AUTOMATED BIRD SPECIES IDENTIFICATION USING AUDIO SIGNAL PROCESSING

Project Reference No.: *48S_BE_2912*

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Keywords:

Convolutional Neural Network, machine learning, CNN layers, bird sound recognition, spectrogram.

Introduction:

Understanding bird diversity and distribution is essential for informed conservation ef forts. Bird sound recognition, the task of automatically identifying bird species based on their vocalizations, plays a vital role in this process. Traditionally, bird sound recognition relied on expert human listeners or complex spectral analysis techniques. However, these methods are time-consuming, require specialized expertise, and can be prone to errors. Bird sound recognition is a challenging task in the field of machine learning, as it requires the classification of complex audio signals. In this research paper, we propose a novel approach to bird sound recognition using a Convolutional Neural Network (CNN). CNNs have shown great success in image classification tasks, and we aim to leverage their capabilities in the realm of audio signal processing. Our proposed CNN architecture consists of multiple layers of convolutional and pool ing operations, followed by fully connected layers for classification. We employ spectrogram representations of bird sound recordings as input to the CNN, allowing the network to extract features from the frequency domain. By training the CNN on a large dataset of bird sound recordings, we aim to teach the network to accurately classify different bird species based on their vocalizations. We evaluate the performance of our CNN model using a test dataset of bird sound recordings, measuring metrics such as accuracy, precision, recall, and F1 score. Our results demonstrate the effectiveness of the CNN in accurately recognizing bird sounds,

outperforming traditional machine learning algorithms in terms of classification performance. This research paper contributes to the field of bird sound recognition by proposing a CNN-based approach that leverages the power of deep learning for audio signal processing. Our findings show case the potential of CNNs in handling complex audio data and provide a foundation for future research in the development of advanced bird sound recognition systems. Ma chine learning particularly deep learning techniques, offers a promising alternative to traditional methods. Convolutional neural networks (CNNs) have demonstrated remarkable success in various domains, including image classification and speech recognition. Their ability to automatically extract hierarchical features from raw data makes them well-suited for processing audio signals.

Objectives:

1. Determining the bird species by listening to a vocal note is the major objective of the study. Certain experts, like ornithologists, found it difficult to correctly analyse the bird from a picture.
2. Although subject-matter experts can manually classify birds, the process is be coming more time-consuming and arduous due to the volume of data accessible. Accordingly, we will accurately and swiftly identify the birds by utilizing this model.
3. Ensure that the dataset of bird cries and songs is extensive and diversified, encom passing a broad spectrum of species and habitats.
4. Identify pertinent elements from the recorded sounds to depict the attributes of bird calls and songs.
5. Using the collected MFCC features, create and deploy a CNN network to categorize different species of birds.
6. Evaluate the CNN network's performance on a validation set after training it on the prepared dataset.
7. Enhance the model's functionality to get superior precision in identifying different species of birds

Problem Statement

“To develop an automated system that can accurately identify bird species based on their vocalizations in an audio recording, utilizing signal processing techniques to extract key features from the sound data and applying machine learning algorithms to classify the bird species.”

Methodology:

A robust dataset comprising recordings of various bird species is essential for model training. The dataset should be diverse, encompassing different species, geographic locations, and environmental conditions. The process of data acquisition involves the collection of audio recordings in natural environments, which are then used as the basis for developing recognition algorithms and conducting various. Data acquisition methods have evolved significantly due to advancements in sensor technology and recording equipment. With the advent of digital audio recorders and automated sensor networks, data collection has become more efficient and capable of covering larger geographic areas. Additionally, data management and storage are critical aspects, as the amount of audio data collected can be substantial. This requires effective organization, storage, and archiving strategies to ensure the accessibility and usability of the recorded data. In summary, data acquisition is the foundation upon which the exploration of bird sound recognition methods and technologies is built. Now, our dataset has 500 sound clips, which must be divided in to a Train dataset, Validation dataset and Test dataset before being given as input to the CNN in the ratio of 70:10:20. The Train dataset is used to train the network and f it the model. Validation dataset is used to tune the hyperparameters of a model during iterative training. Test dataset is used to provide an equitable evaluation of the terminal model fit on the training dataset. Finally, the dataset can be divided into several segments and cross validation can be used to ensure that the sound clips present in each dataset have equal data representation and distribution from all classes

Scope:

In this project a reliable method for classifying different species of bird based just on their cries. In order to achieve accurate classification, this entails gathering and pre

processing audio data, identifying characteristics, and training neural networks. The initiative intends to advance AI and signal processing technology while supporting environmental monitoring, conservation efforts, and biological research. It can also be used in citizen science, education, and commercial birdwatching tools. In the end, this helps with ecological research, species monitoring, and biodiversity tracking

Purpose:

Raising public knowledge of bird-watching, identification, and in particular the identification of birds found in India, is the main objective behind the creation of the identification website. It also satisfies the need to simplify bird identification, which eases the phenomenon of birding. To develop an enhanced method for recognizing species of bird from their calls, which will improve the research and conservation of avian biodiversity. The study intends to discuss the limitations of conventional methods by merging CNN networks to handle the temporal aspect of bird cries with Mel-Frequency Cepstral Coefficients (MFCC) for exact audio feature extraction. This will help researchers, ornithologists, and bird enthusiasts in their efforts to track bird populations, comprehend avian behavior, and support conservation efforts by enabling more precise and automatic species identification.

Limitations

The limitations of automated bird species identification using audio signal processing include background noise, variability in bird calls, incomplete training datasets, and difficulties in distinguishing between similar species.

Conclusion:

Conclusion CNNs offer a powerful and efficient approach to bird sound recognition, surpassing tra ditional methods in accuracy and ease of implementation. This technology has the po tential to revolutionize bird research and conservation, enabling more comprehensive and informed management of bird populations. Future research directions include exploring the application of transfer learning and incorporating multimodal information to fur ther enhance model performance. Even though there are problems, we've still made big progress in the last few years. As technology gets better and more people collect information, the computer systems that recognize bird sounds

will probably get much better at their job. This will really help in protecting birds and keeping an eye on the environment. It will also help us learn more about how nature works in general.

Future Scope

The goal of this project is to develop a system that can perform accurate and timely bird identification and prediction. It can be used on mobile devices. Through an app, users can record the bird sounds and then it will process the data and return the results. This data will allow us to collect important information about birds, such as their movements across different areas and the number of species in a particular locality