



AUDIO CLASSIFICATION

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BACKGROUND

- Estimated 10,000 species of birds throughout the world.
- Cornell Lab of Ornithology
- Birds are great informants of trends for:
 - Air quality
 - Biodiversity
 - Climate change



Large ground-finch
(*Geospiza magnirostris*)

Nihoa finch
(*Telespiza ultima*)

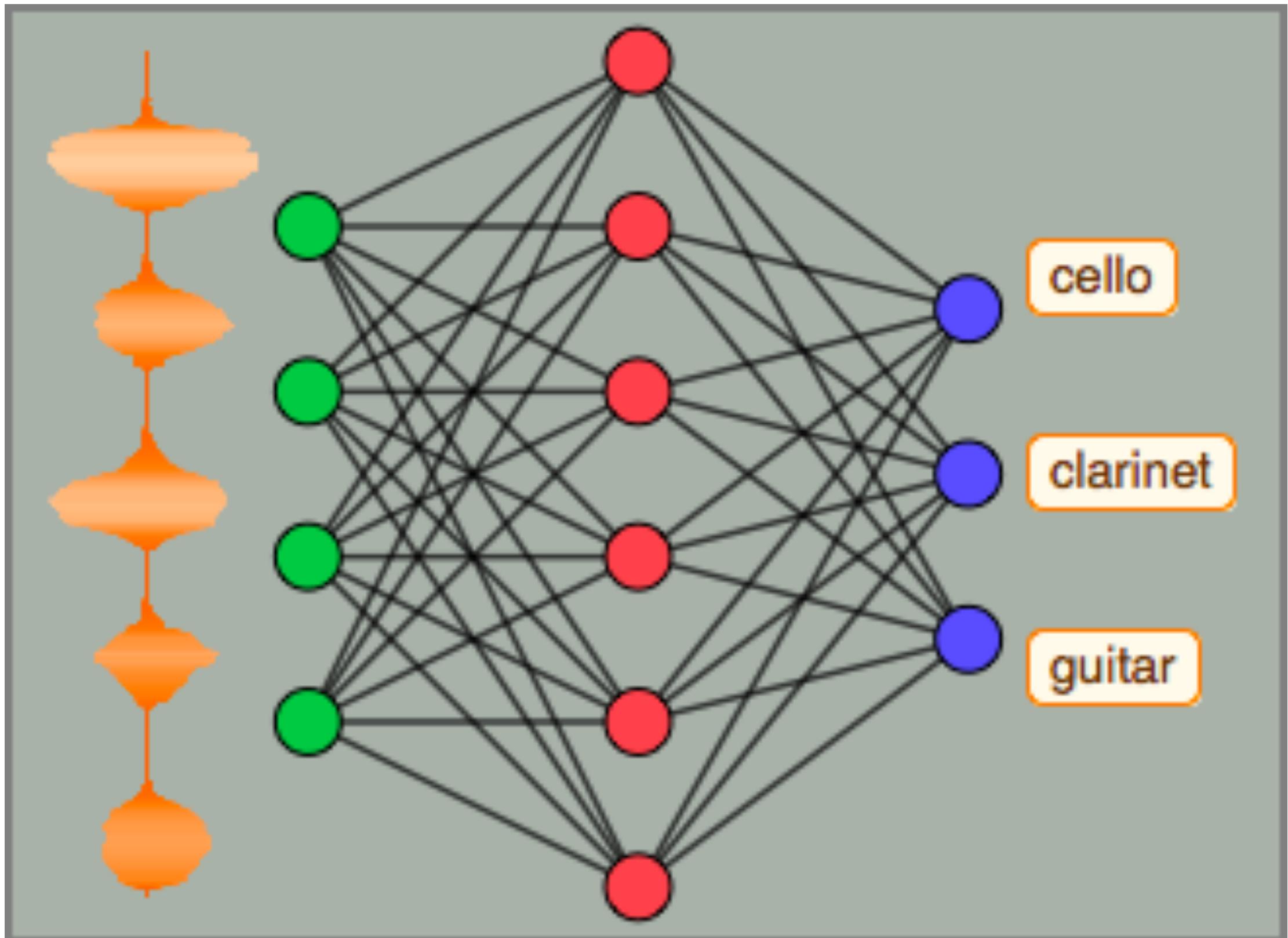


Green warbler-finch
(*Certhidea olivacea*)

Oahu creeper
(*Paroreomyza maculata*)

