



Reverse Wavelet Interference Algorithm for Detection of Avian Species and Characterisation of Biodiversity

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INTRODUCTION

- Sound is a *signature* attribute of birds.
- Bird sound is characterized by amplitude and frequency.
- This enables sound to be used as a proxy to identify presence or absence of a bird.
- Digital sonic recorders help in rapid, non-intrusive collection of bird sounds.
- Number of bird species in a site is a reflection of its whole biological diversity.
- Successful identification of number of bird species in a location from sonic records will act as traveller to estimate biological diversity.
- However, identification of bird species from digital sonic record continues to remain a challenge.
- Here we introduce **Reverse Wavelet Interference (REWIN) Algorithm** to effectively identify avian species from sonic data.
- Temporal dynamics of different acoustic indices (Acoustic Complexity, Acoustic Diversity, Acoustic Evenness) of the study site was also computed.
- With 80% accuracy, REWIN stands out as a promising means to rapidly estimate biological diversity in terrestrial landscapes and thereby dovetail directly to contribute to Sustainable Development Goals (SDG).

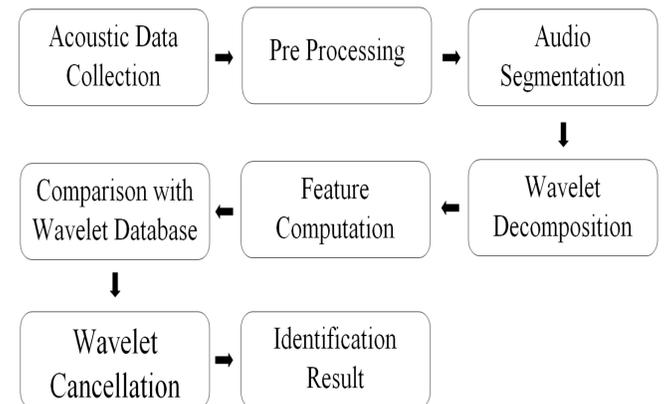


Figure 1. Work Flow

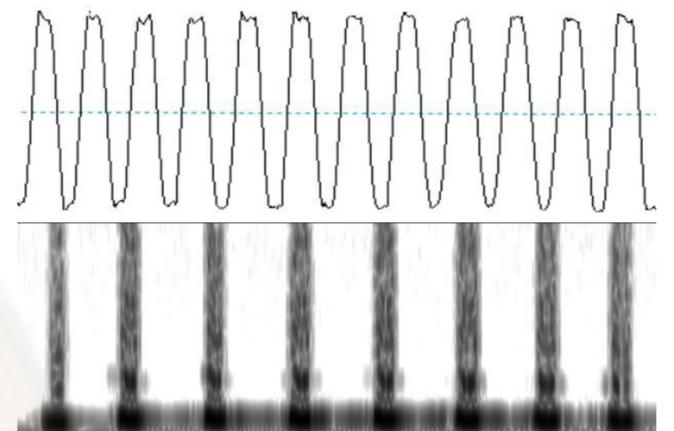


Figure 2. A typical wave form and spectrogram of song pattern of **Greater Coucal**. The maximum amplitude of wave form represented by the trough are almost same.

METHODS

- Acoustic data were collected from two agricultural landscapes at Perumbavoor (10.1319° N, 76.4822° E) and Kollam (9.0017° N, 76.8002° E), Kerala, India during January 2018 using Zoom H1 sonic recorder with a sampling rate of 44.1kHz/16 bit.
- Segmentation of acoustic data containing bird sounds into waveform (set of modulated amplitude and frequencies) - Short time Fourier Transformation . *Each wave form represents an individual vocalization of avian species.*
- Generation of Reverse wavelet for avian species from sonic library.
- Panning of reverse wavelet across the spectrogram of interest.
- Resultant spectra with minimal residual amplitude/ silence [*Indicative of respective species*].
- Sequential analysis of sonic records of species in sonic library - Number of bird species
- Avian diversity Assessment** Diversity of avian species in the study locations were assessed by using phonic metrics: Acoustic Complexity Index (ACI) Acoustic Diversity Index (ADI) Acoustic Evenness Index (AEI) Bioacoustic Index (BI) Normalised Difference in soundscape Index (NDSI)

RESULTS

- REWIN** Algorithm was tested using a sonic database of 10 commonly occurring birds.
- The Reverse Wavelet Interference Algorithm identified 80% of bird species.
- The accuracy of the algorithm was determined by comparing the REWIN output with ground truth (species identification by ornithologist).
- The Acoustic Indices studied shows a strong correlation with avian diversity.

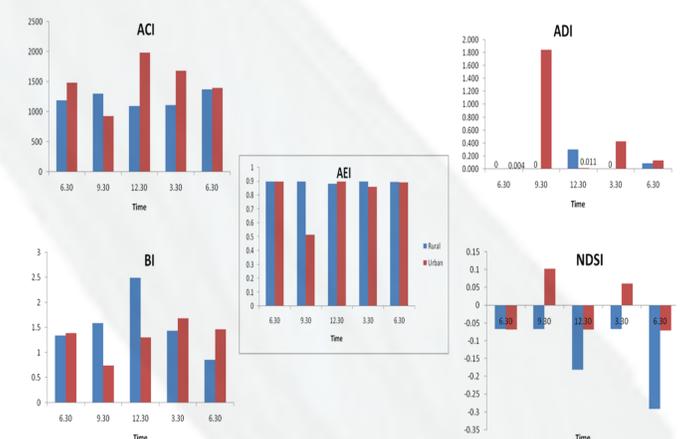


Figure 3. Result of acoustic analysis using Acoustic Indices

CONCLUSIONS

- REWIN is a promising algorithm for accurate identification of birds from acoustic data.
- It enhances the prospect of using acoustic data for rapid assessment of biological diversity.
- Rapid assessment of biodiversity using acoustic indices is a prospective option that can be adopted as means to generate biodiversity indicators of Sustainable Development Goal.