Transfer Learning with Semi-Supervised Dataset Annotation for Birdcall Classification

BirdCLEF 2023, Team DS@GT

Anthony Miyaguchi
acmiyaguchi@gatech.edu

Georgia Institute of Technology

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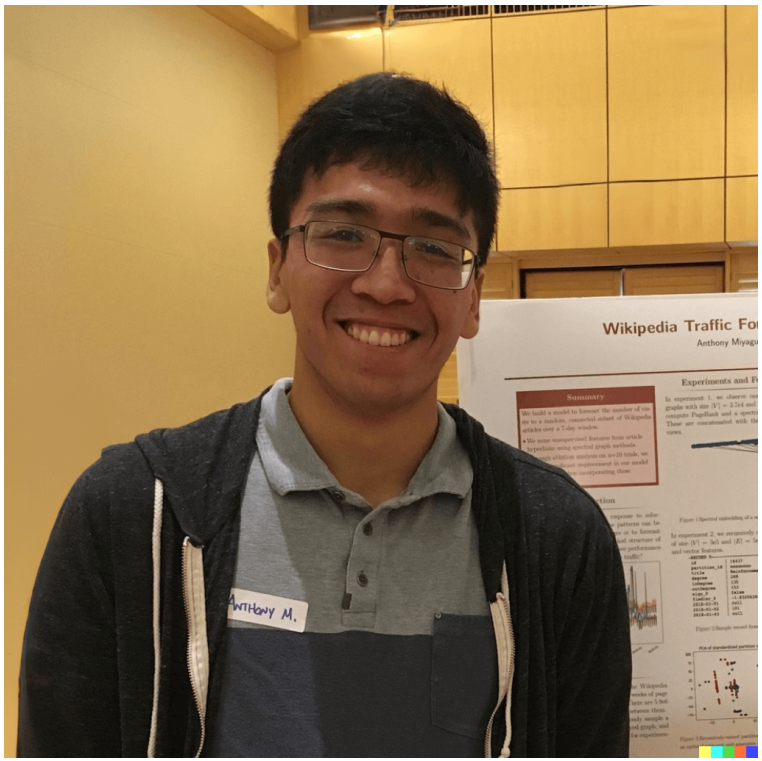
Who am I?



- A Software Engineer
  - 5 years as a Data Engineer at Mozilla
  - 1.5 years as a Software Engineer at Planet Labs
- OMSCS, matriculated Spring 2022
  - B.S. Computer Science and Engineering from UCLA 2016
  - Graduate Certificate from Stanford Center for Professional Development (SCPD) 2018
- Career focus on scalable data systems and machine learning