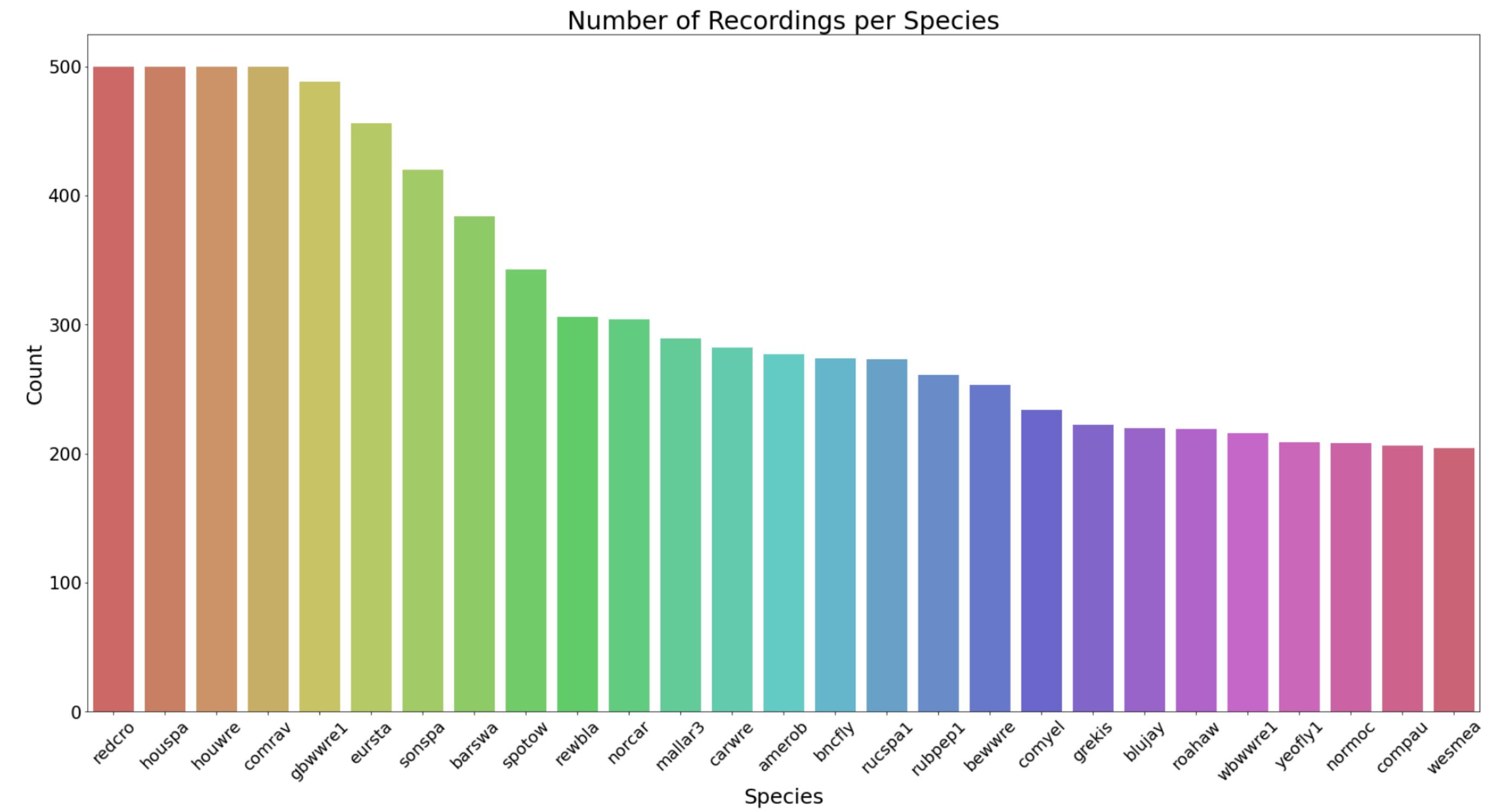
OBJECTIVE

- AI model to bring clarity to bird identification from audio data.

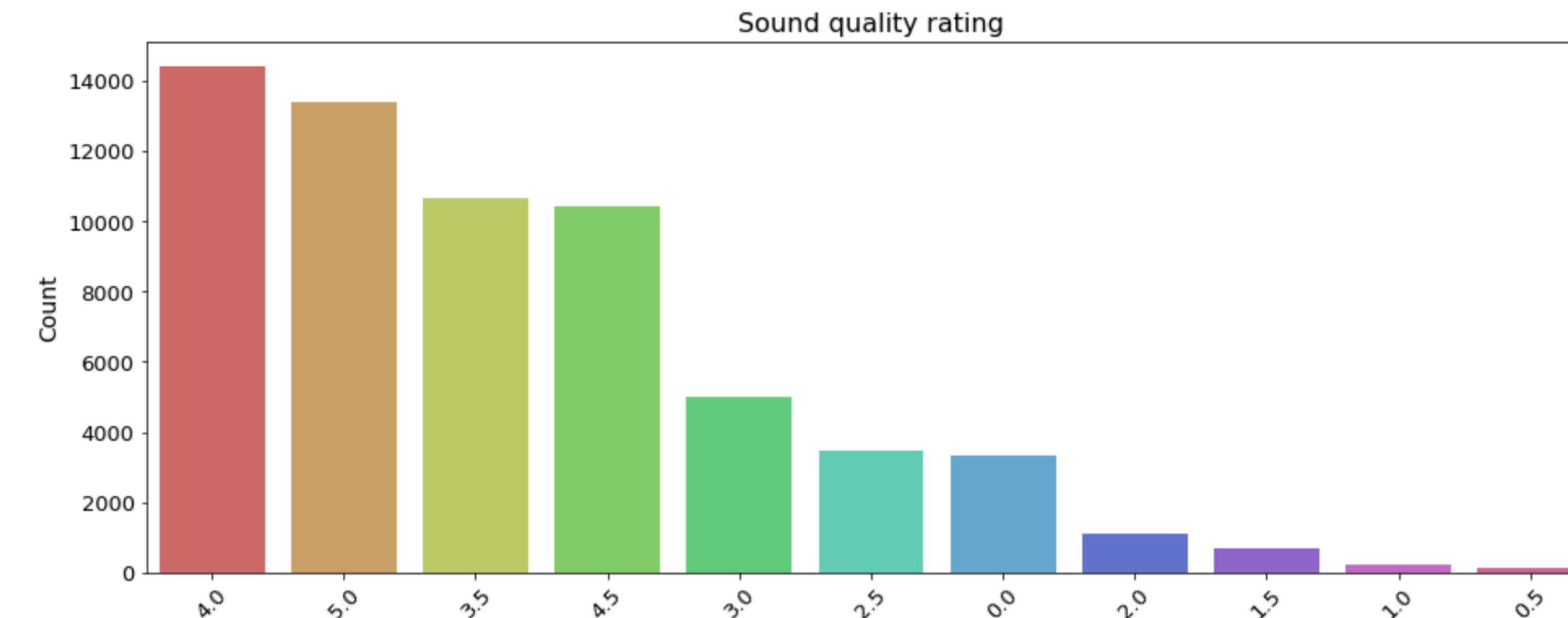


DATA CLEANING

- 8,500/62,000 recordings used.



- Selected species with at least 200 high-quality recordings.

