From the lab to the field: integrating bioacoustics and ecoacoustics

Both small- and large-scale work currently drives bioacoustic research: taxonomists may use sounds to identify or describe a single species, while acoustic observatories collect large volumes of data that require automated analysis. In this symposium, we will review the state-of-the-art and provide suggestions for collaboration between researchers working at opposite ends of the scale.

Topics covered will include data collection from observatories, how that data can be analysed (including annotation and identification) and sustainably archived for future researchers. We are fortunate to be experiencing a surge in the rate that acoustic data are collected, which presents both opportunities and challenges. The symposium, therefore, aims to bridge all stages of the data life cycle from collection, through analysis to publication. In particular, we address the problems of dataset annotation and how annotations are shared.

A core topic that symposium speakers will cover is achieving future-proof research. Automated species identification, particularly for less well-studied taxa, is often performed against an ever-changing taxonomy as researchers discover new species and redefine species concepts. A genuinely automatic observatory must, therefore, be adaptable and training sets must be regularly updated to reflect new scientific understandings and bridge the fields of bioacoustics and ecoacoustics.

Session Details (90mins)
Chairs:
Ed Baker: ed.baker@york.ac.uk (University of York; Natural History Museum, London)
Klaus Riede: klausriede@hotmail.com (Museum Koenig, Bonn, Germany)
Tomás Rostirolla: onaiser@gmail.com   (Universidade Federal de Santa Catarina; Arquivo Bioacústico Catarinense, Florianópolis)

Speakers (all talks of 15 minutes, plus 5 minutes for questions):

Ed Baker: Some considerations for automated observatories, from shifting foundations to data permanence

Tomás Rostirolla: Tackling all-taxa acoustic inventories in the neotropics
South America forest comprise some of the most diverse hotspots of biodiversity in the world. Managing such places require integration from diverse specialists, yet knowledge on species information still incipient. We'll explore the ABC endeavour of annotating all acoustic taxa in the Serra do Tabuleiro State Park, the most biodiverse region from south Brazil, and the efforts of sharing finds and information to scientific and professional communities. Thought bird and anuran repertoires are fairly known, an overwhelming activity of insects still poorly understood, revealing clear needs of deeper field and acoustic research.

Paul Roe: (Queensland university of Technology) Designing an Acoustic Observatory
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The Australian Acoustic Observatory will have 400 continuously recording sensors deployed around Australia that will produce over a terabyte of compressed audio each day for five years. We share insights gained through addressing the challenges of designing this system, including site selection, ensuring sensor hardware is robust to harsh conditions for long durations, protocols for deployment and retrieval of recordings, maintaining data provenance, and development of a public repository capable of making the audio discoverable and navigable.

Sarab Sethi (Imperial College London, UK): An exploration of high dimensional acoustic features applied to a real-time monitoring network in Borneo

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Automated acoustic monitoring of ecosystems provides a cost-effective way to track changes in natural system's dynamics across temporal and spatial scales. Current methods of analysing soundscapes in a holistic manner typically reduce chunks of audio data to a single index (or a few indices), broadly based on the entropy of the signal. We find that by adopting a deep convolutional neural net used for general purpose audio classification, we are able to embed the audio in a more descriptive, high dimensional feature space. We apply this technique to a real-time passive acoustic monitoring network based in the tropical forests of Sabah, Borneo. We are able to accurately predict metrics of habitat quality from audio alone using this feature embedding, and show how this is not possible using existing approaches. Additionally, we explore potential applications of this approach to general acoustic anomaly detection.

Klaus Riede (Museum Koenig, Bonn, Germany): From song libraries to corpora: a case study on extracting Orthoptera songs from environmental recordings

Orthoptera are a major component of soundscapes, particularly in tropical and subtropical forests, but also temperate grasslands. However, most acoustic monitoring projects still focus on vertebrates, particularly birds, frogs or bats. Fortunately, many of these recordings are publicly available or are readily shared by the authors, which facilitates re-use for Orthoptera assessments based on song identification. Using ecoacoustic recordings from North- and South America, Malaysia and Greece I demonstrate their usability for Orthoptera monitoring. However, further development of automatic species recognition is hampered by a lack of labelled reference recordings and incomplete song libraries. The Orthoptera Species File could serve as a reference song repository, providing a carefully curated taxonomic backbone, while Bio.acousti.ca could serve as a repository for large labelled corpora, needed for development of automatised song recognition.

Final 10 minutes for questions on the themes of the symposium for all chairs/speakers.