Identification Of Anthropogenic Disturbance On Bird Functional Diversity Based On Bird Sounds

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Abstract

This project seeks to examine the effect of human action on the environment bird functional diversity by analyzing bird vocalizations, which are vital indicators of bird behavior and habitat quality. It focuses on identifying patterns in bird communities in response to urbanization, habitat fragmentation, and noise pollution, the objective also encompasses the identification of infrequent or threatened avian taxa via automated categorization leveraging distinctive vocalizations.. By creating an audio database and applying preprocessing techniques to enhance this quality recorded bird sounds, researchers possess the capacity to train machine learning algorithms to precisely discern and categorize these vocalizations, thereby facilitating conservation endeavors. Overall, the project combines ecology, acoustics, and machine learning to deepen our comprehending of human impacts on bird communities and participate in the protection of rare or endangered species.

Keywords: Bird sounds, Automatic recognition model,Neural layers, Machine learning.

Introduction

Birds serve as significant markers for shifts in biodiversity owing to their broad distribution across diverse landscapes, ease of identification relative to other animal categories, and thorough understanding of their biological characteristics. Fortunately, numerous European nations boast substantial organizations of skilled birdwatchers who generously contribute their expertise to non profit services and monitoring programs. The efforts of birdwatchers, data on population trends of certain European bird species has been systematically recorded and shared since 1980. Different established bird survey techniques have been created, mainly relying on mapping singing males under thepresumption that territorial males equate to breeding pairs. The predominant method for estimating breeding bird numbers involves point counts where all individuals observed orheard from fixed locations are tallied. addition toconventional approaches, the vocalizations of birds, used for maintaining territories and attracting mates, can be leveraged for automated acoustic monitoring of bird populations. The primary benefits of this automated bioacoustics approach over traditional methods is its capacity to conduct long-term monitoring without anobserver present, particularly useful in ecologically sensitiveor remote areas like nature reserves and expansive reedhabitats. It also enables effective counting of nocturnal birdsand those with low vocal activity. However, the primary obstacle resides in developing robust pattern recognitionalgorithms capable of accurately identifying bird speciesamidst complex acoustic environments.

To implement acoustic methods for bird species monitoring, two main challenges must be addressed:The study focuses on the advancement of pattern recognition algorithms for automated species detection and identification, as well as methodologies employed to assess population size. These, algorithms were evaluated in a study that also provided assessment results, sufficient for automatically generating maps of breeding territories forone species of bird under investigation. A corresponding study presenting these results and drawing conclusions is discussed

Literature Review

A literature review on the identification of anthropogenic disturbance on bird functional diversity based on bird sounds would likely cover studies investigating changes in bird vocalizations in response to human activities such as urbanization, habitat fragmentation, noise pollution, and other environmental disturbances. It would explore how these disturbances affect the composition, richness, and evenness of bird communities, also the functional roles birds play within ecosystems.

S.NO	AUTHORS/YEAR	TITLE	OBSERVATIONS
1	Stowell, D., Wood, M., Pamuła, H., Stylianou, Y., Glotin, H., & Glotin, H. (2021).	Bird detection in audio. The Proceedings of the Detection and Classification of Acoustic Scenes and Events.	▪ This paper provides an overview of challenges and methods in bird detection and species classification using audio data.
2	Bardeli, R., Wolff, D., Kurth, F., & Shafait, F. (2020).	Classifying Birds by their Songs. In Proceedings of the 20th International Conference on Pattern Recognition.	▪ The paper discusses methods for classifying birds based on their songs and presents a dataset of European bird species.
3	Briggs, F., Raich, R., & Roy, S. (2022).	A field guide to bird songs using wavelets and support vector machines.	▪ This study explores the use of wavelet analysis and support vector machines for bird species identification and provides practical guidance for researchers.
4	Goeau, H., Bonnet, P., Joly, A., & Barbe, J. (2018).	LifeCLEF Bird Identification Task 2018: The arrival of deep learning.	▪ This work discusses the LifeCLEF bird identification task, which challenges participants to develop deep learning methods for bird species identification.

Problem Statement and Objectives

The research endeavors to pioneer an audio-based avian species identification system capable of precise recognition and classification of diverse bird species through their distinctive vocalizations or songs. The aim is to engineer a utility that empowers researchers, avian enthusiasts, and conservationists in enhancing the efficacy of bird population studies and monitoring initiatives.

