Image Classification: Aves Species

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Abstract

Bird watching is the practice of observing birds in their natural environment. The objective of this project is to assist birdwatchers as well as ornithologists correctly identify different species of birds with ease. To achieve this, we plan on implementing Supervised Machine Learning techniques such as Deep Learning and classification algorithms to develop a model to accurately identify 225 different bird species given an image of a bird.

Introduction

More than 45 million people watch birds around their homes and away from home, according to the findings of the U.S. Fish & Wildlife service [1]. Nowadays, bird species identification is seen as a mystifying problem which often leads to discombobulation and uncertainty. Many people visit bird sanctuaries to look at the birds, while they barely recognize the differences between different species of birds and their characteristics. Understanding such discrepancies between species can increase our knowledge of birds, their ecosystems and their biodiversity.

The identification of birds with bare eyes is based solely on the basic characteristics due to observer constraints such as location, distance and equipment. Appropriate classification based on specific characteristics is often found to be tedious. Even ornithologists have faced difficulties in distinguishing bird species. To properly identify a particular bird, they need to have all the specificities of birds, such as their distribution, genetics, breeding climate and environmental impact [2]. We plan to develop a model which can classify birds solely using images of the birds, thereby eliminating the need of knowing these specificities. In the future this model can also be applied to create a platform that can identify more species of birds which will give additional information such as habitat, conservation status, as well as links to other resources pertaining to that species.

Proposed Project

The dataset which will be used in this project contains 33,566 images of 225 different bird species. All images are 224 X 224 X 3 color images in jpg format. The dataset has been checked and removed of duplicate images and all the images were cropped so that the bird occupies at least 50% of the pixels in the image [3]. The dataset is not balanced since it has a varying number of images per species. However, each species has at least 100 images. We plan to address the dataset imbalance by implementing techniques such as data augmentation.

After dealing with the class imbalance, the next step in the project would be to extract the features of the images. Next, we plan to use these features to train several classification models such as:

1. Convolutional Neural Networks
2. Support Vector Machines
3. Multivariate Logistic Regression
4. Decision Trees

We plan to implement the CNNs using both torchvision's pretrained models as well as implement our own sequential CNN. We also aim to perform hyperparameter tuning on each of the models in order to improve the classification accuracy. We will then compare the performance of these models with each other using various performance metrics and try to justify the results. Additionally, we hope to develop models using ANNs, KNN, and ensemble methods such as XGBoost if time permits.

References

1. U.S Fish & Wildlife Service, "2016 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation", 2016

2. Satyam Raj , Saiaditya Garyali , Sanu Kumar , Sushila Shidnal, "Image based Bird Species Identification using Convolutional Neural Network", June 2020

3. Gerry, "225 Bird Species", https://www.kaggle.com/gpiosenka/100-bird-species