Overview

TBD

DS@GT Competition Team

Recruitment

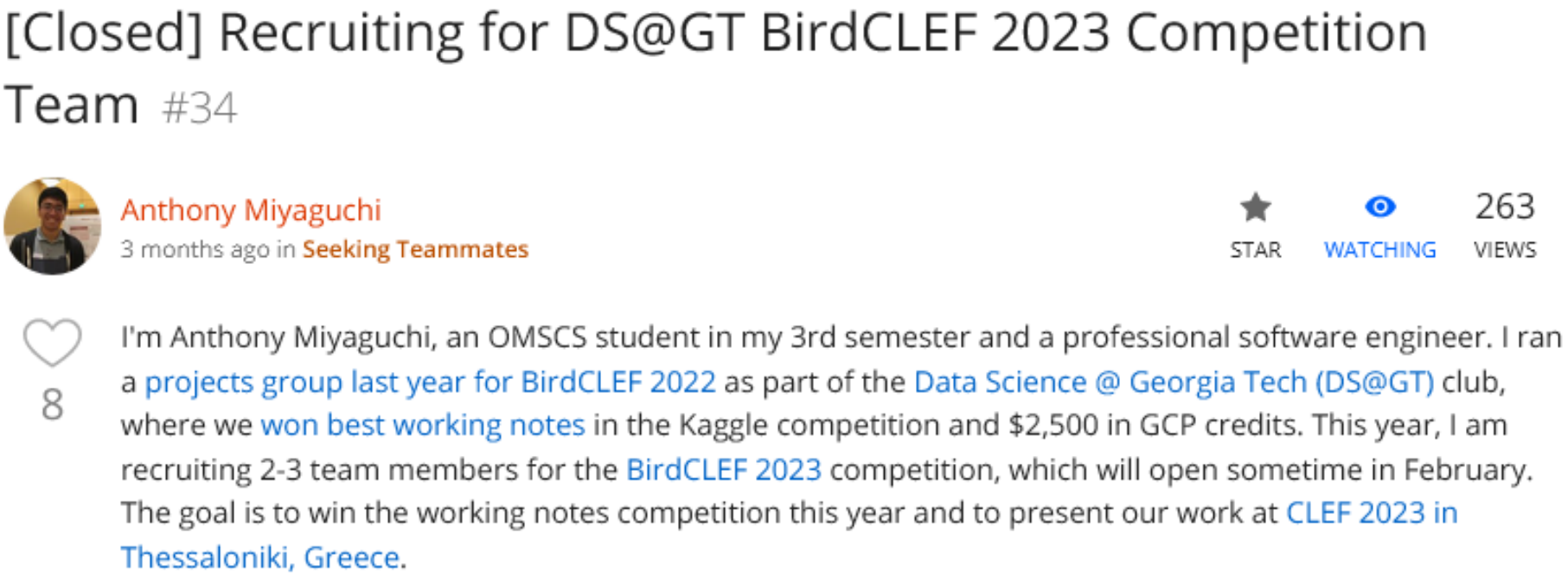
- Built a team of 4 people from DS@GT in Spring 2023
- 3 masters, 1 undergraduate

Technical Approach

- Retrain using embeddings from older models
- Build a process for machine-assisted dataset annotation
- Toy with sequence models (RNNs, Transformers, etc.)

Figure 1: DS@GT: a student-run data science organization

Recruitment: Outreach



[Closed] Recruiting for DS@GT BirdCLEF 2023 Competition Team #34

Anthony Miyaguchi
3 months ago in Seeking Teammates

STAR WATCHING 263 VIEWS

8

I'm Anthony Miyaguchi, an OMSCS student in my 3rd semester and a professional software engineer. I ran a projects group last year for BirdCLEF 2022 as part of the Data Science @ Georgia Tech (DS@GT) club, where we won best working notes in the Kaggle competition and $2,500 in GCP credits. This year, I am recruiting 2-3 team members for the BirdCLEF 2023 competition, which will open sometime in February. The goal is to win the working notes competition this year and to present our work at CLEF 2023 in Thessaloniki, Greece.

Figure 2: A post on the OMSCS Research EdStem board.

Why is audio classification challenging?