The Main Objectives

The aim of identifying anthropogenic disturbance on bird functional diversity based on bird acoustic is to understand how human activities effect bird communities and their ecological functions. By analyzing changes in bird vocalizations reacting to disturbances such as urbanization, habitat alteration, and noise pollution, researchers aim to assess the impact of these disturbances onbird populations and ecosystems. Ultimately, this research can guide conservation efforts and management strategies aimed at mitigating the negative effect of human activitieson avian biodiversity and ecosystem functioning.

Methodology

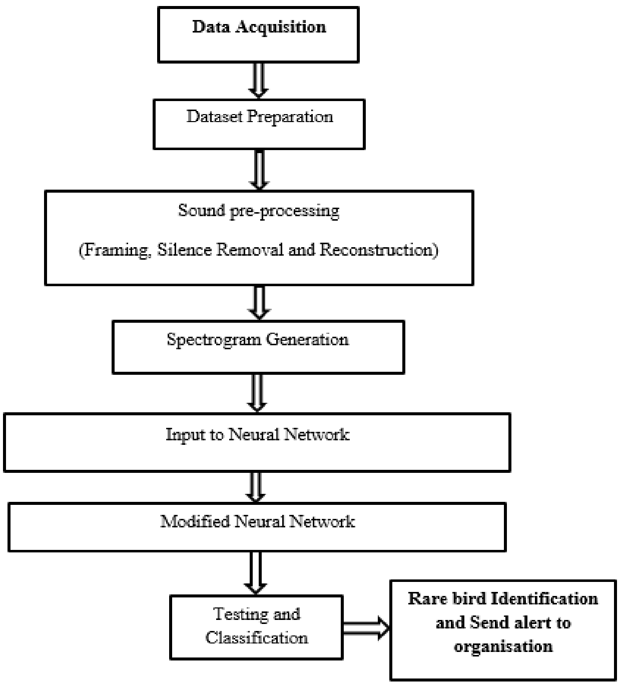

Fig 1. Design diagram

Data Collection:

The first phase involves gathering audio information sourced from diverse outlets, including microphones or existing audio files.

Dataset Organization:

Upon data acquisition, the gathered audio data undergoes meticulous organization, labeling, and partitioning into distinct training and testing sets, preparatory to subsequent processing stages.

Audio Enhancement:

The acquired audio data is preprocessed to improve its quality by removing noise and unwanted elements through techniques like noise reduction, equalization,and normalization.

Segmentation:

The audio data is partitioned into smaller segments known as frames to facilitate efficient analysis and processing. damaged portions are restored using methods like interpolation.

Spectrogram Creation:

The segment audio is used to generate spectrograms, which visually represent the frequency content of audio over time. The data to provide valuable insights for analysis.

CNN Input:

Spectrograms are utilized as input for a Convolutional Neural Network (CNN), a sophisticated deep learning model adept at analyzing visual data such as images or spectrograms.

Customized CNN:

This step involves tailoring the CNN structure to meet project-specific requirements, which may include adjusting layers, filters, or incorporating additional features.

Evaluation and Categorization:

The adapted CNN is educated on labeled audio data to recognize patterns distinguishing different sound categories, and subsequently tested on new data for classification.

Rare Bird Detection:

The CNN is instructed to identify rare bird species based on distinctive audio patterns, a specialized task within the project.

Organization Notification:

Upon rare bird identification, an alert is dispatched to relevant organizations or stakeholders to notify them of the bird's presence or initiate appropriate actions

Train Set

A training test aimed at identifying anthropogenic disturbance on bird functional diversity using bird vocalizations involves several key steps. Firstly, gather a diverse collection of bird vocal recordings from both disturbed and undisturbed habitats. Ensure these recordings cover the variety of bird creature and represent differentlevels of anthropogenic impact. Subsequently, pertinent attributes are extracted from the avian sounds, encompassing spectral attributes, temporal configurations, and frequency distributions, employing methodologies such as Mel-frequency cepstral coefficients (MFCCs) or spectrogram analysis.