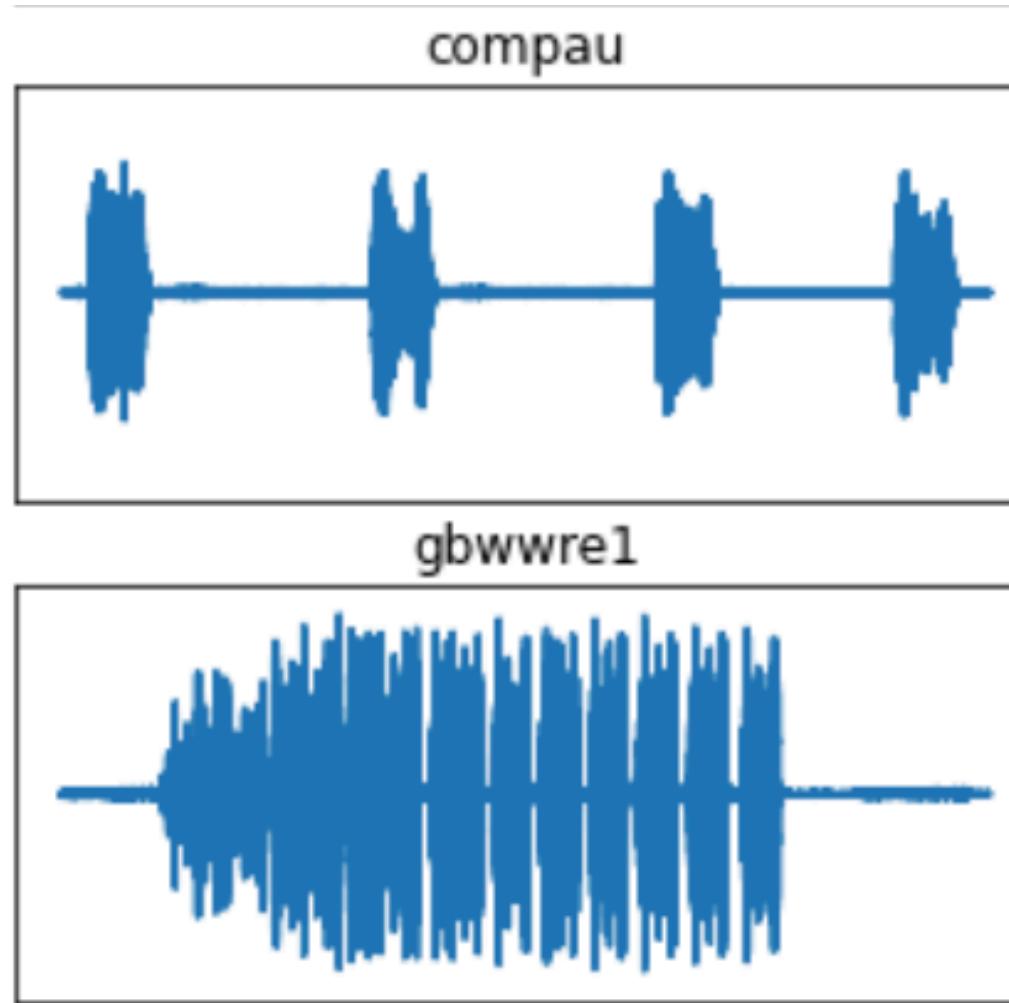


DATA CLEANING

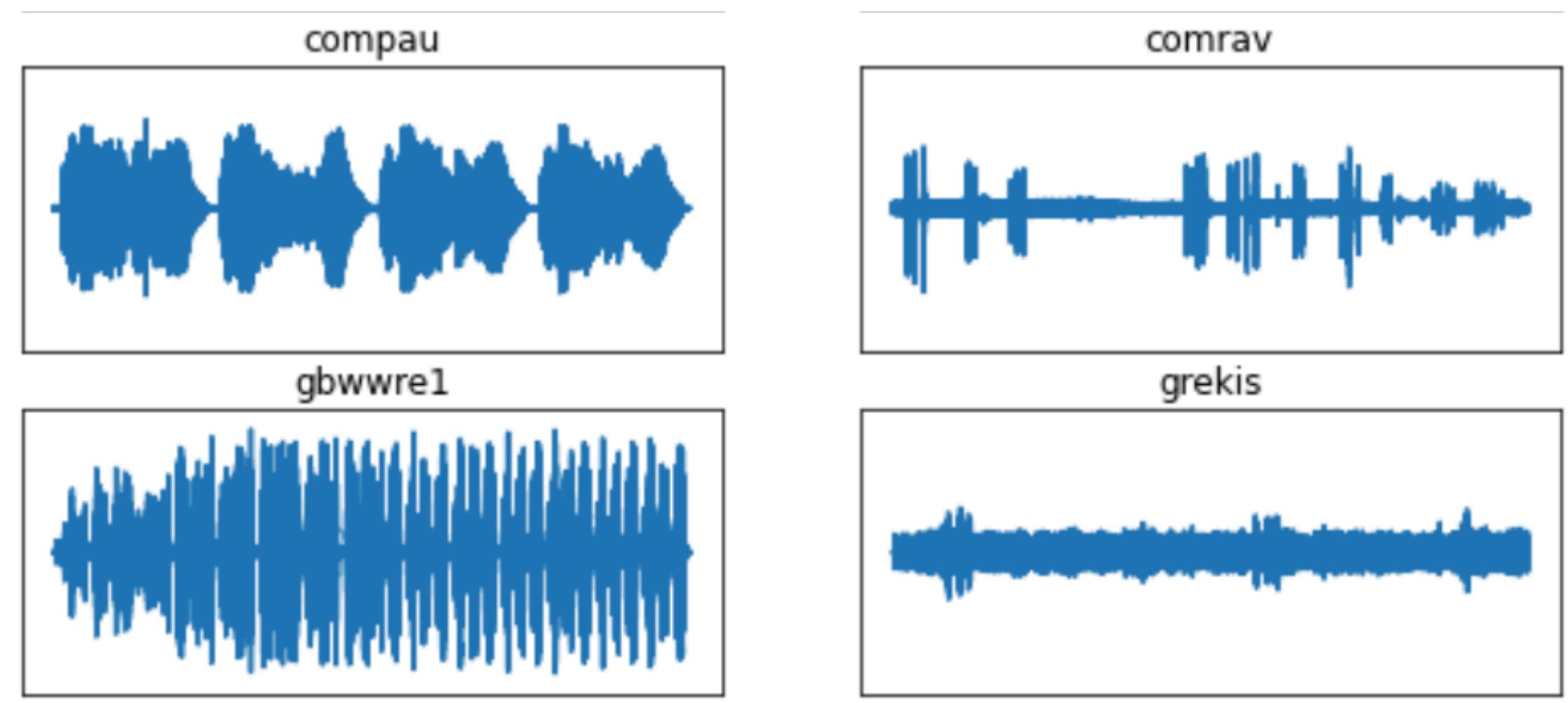
- Filter environmental noise.
- Fast-Fourier Transformation.
- Mel Spectrogram.