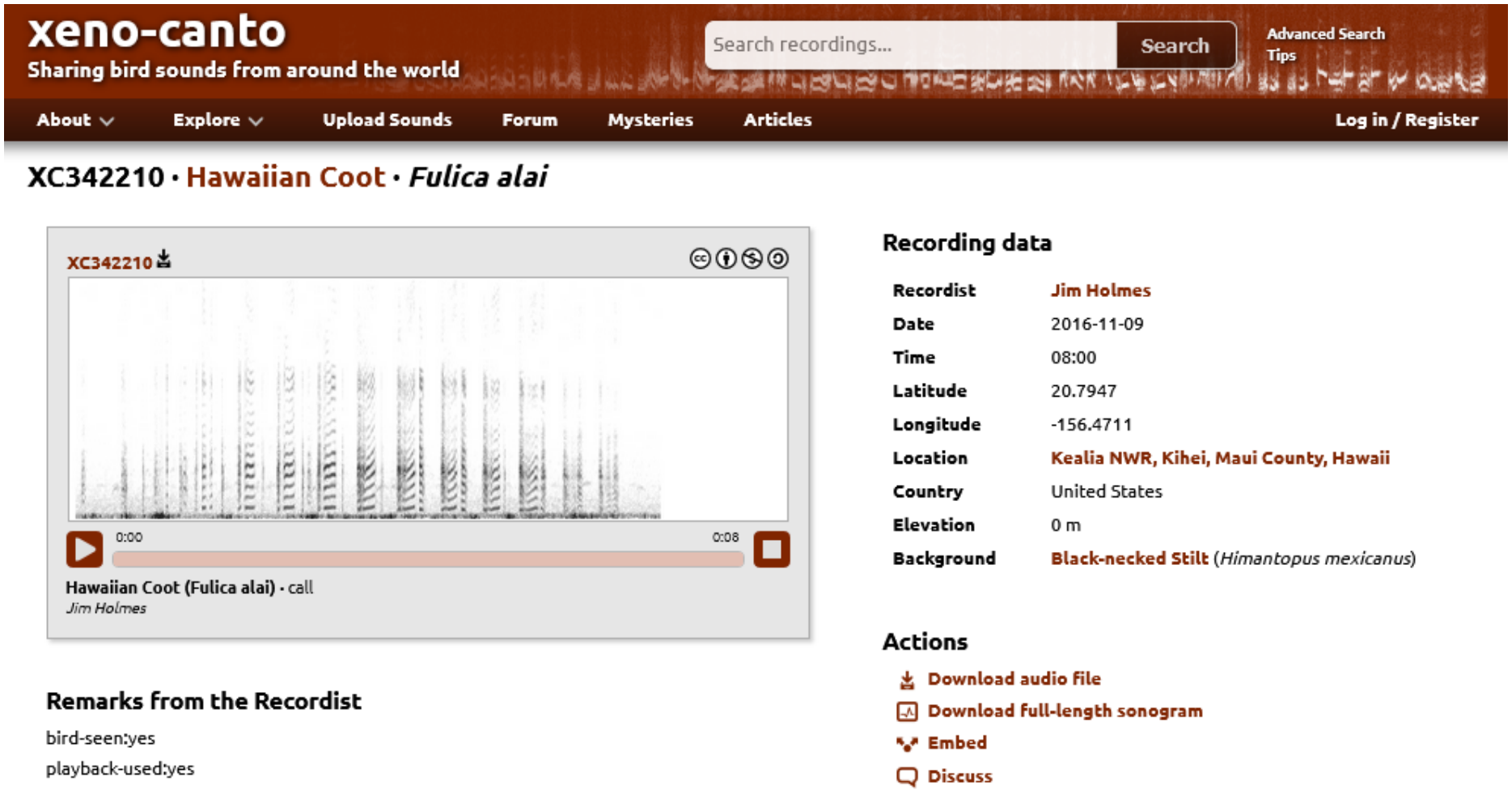


Figure 3: xeno-canto is a crowd sourced database of bird sounds.

Technical approach

Outline

- Building data pipelines with Luigi
- BirdNET embeddings
- Sound Separation with MixIT
- Automated dataset annotation
- Sequence models with embeddings

Reading the literature

Domain specific deep learning model - BirdNET

Kahl, S., Wood, C. M., Eibl, M., & Klinck, H. (2021). BirdNET: A deep learning solution for avian diversity monitoring. Ecological Informatics, 61, 101236.

Sound separation - MixIT

Denton, T., Wisdom, S., & Hershey, J. R. (2022, May). Improving bird classification with unsupervised sound separation. In ICASSP 2022-2022 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP) (pp. 636-640). IEEE.

