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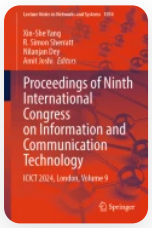

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Abstract

This paper proposes an innovative solution for the conservation and understanding of avian biodiversity in forest ecosystems in Ecuador using deep learning techniques. Preprocessing techniques, including noise signal separation, were applied, and convolutional neural network models were used to extract significant features from Mel spectrograms using data from the forest "La Prosperina". To train the model, an average of 400 samples of bird songs were utilized for each of the six species to be classified, achieving accuracy rates of 99.93% for training dataset and 96.27% for testing dataset, demonstrating exceptional abilities to identify threatened bird species, with positive results represented in a confusion matrix. This approach not only benefits conservationists by providing them with effective and economically viable tools for monitoring bird species and behaviors but also has broader applications.

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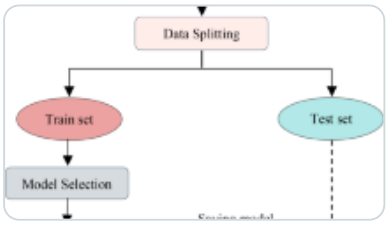

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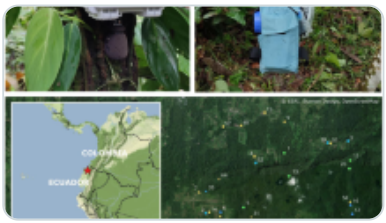

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References

1. Tabur MA, Ayvaz Y Ecological importance of birds, Suleyman Demirel University, Science and Art Faculty, Biology Department, 32260 Isparta, Turkey

Google Scholar

2. BirdLife international (2019) IUCN Red List for birds. [Online]. https://datazone.birdlife.org/species/search

3. Unión Internacional para la Conservación de la Naturaleza (2023) International union for conservation of nature. [Online]. www.iucnredlist.org/es

4. Freile J, Santander T, Jiménez-Uzcátegui G, Carrasco L, Cisneros-Heredia D, Guevara E, Sánchez-Nivicela y B. Tinoco M (2019) Red List of the Birds of Ecuador

Google Scholar

5. ESPOL (2020) Update of the management plan for La Prosperina protected forest

Google Scholar

6. Fagerlund S (2007) Bird species recognition using support vector machines. Eurasip J Adv Signal Process 038637. https://doi.org/10.1155/2007/38637

7. Scott Brandes T (2008) Automated sound recording and analysis techniques for bird surveys and conservation. Bird Conserv Int 18(S1):S163–S173. https://doi.org/10.1017/S0959270908000415

8. Amlathe P (2018) Standard machine learning techniques in audio beehive monitoring: classification of audio samples with logistic regression, K-nearest

neighbor, random forest and support vector machine, master's thesis. Utah State Univ. https://doi.org/10.26076/7e6c-25b1

Article Google Scholar

9. Xeno-canto Foundation (2023) xeno-canto Sharing wildlife sounds from around the world. [Online]. https://xeno-canto.org

10. Swartz BE (1998) The advantages of digital over analog recording techniques. Electroencephalogr Clin Neurophysiol 106(2):113–117

Google Scholar

11. Mierswa I, Morik K (2005) Automatic feature extraction for classifying audio data. Mach Learn 58:127–149

Article Google Scholar

12. Mario L (2018) Audio-based bird species identification with deep convolutional neural networks

Google Scholar

13. Mark F, Rod H (2007) Spectrograms: turning signals into pictures. J Eng Technol 24:32–35

Google Scholar

14. Schrage A (2015) Seeing song: an interview with a partially deaf ornithologist who studies bird song. Tough Little Birds

Google Scholar

15. Zhang B, Leitner J, Thornton S Audio recognition using mel spectrograms and convolution neural networks. Department of electrical and computer engineering, University of California, San Diego

Google Scholar

16. Kaneko T, Tanaka K, Kameoka H, Seki S (2022) iSTFTNet: fast and lightweight mel-spectrogram vocoder incorporating inverse short-time fourier transform. In: ICASSP 2022–2022 IEEE international conference on acoustics, speech and signal processing (ICASSP), pp 6207–6211

Google Scholar

17. Zhang S, Gao Y, Cai J, Yang H, Zhao Q, Pan F (2023) A novel bird sound recognition method based on multifeature fusion and a transformer encoder. Sensors 23(19):8099. https://doi.org/10.3390/s23198099

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18. Kahl S, Wood CM, Eibl M, Klinck H (2021) BirdNET: a deep learning solution for avian diversity monitoring. Ecol Inf 61:101236. ISSN 1574–9541. https://doi.org/10.1016/j.ecoinf.2021.101236

19. Wu S-H, Chang H-W, Lin R-S, Tuanmu M-N (2022) SILIC: a cross database framework for automatically extracting robust biodiversity information from soundscape recordings based on object detection and a tiny training dataset. Ecol Inf 68:101534. ISSN 1574–9541. https://doi.org/10.1016/j.ecoinf.2021.101534

20. Boyer RS, Moore JS (1991) MJRTY—a fast majority vote algorithm, in Automated reasoning: essays in honor of Woody Bledsoe. Springer, Netherlands, pp 105–117

Google Scholar

21. Nayak S, Karande S, Koparde P (2022) Whose hoot? Identification of owl species using call recognition with neural networks. SSRN Electron. J

Google Scholar

22. Şaşmaz E, Tek FB (2018) Animal sound classification using a convolutional neural network. In: 2018 3rd International conference on computer science and engineering (UBMK). Sarajevo, Bosnia and Herzegovina, pp 625–629. https://doi.org/10.1109/UBMK.2018.8566449

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