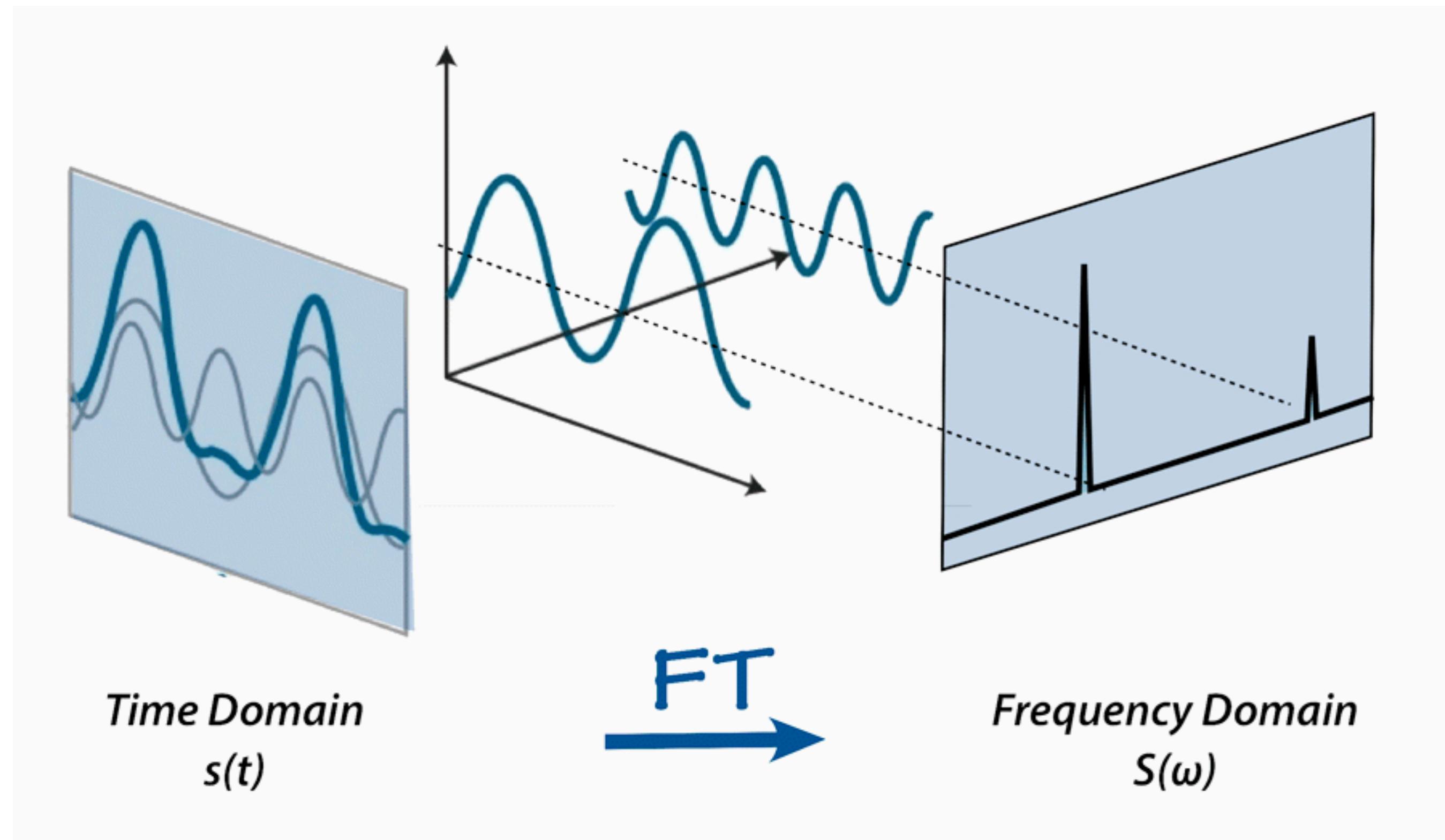
Before Envelope



After Envelope

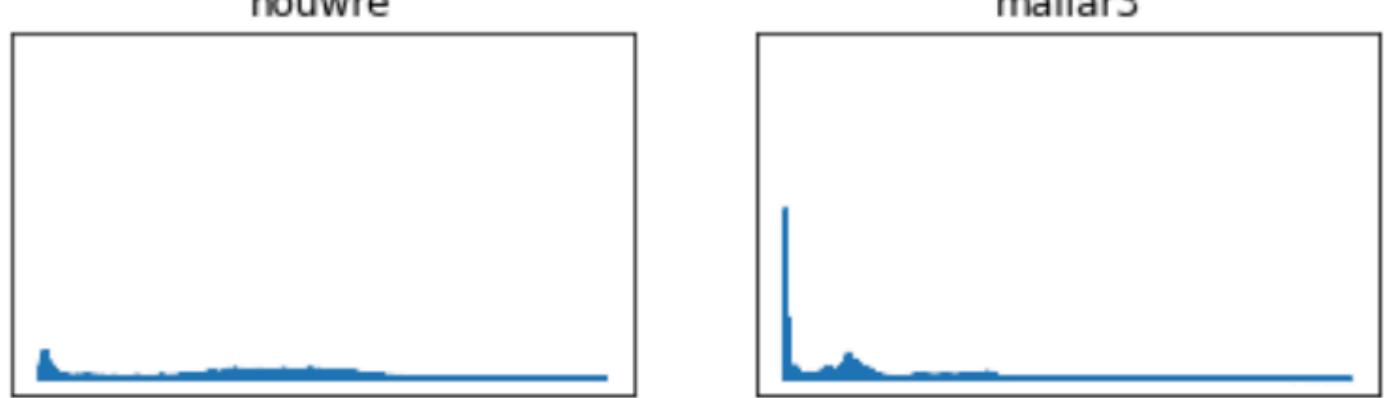
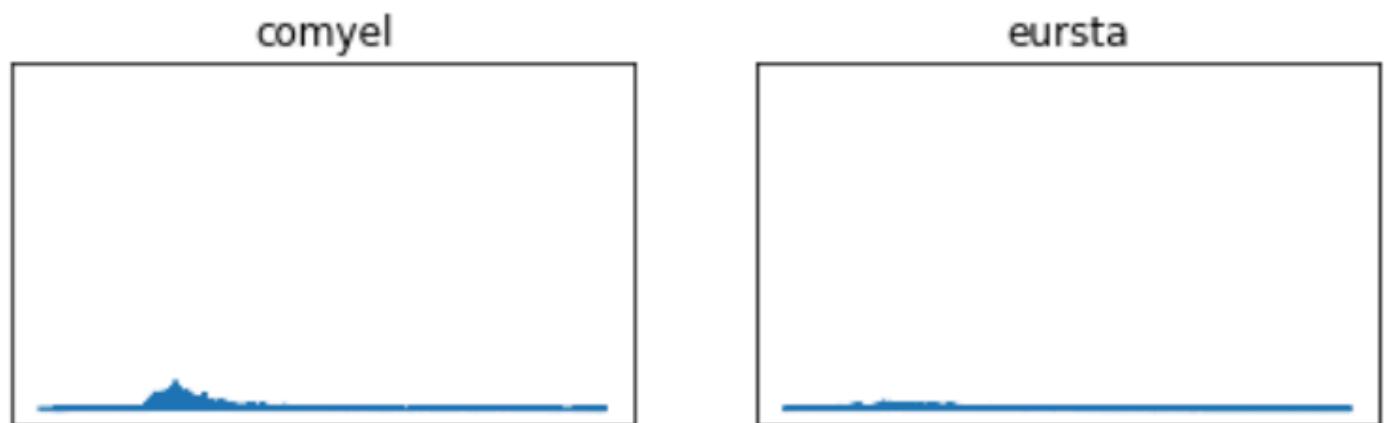


