Daniel Gladman

(co-founder of Project Echo), Nov, 2022

Abstract

This short report will survey some potential data sources through literature and internet search. It will provide an appraisal and recommendations for the project with respect to data.

PROJECT ECHO

Literature Review and Data Search

Headlines

* Animal Audio Classification is an emerging field of research
* Animal classification is primarily focused on marine, bird and amphibian datasets
* Publicly available datasets are sparse but repositories of audio data exist where data could be sourced
* Project Echo should aim to quickly harvest any available data to feed its algorithm
* Long-term Project Echo should aim to build its own database of animal sounds and consider a long term vision for having the largest repository to train its algorithm.
* This is not an exhaustive list of resources, but a list that must be reviewed and grown.

Background and Aims:

Project Echo’s vision is to provide tools that will aid conservationists in their efforts to protect and preserve endangered wildlife and minimize the impact of predatory and other destructive fauna. The aim of the project is to develop an AI/ML end-to-end solution to understand the density and classification of noise producing animals in a rainforest. However, to achieve this aim, it is necessary to understand what data is presently available to begin construction of our proof of concept.

This brief report will aim to 1) survey the available literature on animal vocalizations with a particular focus on identifying what data could be utilized by Project Echo, 2) search the internet and identify opportunities to secure data to train our model and 3) based on the outcomes of 1 and 2, provide recommendations for the direction of the project regarding its approach to building data.

Literature Review

Recent Proliferation of research:

Audio classification via machine learning and AI has recently increased in popularity. A systematic review of 68 publications performed by Ekpezu et al (2022) indicate that the number of conference papers and published studies since 2010 has grown exponentially, with most papers being produced in 2018 and 2019. Mutanu et al’s (2022) systematic review of bio-classification and general audio classification yielded 124 publications over 20 years. They also found a similar pattern to Ekpezu et al (2022); that research into this area has grown exponentially starting off in 2018.

Types of audio research

The papers identified by Ekpezu et al (2022) focused on classifying audio from one or more of the following sources: Anthrophony (human sounds), Geophony (environmental sound) and Biophony (animal noise), the latter being the focus of close to half the published research. However, the data used by the included papers tended to focus on marine animals, typically whales and dolphins. On the other hand, Mutanu et al’s (2022) review focused on Bioacoustics and General Accoustics research; the former consisting of 77 publications that aimed to classify animal sounds ranging from birds, insects, and whales. Frog croaks and bird chirps were predominant in the research, however a few studies investigated sound from animal movement, while others investigated bee and mosquito audio. The literature suggests that a broad range of animal species have been investigated, which is good for building a proof of concept. However, whether targeted classification research for specific species/regions that also contain geospatial information remains to be seen.

Prior Data Sources and Availability:

Ekpezu et al (2022) grouped the data sources of their reviewed publications into two categories: 1.) Pre-existing sound datasets: Sound collected from prior experiments/project or public databases, and 2.) Live Recordings: Sound generated with a specific research or project goal in mind. Only 75% of the included publications referenced their dataset, and of those that did, only half reported that their data was publically available.

Mutanu et al (2022) also indicated that most of the bioacoustics research was derived from self-generated data. This means that research is primarily being driven by those who have a particular vested interest in the animal population of interest. There are few publicly available datasets for insects, arachnids and arthropods (Mutanu et al, 2022), however according to Abdollahi et al’s (2022) review into bee classification, bee specific datasets such as BUZZ, Nu-hive and OBSH are claimed to be publicly available. Mutanu et al (2022) report that the majority of datasets include bird, frog, cat, whale and dog data and make the recommendation that more diverse and publicly available datasets will be needed if more progress is to be made in this area of research.

Present Report: Data Search

In accordance with the project plan, an internet search for any available data that could be leveraged by Project Echo was performed. The goals of this search were to provide a list of sources that project members

Methodology

Two approaches were used to search for datasets, 1) Searching individual research papers and determining whether their data is accessible and 2) General search engine queries for animal sound databases.

Research Paper sourced Data

Consistent with the systematic reviews of the literature, many papers are not following open science practices and are protecting their data. However one promising public resource of animal audio data emerged from papers produced by Phillips and Towsey (2018) and Teixeira et al (2019); Ecosounds (n.d.) is a repository of environmental audio recordings that provides publicly sourced annotations of animal sounds in Australia and other parts of the world.

Internet Search

An internet search using the Google search engine using various combinations of terms such as ‘animal sound’ ‘database’ ‘repository’ ‘Australia’ ‘data set’ ‘dataset’, yielded useful results. A non-exhaustive list of promising sources are provided in the appendix to this report.

The challenges for these sources is that data mining and scraping will be required to gain access to the audio files. This will be a required skill in Project Echo going forward.

Other Data Source Opportunities

There remain other possible sources that could be tapped into, these include public github projects, other general sound repositories such as <https://freesound.org/>. However the latter may not contain high quality sound data, but it may be possible to scrape together some audio data from this resource.

Remarks and Recommendations

Audio classification remains an emerging field with plenty of scope for projects like Project Echo to make big contributions in the field. The current literature search yielded only two systematic reviews into animal audio classification written in present year 2022, with at most a few hundred individual relevant studies. It remains to be seen whether any meta-analysis or dataset consolidation has begun to occur, which could be an ongoing opportunity that Project Echo may wish to explore as it continues to evolve. At present, a lot of data appears to be hidden away and made unavailable due to licensing and copyright, which would be a challenge to building a large, consolidated dataset. However, given that most of the present research is built on self-generated datasets, this may be an unavoidable challenge that Project Echo must face into.

In the short term, given the tight 6-week turnaround, it is recommended that Project Echo quickly source as much data as it can to develop the proof of concept. This will involve data scraping some of the previously identified sources and creating a storage system. Going forward, it is recommended that Project Echo begins to develop its own database of animal vocalizations and continue to scour the internet and available literature to grow its database on an ongoing basis.

Another remark is that Project Echo is exploring user cases for its proof of concept, in particular the Wild Otway Initiative, but also others. It is important to note that any external stakeholder of the project may be a potential data source.

This paper does not provide an exhaustive list as it was produced in a short period of time. Therefore, current and future project members are encouraged to use this as a starting resource and identify more repositories and opportunities to source data.

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**Appendix A**

*Table 1. Summary of search engine search for animal audio databases.*

Table

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