Building data pipelines with Luigi

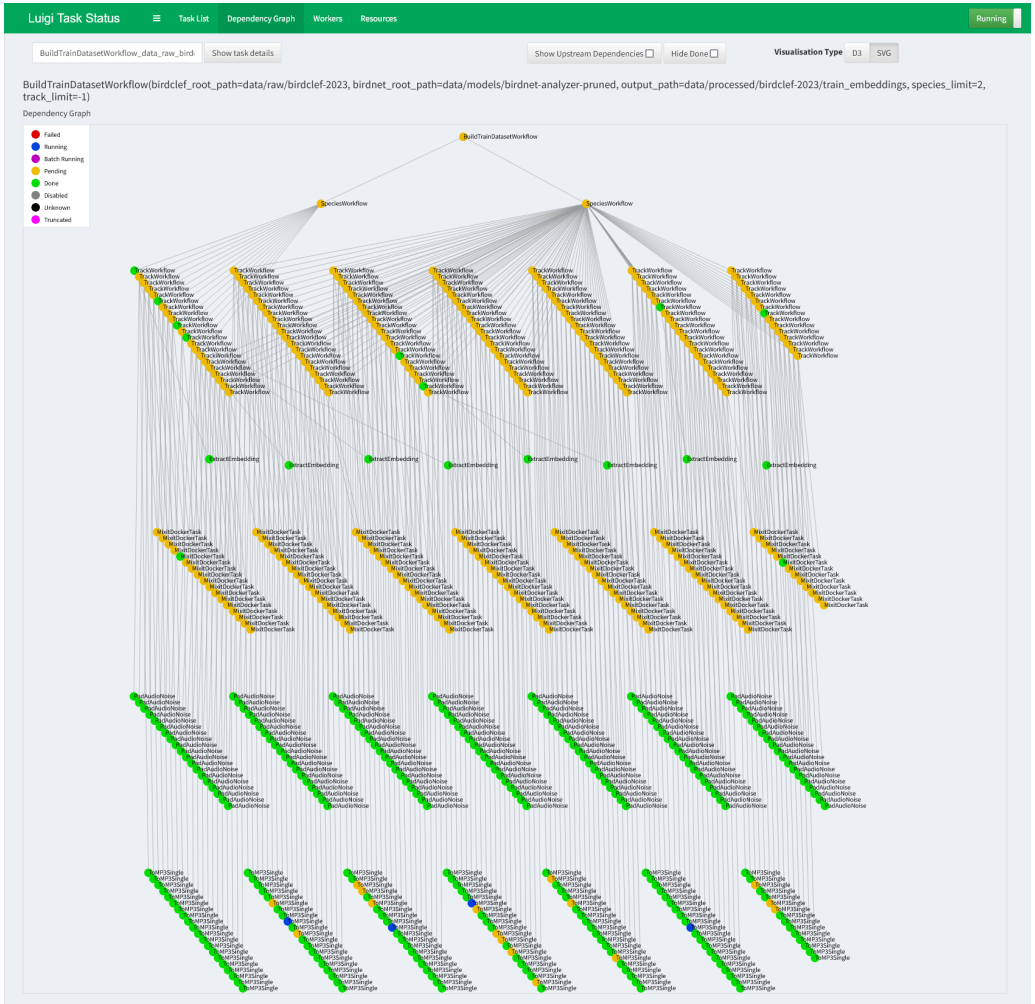


Figure 4: Luigi is a Python library for building data pipelines.