The envelope function removes noise from audio data.

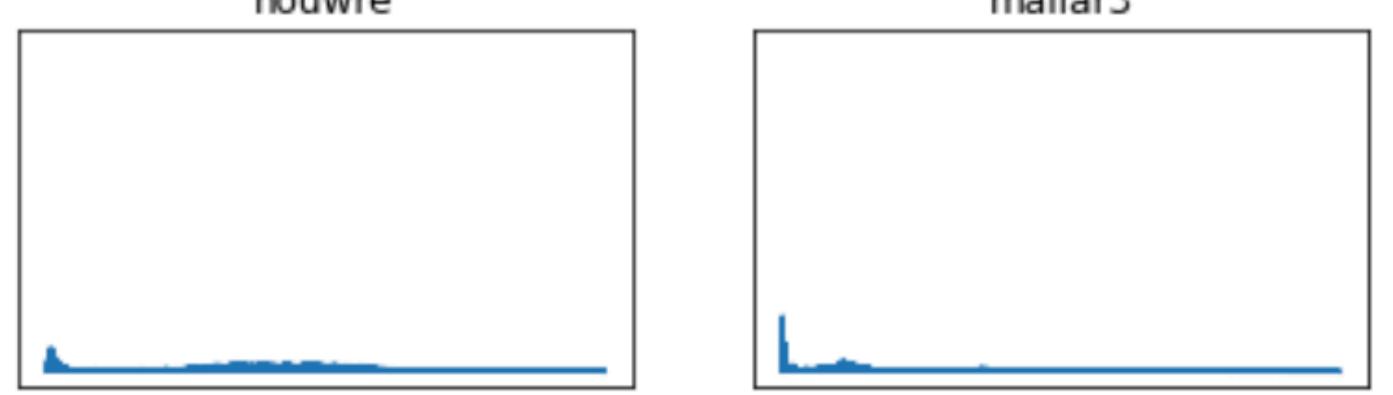
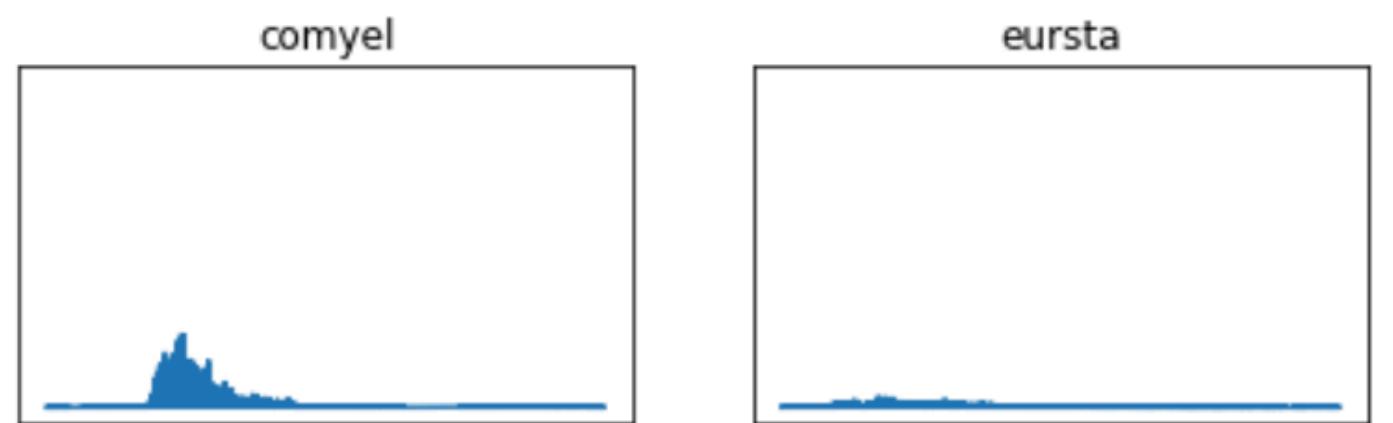