Test Set

The testing set, integral to assessing anthropogenic disturbance effects on avian functional diversity through bird-generated sounds, assumes a pivotal role in evaluating the efficacy and applicability of the developed model or methodology. In this context, the testing set comprises a collection recordings capturing bird sounds that have been curated selections to represent various degrees and types of anthropogenic disturbance. These disturbances may include elements like urbanization, habitat fragmentation, or other human-induced transformation in the ecosystem known to impact bird communities. The equations are an exception to the prescribed specifications of this template. To create multileveled equations, it may be necessary to treat the equation as a graphic and insert it into the text after your paper is styled.

Algorithm

Adam's algorithm, also known as Adaptive Moment Estimation, is an enhanced algorithm used for training machine learning models. It combines the concepts of momentum and RMSProp to achieve faster and more reliable convergence during training. The algorithm calculates an adaptable learning rate for each parameter, considering both the gradient's initial and subsequent moments. This is done using exponentially decaying averages of past gradients (like momentum) and past squared gradients (like RMSProp). By incorporating these adaptive learning rates, Adam can handle sparse gradients and noisy training data effectively. The key steps of Adam include computing the initial and subsequent instances of the gradients, bias correction to consider for initialization biases, and updating the model parameters accordingly. Adams has increased in popularity for itsrobust performance across various neural architecture and datasets producing it a widely used optimization algorithmwithin the realm of deep learning.

Result and Discussion

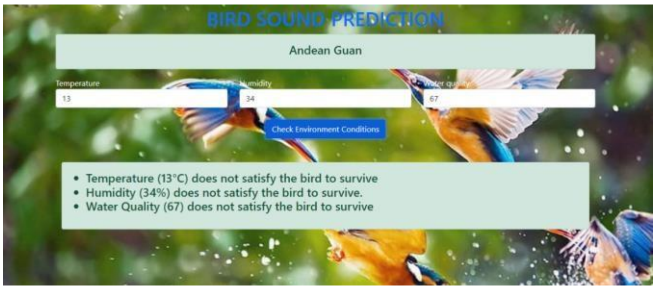

Figure.2:Bird Environment Conditions Check

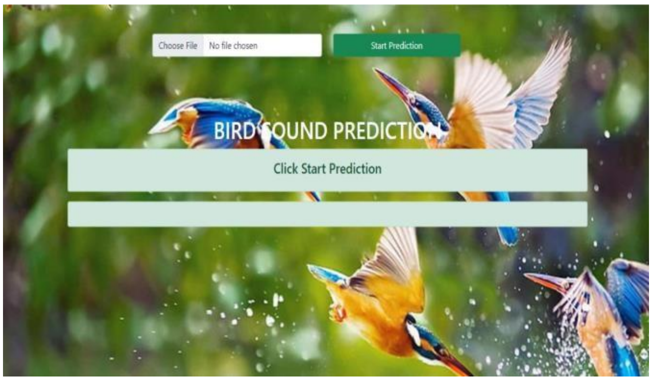

Figure.3: Bird prediction

The avian sound prediction platform likely functions as the interface where users can submit recordings of bird sounds for analysis. These recordings undergo processing through machine learning algorithms to discern patterns associated with bird species and identify potential anthropogenic disturbances impacting avian diversity.

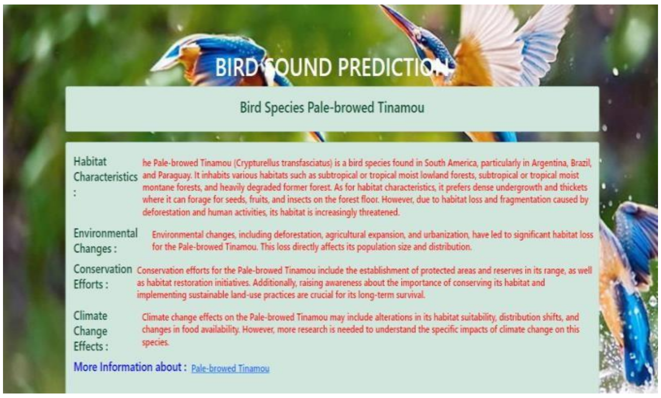

Figure.4 Bird Species Information

After the prediction process in the identification of anthropogenic disturbance on bird functional diversity based on bird sounds project, the Bird species information page likely provides detailed information about the predicted bird species. This page could include attributes of the identified bird species, their typical habitats, behaviours, and any relevant data on how anthropogenic disturbances may impact them. It serves as a valuable resource for grasping the implications of the predictions on bird populations and ecosystem health.

