



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 6, June 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118



9940 572 462



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Automated Bird Species Identification Using Audio Signal Processing and Neural Network

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ABSTRACT: In this paper, an automatic bird species recognition system has been developed and methods for their identification have been investigated. Automatic identification of bird sounds without physical intervention has been a formidable and onerous endeavor for significant research on the taxonomy and various other sub fields of ornithology. In this paper, a two-stage identification process is employed. The first stage involved construction of an ideal dataset which incorporated all the sound recordings of different bird species. Subsequently, the sound clips were subjected to various sound preprocessing techniques like pre-emphasis, framing, silence removal and reconstruction. Spectrograms were generated for each reconstructed sound clip. The second stage involved deploying a neural network to which the spectrograms were provided as input. Based on the input features, the Convolutional Neural Network (CNN) classifies the sound clip and recognizes the bird species. A Realtime implementation model was also designed and executed for the above described system.

I. INTRODUCTION

According to the International Union for Conservation of Nature (IUCN), there are nearly 10,000 known species of birds dispersed among a vast range of ecosystems, from the rainforests of Brazil to the icy shores of Antarctica. These species exhibit amazing diversity in terms of behavior and morphology and normal functioning of an ecosystem. But this magnificent biological diversity has been threatened by the recent human activities which range from intrusion into their habitat to complete annihilation of their habitats and this coupled with natural phenomena like global warming and climate change has driven many species to extinction. As many species of birds have become endangered and are near to extinction, many people have no knowledge about the species which are few in number. Thus, application built using this model may be helpful in identifying the endangered species and help society in spreading awareness about the need of all the species for balance in the nature. On a large scale, accurate bird recognition is essential for avian biodiversity conservation. It helps us quantify the impact of land use and land management on bird species and is fundamental for bird watchers, conservation organizations, park rangers, ecology consultants, and ornithologists all over the world. So we come with an idea that help ornithologists to identify bird species.

Motivation

The main Motivation is On large scale, accurate bird recognition is essential for an biodiversity conservation. It helps us quantify the impact of land use and land management on bird species and is fundamental for bird watchers, conservation organizations, park rangers, ecology consultants, and ornithologists all over the world. So we come with an idea that help ornithologists to identify bird species.

Objective

- To achieve Automatic identification of bird sounds without physical intervention.
- As many species of birds have become endangered and are near to extinction many people have no knowledge about the species which are few in number, Thus application built using this model may be helpful in identifying the endangered species and help society in spreading awareness about the need of all the species for balance in the nature

II. LITERATURE SURVEY

Chandu B, Akash Munikoti, Karthik S Murthy, Ganesh Murthy V, Chaitra Nagaraj,” Automated Bird Species Identification using Audio Signal Processing and Neural Networks”

[1] In this paper, an automatic bird species recognition system has been developed and methods for their identification has been investigated. Automatic identification of bird sounds without physical intervention has been a formidable and onerous endeavor for significant research on the taxonomy and various other sub fields of ornithology. In this paper, a two-stage identification process is employed. The first stage involved construction of an ideal dataset which incorporated all the sound recordings of different bird species. Subsequently, the sound clips were subjected to various sound preprocessing techniques like pre-emphasis, framing, silence removal and reconstruction. Spectrograms were generated for each reconstructed sound clip. The second stage involved deploying a neural network to which the spectrograms were provided as input. Based on the input features, the Convolutional Neural Network (CNN) classifies the sound clip and recognizes the bird species. A Real time implementation model was also designed and executed for the above described system.

Vemula Omkarini,” Automated Bird Species Identification Using Neural Networks”

[2] Birds are the warm-blooded vertebrates constituting of class Aves, there are nearly 10 thousand living species of birds in the world with multifarious characteristics and appearances. Bird watching is often considered to be an interesting hobby by human beings in the natural environment. The human knowledge over the species isn't enough to identify a species of bird accurately, as it requires lot of expertise in the field of Ornithology. This paper presents an automated model based on the deep neural networks which automatically identifies the species of a bird given as the test data set. The model was trained and tested for 253 species of birds with the total images 7637 and 1853 images for train and test respectively and the model has shown a promising accuracy of 98 when tested with the test datasets

Mario Lassecc,” Audio-based Bird Species Identification with Deep Convolutional Neural Networks”

[3] This paper presents deep learning techniques for audio-based bird identification at very large scale. Deep Convolutional Neural Networks (DCNN) are finetuned to classify 1500 species. Various data augmentation techniques are applied to prevent over-fitting and to further improve model accuracy and generalization. The proposed approach is evaluated in the BirdCLEF 2018 campaign and provides the best system in all subtasks. It surpasses previous state-of-the-art by 15.8 identifying foreground species and 20.2 considering also background species achieving a mean reciprocal rank (MRR) of 82.7 and 74.0 on the official BirdCLEF Subtask1 test set.



Jiri Stastny* , Michal Munk3 and Lubos Juranek, “Automatic bird species recognition based on birds vocalization “

[4] This paper deals with a project of Automatic Bird Species Recognition Based on Bird Vocalization. Eighteen bird species of 6 different families were analyzed. At first, human factor cepstral coefficients representing the given signal were calculated from particular recordings. In the next phase, using the voice activity detection system, segments of bird vocalizations were detected from which a likelihood rate, with which the given code value corresponds to the given model, was calculated using individual hidden Markov models. For each bird species, just one respective hidden Markov model was trained. The interspecific success of 81.2 has been reached. For classification into families, the success has reached 90.45.