Amplitude over time —> frequency "importance"

Before FFT

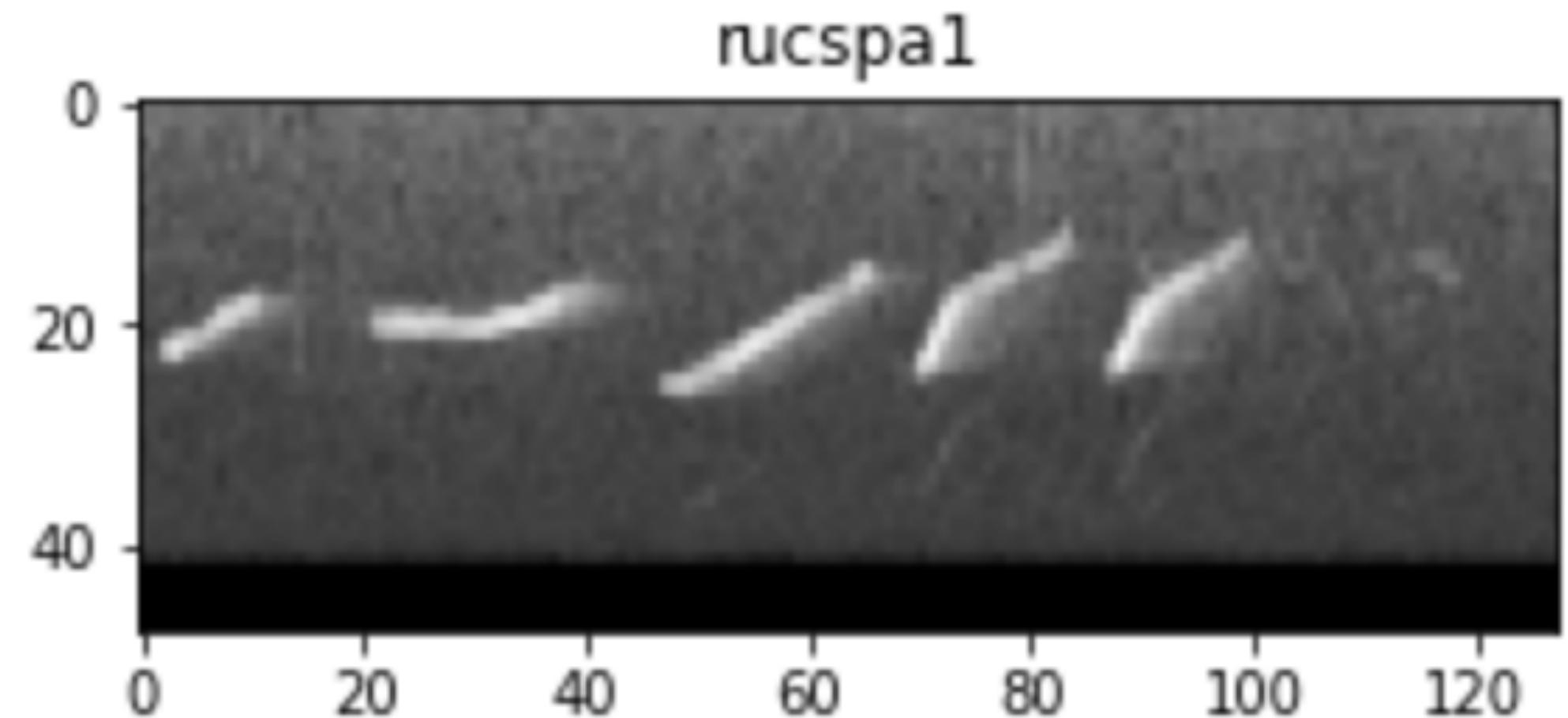