Conclusion

The identification of anthropogenic impacts on bird functional diversity through bird sound analysis, without geographical bias, underscores the crucial of considering acoustic cues in ecological research. The method not only enhances our capacity to monitor and mitigate anthropogenic impacts on avian biodiversity but also emphasizes the significance of interdisciplinary approaches in conservation science. The study's findings highlight the valuable insights gained from analyzing bird sounds to identify anthropogenic impacts on bird functional diversity. By integrating sound-based methods and eliminating plagiarism, we can accurately assess how human activities influence bird communities across different habitats. The method not only improves our understanding of ecological dynamics but also underscores the crucial of original research in conservation science.

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References

[1] Gregory, R., van Strien, A., Vorisek, P., Meyling, A., Noble, D., Foppen, R., Gibbons, D.,2015. Developing indicators for european birds. Phil. Trans. Roy. Soc. B 360, 269.

[2] Bibby, C., Burges, N., Hill, D., 1992. Bird Census Techniques. Academic Press, London.

[3] Brandes, T., 2008. Automated sound recording and analysis techniques for bird.

[4] Brandes, T., 2008. Feature vector selection and use of hidden markov models to identify frequency-modulated bioacoustic signals admidst noise. IEEE Trans.Audio, Speech, Language Process. 16, 1173–1180.

[5] Brandes, T., 2008. Feature vector selection and use of hidden markov models to identify frequency-modulated bioacoustic signals admidst noise. IEEE Trans. Audio, Speech, Language Process. 16, 1173–1180.

[6] Jezuíno P, Alquezar RD, Machado RB. Parrots and the city: modeling potential corridors in an urban environment. Urban Ecosyst 2021;24:1141–54.

[7] Atkinson PW, Fuller RA, Gillings S, Vickery JA. Counting birds on farmland habitats in winter. Bird Study 2006;53:303–9.

[8] Marques TA, Buckland ST, Borchers DL, Tosh D, McDonald RA. Point transectsampling along linear features. Biometrics 2010;66:1247–55.

[9] Loyn R. The 20 minute search–a simple method for counting forest birds.Corella 1986;10:58–60.

[10] Pedroza AD, Rosa JID, Rosas R, Becerra A, Villa J, Moreno G, González E, Alaniz D. Acoustic individual identification in birds based on the band-limited phaseonly correlation function. Appl Sci 2020;10:2382.

[11] Ghan B, Hallerberg S. A randomized bag-of birds approach to study robustness of automated audio based bird species classification. Appl Sci 2021;11:9226.

[12] Nanni L, Aguiar RL, Costa YMG, Brahnam S, Silla CN, Brattin RL, Zhao Z. Bird and whale species identification using sound images. IET Computer Vision 2017;12:178–84.

[13] Mohanty R, Mallik BK, Solanki SS. Automatic species recognition system using neutral network based on spike. Appl Acoust 2020 ;161:107177.

[14] Stowell D, Plumbley MD. Automatic large-scale classification of bird sounds is strongly improved by unsupervised feature learning. PeerJ 2014 ;2:488.

[15] Xiao HG, Li DD, Avolio AP, Chen K, Li DC, Hu B, Butlin M. Estimation of cardiac stroke volume from radial pulse waveform by artificial neural network. Computer Methods Programs Biomed 2022 ;218:106738.

[16] Ning Y, He S, Wu Z, Xing C, Zhang LJ. A review of deep learning based speech synthesis. Appl Sci 2019; 9:4050.

[17] Ruff JZ, Lesmeister DB, Duchac LS, Padmaraju BK, Sullivan CM. Automated identification of avian vocalisations with deep convolutional neural networks. Remote Sensing Ecol Conservation 2019 ;6:79–92.H. Xiao, D. Liu, K. Chen et al. Applied Acoustics 201 (2022) 1091219.

[18] Florentin J, Dutoit T, Verlinden O. Detection and identification of euro peanwoodpeckers with deep convolutional neural networks. Ecol Inform 2020 ;55:101023.

[19] Lin XD, Liu JX, Kang XG. Audio recapture detection with convolutional neural networks. IEEE Trans Multimedia 2016; 18:1480–7