BirdNET embeddings

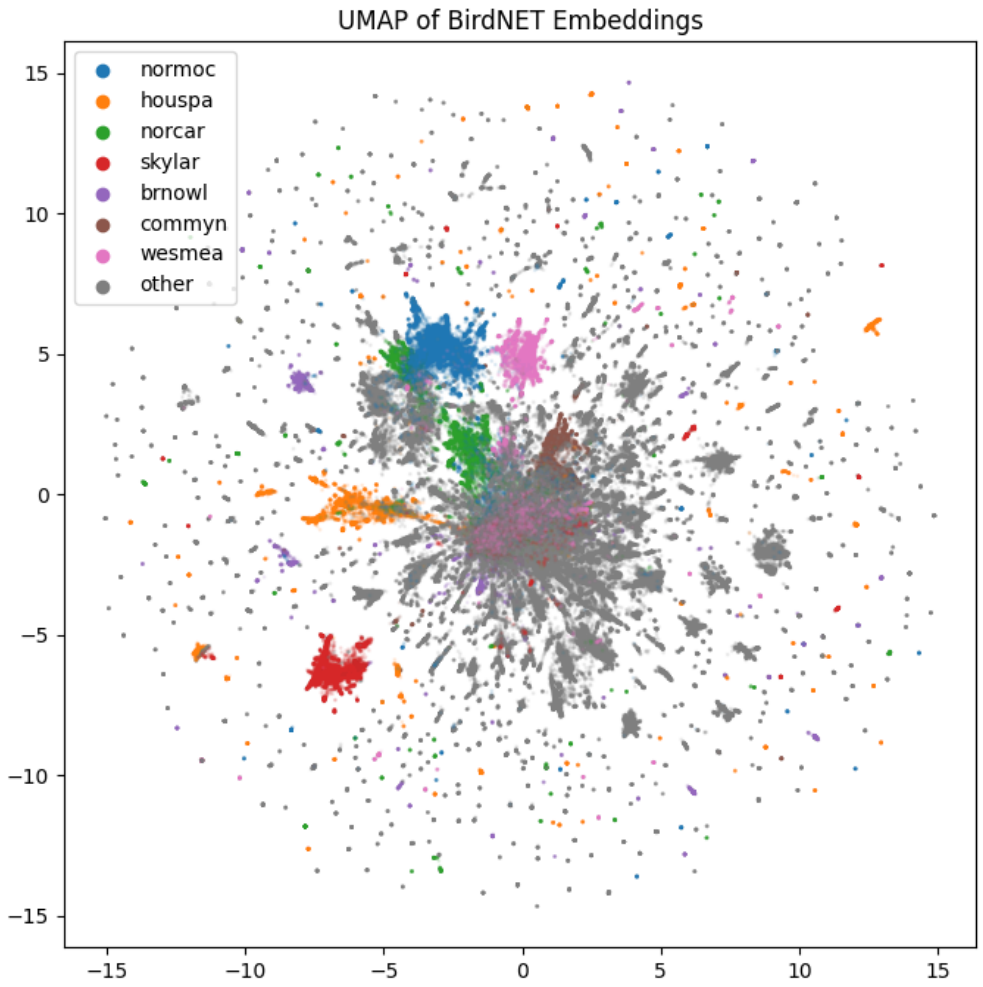


Figure 5: We can use the BirdNET embedding space for search and nearest neighbor queries.