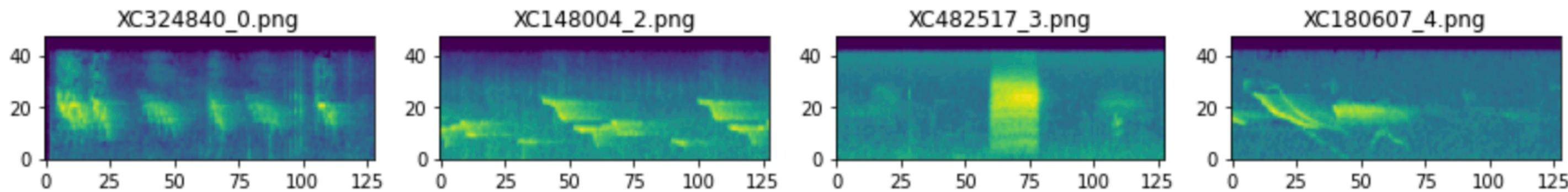
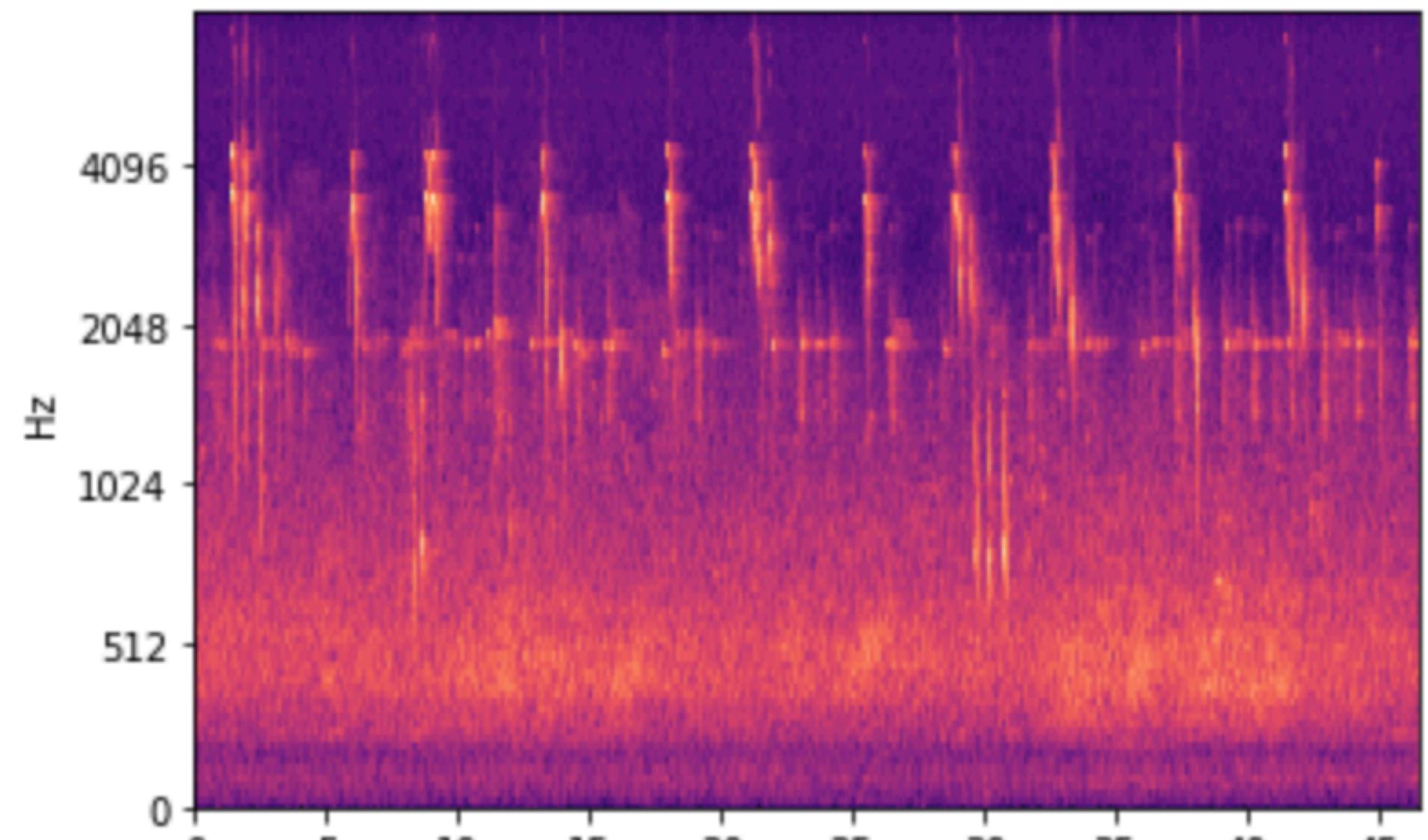