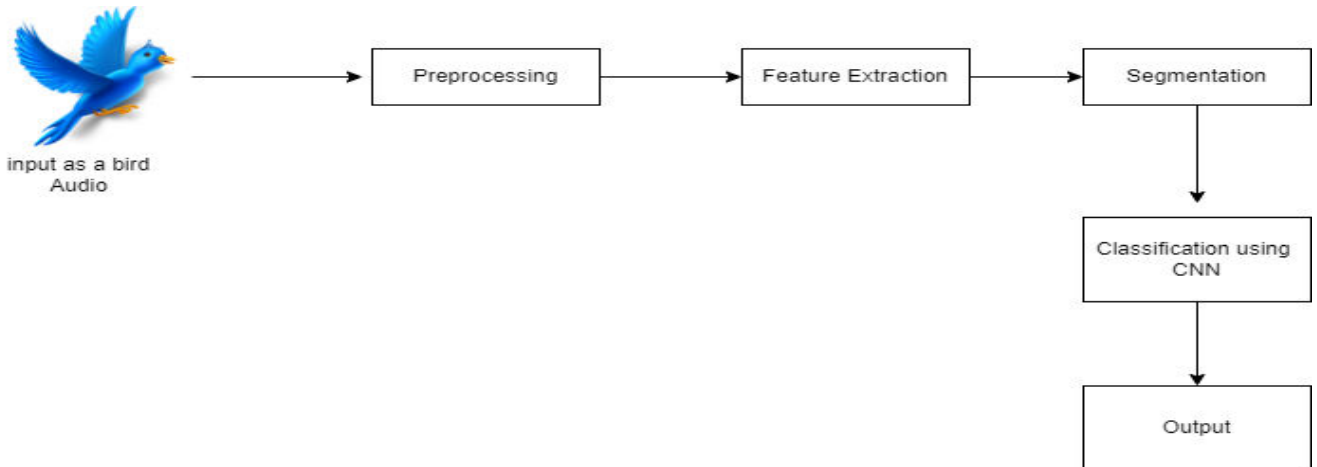
Aarti Madhavi, 2Rajni Pamnani, “ Deep Learning Based Audio Classifier for Bird Species”

[5]The effect of human activities on the environment has reached a point where it has become necessary to track the effects before it causes irreparable damage to the environment. One of the ways to track such effects is to monitor the breeding behaviour, biodiversity and population dynamics of animals. Birds are one of the best species to track as they do tend to be the most reactive ones for any change in the environment e.g., deforestation or forest fires. Till now, the tracking of the birds was done manually by experts, which is very tedious at the same time consuming and non-viable method. As a result to alleviate this issue and provide assistance to the ecologists we proposing a machine learning method to recognize the bird’s species based on the audio recordings. To achieve this goal, we intend to use the state of art convolutional neural network architecture called the deep residual neural networks as compared to the traditionally used classifiers like SMACPY, SVM and other relatively less sophisticated methods. We leverage methods like data augmentation and the existing carefully crafted datasets from Neural Information Processing Scaled for Bioacoustics to show case the effectiveness of our method.

III. PROPOSED SYSTEM

in a propose system we used python using machine learning . in a system we used in our project CNN for image process. instead of recognizing a large number of disparate categories, the problem of recognizing a large number of classes within one category is investigated that of birds. Classifying birds pose an extra challenge over categories, because of the large similarity between classes. In addition, birds are non-rigid objects that can deform in many ways, and consequently there is also a large variation within classes. Previous work on bird classification has deal with a small number of classes, or through voice. These different nodes are compared with the testing dataset and score sheet is obtained from it. After analyzing the score sheet it can predicate the required bird species by using highest score. Experimental analysis on dataset .

SYSTEM ARCHITECTURE



IV. ALGORITHM

A Convolutional Neural Network (CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. CNN are used for image classification and recognition because of its high accuracy. ... The CNN follows a hierarchical model which works on building a network, like a funnel, and finally gives out a fully-connected layer where all the neurons are connected to each other and the output is processed. As the neural network receives an input(tensor) and transforms it through a series of hidden layers. Each hidden layer is made up of a set of neurons, where each neuron is fully connected to all neurons in the previous layer. At each layer, units are organized into 2-D grids called feature maps. The big idea behind CNN is that a local understanding of an image is good enough. The practical benefit is that having fewer parameters greatly improves the time it takes to learn as well as reduces the amount of data required to train the model. In this experiment, unsupervised learning algorithm has been used for developing the system, because the inputted image defined is not known. Also, the data which is given to unsupervised learning algorithm are not labeled, i.e. only the input variables(X) are given with no corresponding output variables. In unsupervised learning, algorithms discover interesting structures in the data themselves. In detail, clustering is used for dividing the data into several groups. In depth, deep learning models used to find vast number of neurons. Deep learning algorithms learn more about the image as it goes through each neural network layer. For classifying Neural Network is used. Figure 2 represents layers of neural networks for feature extraction. The neural network is a framework for many machine learning algorithms. Neural networks consist of vector of weights

V. CONCLUSION

In this work, a system is proposed. The system was able to classify bird species based on the spectrogram image generated from their sounds. Convolutional Neural Network (CNN) classifies the sound clip and recognizes the bird species.

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Impact Factor: 8.118



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