BirdNET predictions for annotation

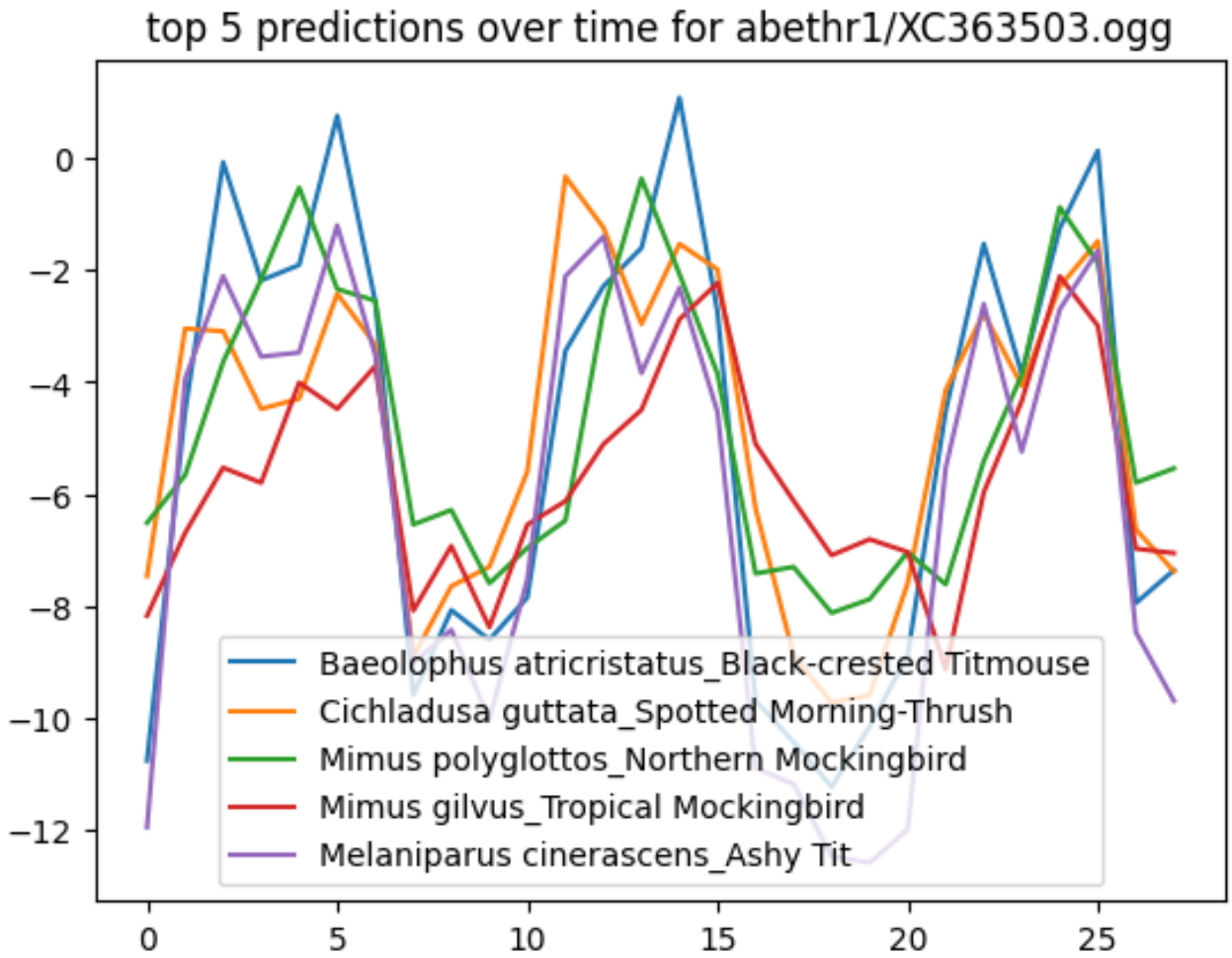


Figure 6: The BirdNET predictions can help with data annotation.

