgrounds discussed above. We will define the problem state. Our main job is to automate the process of counting without human interference. But before jumping into the problem of counting. We should be able to differentiate the species more accurately. In this project we will only be working on species identification of birds. As we all are well aware about the animals, we weren't that much aware about the bird species. Also most of the birds being small, it is very much difficult to classify their species. Our goal in this project is to develop an ML algo to differentiate and identify various species of birds.

Solution Statement

This is a typical classification problem. But with a huge amount of classes. First let us try it with a standard basic ML algorithm such as Support Vector Machine (SVM), see how it performs and check if there is a performance increase if we use CNN model with adam optimizer.

Datasets and Inputs

The datasets for this project were taken from the kaggle datasets. This dataset is really a very large dataset and bringing up a very good accuracy for this dataset is really a challenging task. This dataset consists of images of 510 species of birds. This is a well cleaned dataset. It consists of 81,950 train images, 2550 test images and 2550 validation images. This dataset would be an ideal resource for our problem statement.

Benchmark Model

The benchmark model that we are using is “CNN + MobileNetV2”. This notebook briefly explains the structure of this model. MobileNetV2 is a pre-trained model and on top of it they are using CNN to reduce the image size. This model gives a very good train accuracy of 92% and test accuracy of 84%.

Evaluation Metrics

The only evaluation metric we are going to use is accuracy. This metric alone is enough to check the reliability of the model

Project Design

As the dataset is a well pre-processed one. We don’t want to spend out time on pre-processing. We can directly work on training the datasheet. First we will be using the standard SVM model. We can use ImageDataGenerator from tensorflow to convert the images to tensorflow iterables. Then we can use these iterables to create a numpy array of images. Then we will be stacking this 3D image array as a single linear array. We can then train these linear arrays using the SVM model.

Then we will create a CNN model. Here we will first pass the TF iterable objects into CNN layers and then add dense layers, the activation would be a softmax activation. Then we can use this trained model to predict the images inside the “images to predict” folder of the dataset.