Sound Separation with MixIT

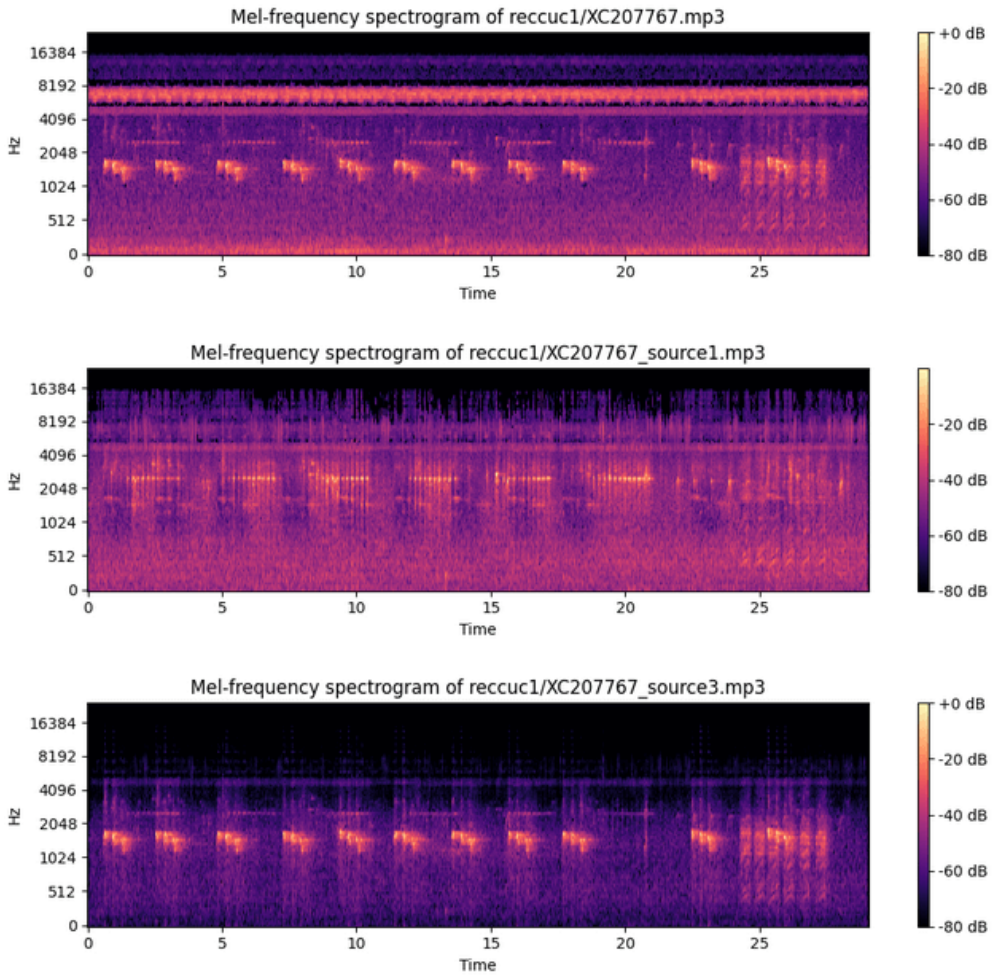


Figure 7: MixIT is a sound separation algorithm.

Automated dataset annotation

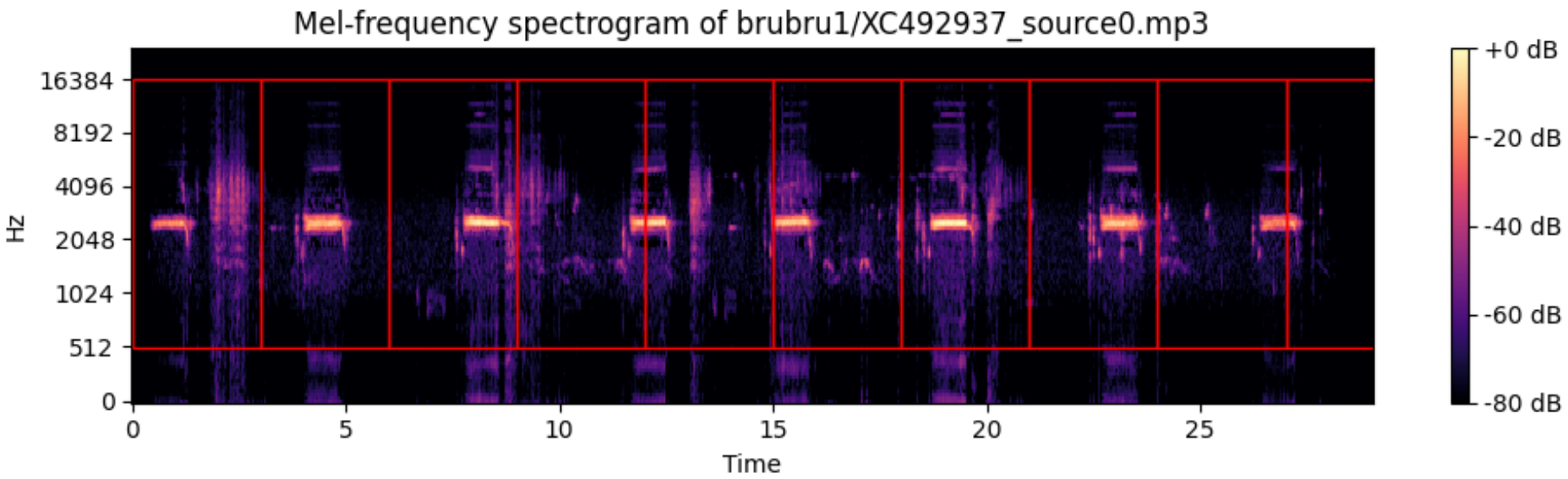


Figure 8: Chunked spectrogram of a bird call.

Sequence models with embeddings

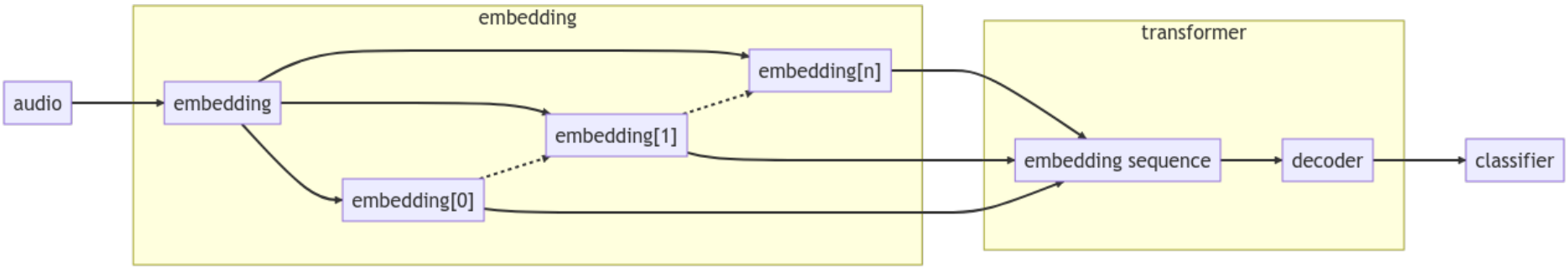


Figure 9: We experiment with embeddings in a sequence model (e.g. Transformers) to imbue temporal context.

And for the DS@GT Folks...

Figure 10: Bird conservation is a worthy cause and a great opportunity to learn.

Advice for myself two years ago

Building a team is worthwhile

- A strong team can help you achieve more than you could on your own. It's also an opportunity to connect with other students.

Be prepared to learn how to lead a team

- Effective communication and clear timelines are key to keeping the team on track
- Remember that everyone on the team is capable and valuable, and make an effort to recognize and appreciate their contributions

Reach out to OMSCS and OMSA early

- Working professionals have *a lot* to bring to the table.

Be on the lookout for opportunities

Figure 11: Be on the lookout!

There's an abundance of opportunities for OMSCS students to collaborate with other students.

Thank you to everyone involved

DS@GT Leadership

- Pulak Agarwal
- Krishi Manek

BirdCLEF 2022

- Jiangyue Yu
- Bryan Cheungvivatpant
- Dakota Dudley
- Aniketh Swain

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- Jinsong Zhen
- Kien Tran
- Siying Liu
- Muskaan Gupta
- Xinjin Li

BirdCLEF 2023

- Chris Hayduk
- Erin Middlemas
- Grant Williams
- Nathan Zhong
- Murilo Gustineli

Links and Resources

- Working Notes, "Motif Mining and Unsupervised Representation Learning for BirdCLEF 2022"
- DS@GT, Kaggle Competition Team Proposal, BirdCLEF 2022
- DS@GT, Project Group Proposal, BirdCLEF EDA Fall 2022
- DS@GT, Kaggle Competition Team Proposal, BirdCLEF 2023
- DS@GT, Assessment, BirdCLEF EDA Fall 2022
- DS@GT, Assessment, BirdCLEF 2023
- BirdCLEF Motif Viewer, Barn Owl, XC138041
- BirdCLEF 2023 MixIT Exploration, Red-chested Cuckoo, 2FXC207767

Thank you!

Time for Questions and Answers

Figure 12: Q&A