After FFT



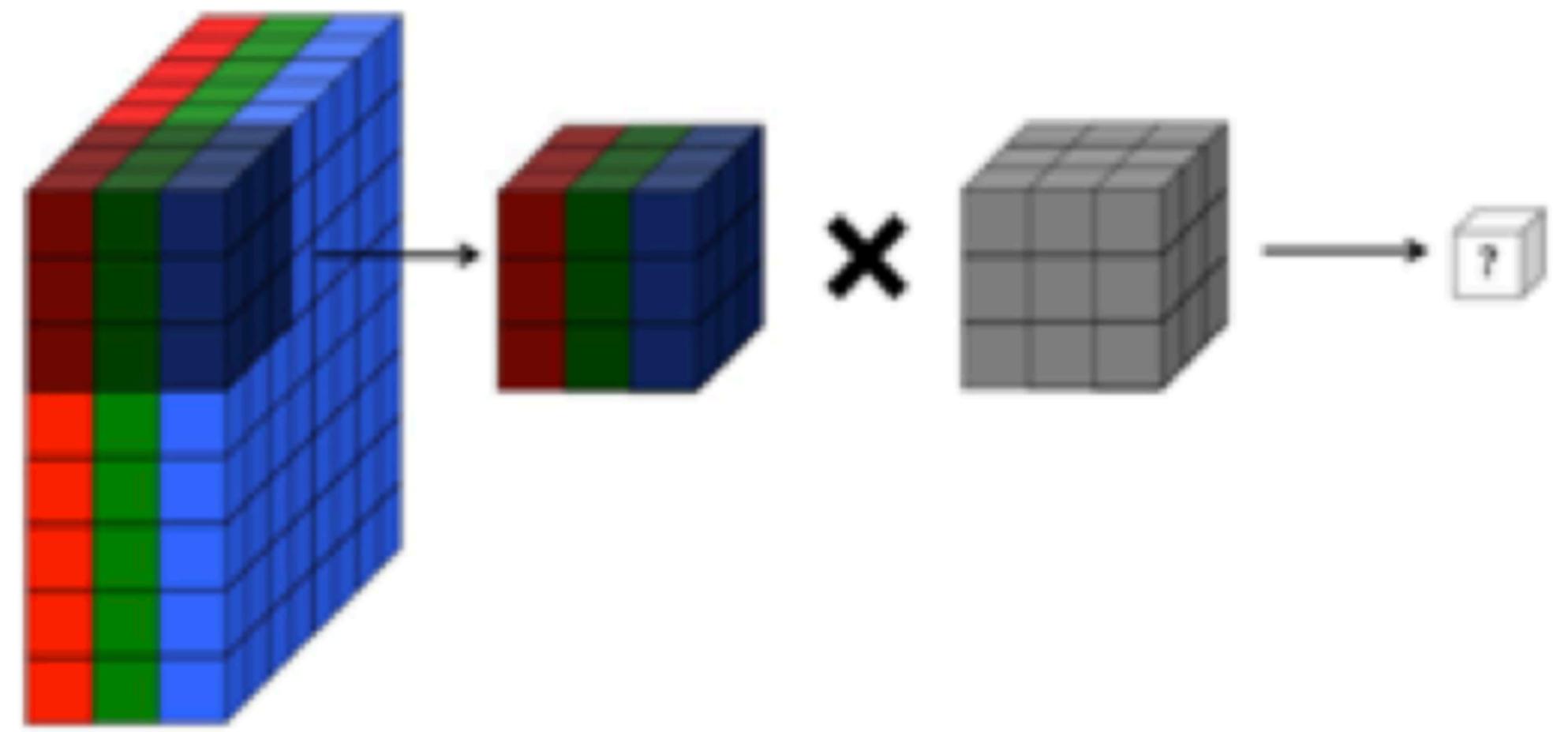
MEL SPECTROGRAM

- Translate audio files into images.
- 5 second audio clips.
- Created over 48,000 spectrograms.
- Original rendering > FFT > data reduction



MODELING

- Multiple model architectures constructed and compared for accuracy.
- Convolutional Neural Networks (CNNs) primarily used.
 - Useful for **image** data.
- Tested against one Long Short-Term Memory (LSTM) model.
 - Useful for **time-related** data.

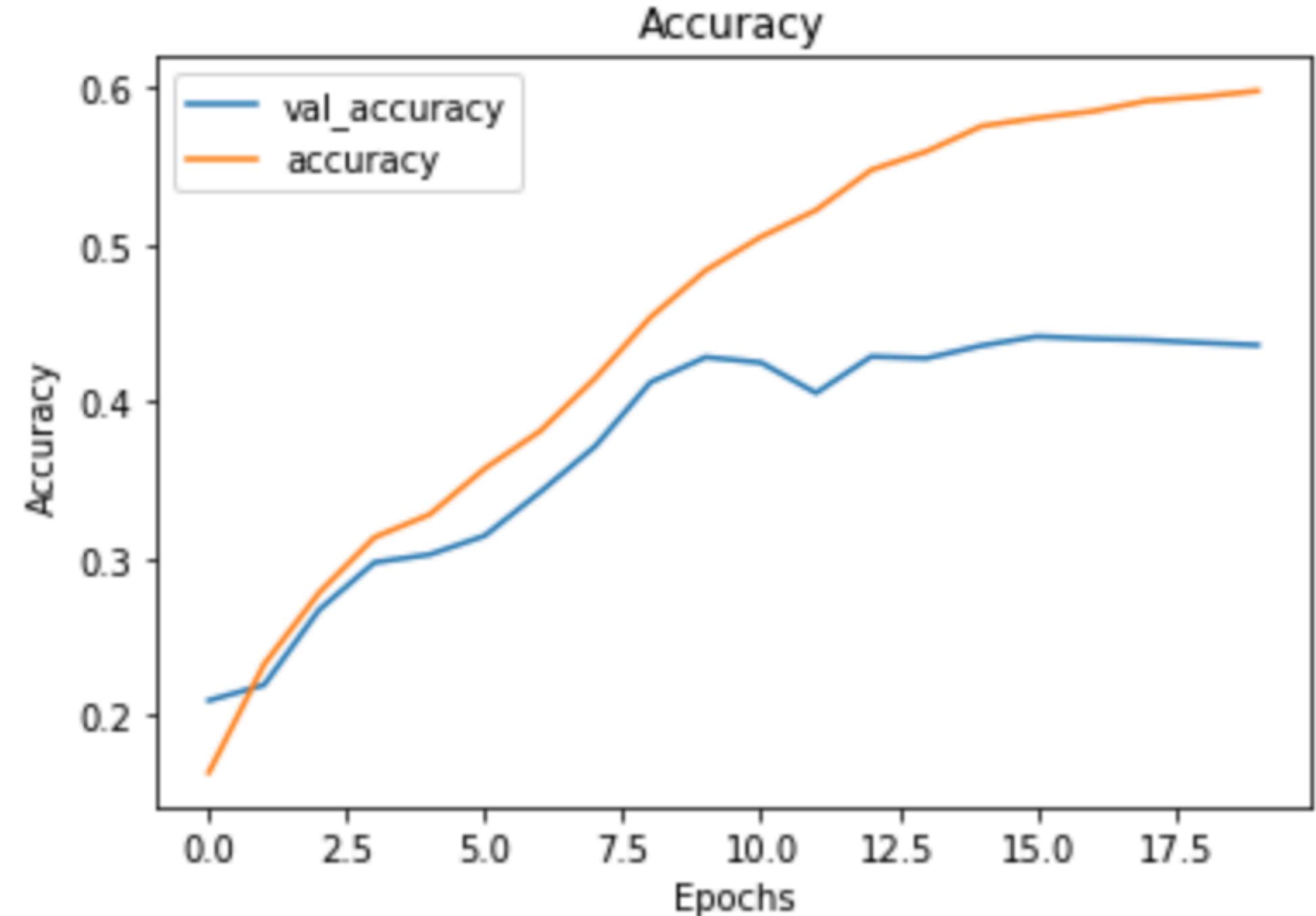


Convolutional Neural Network

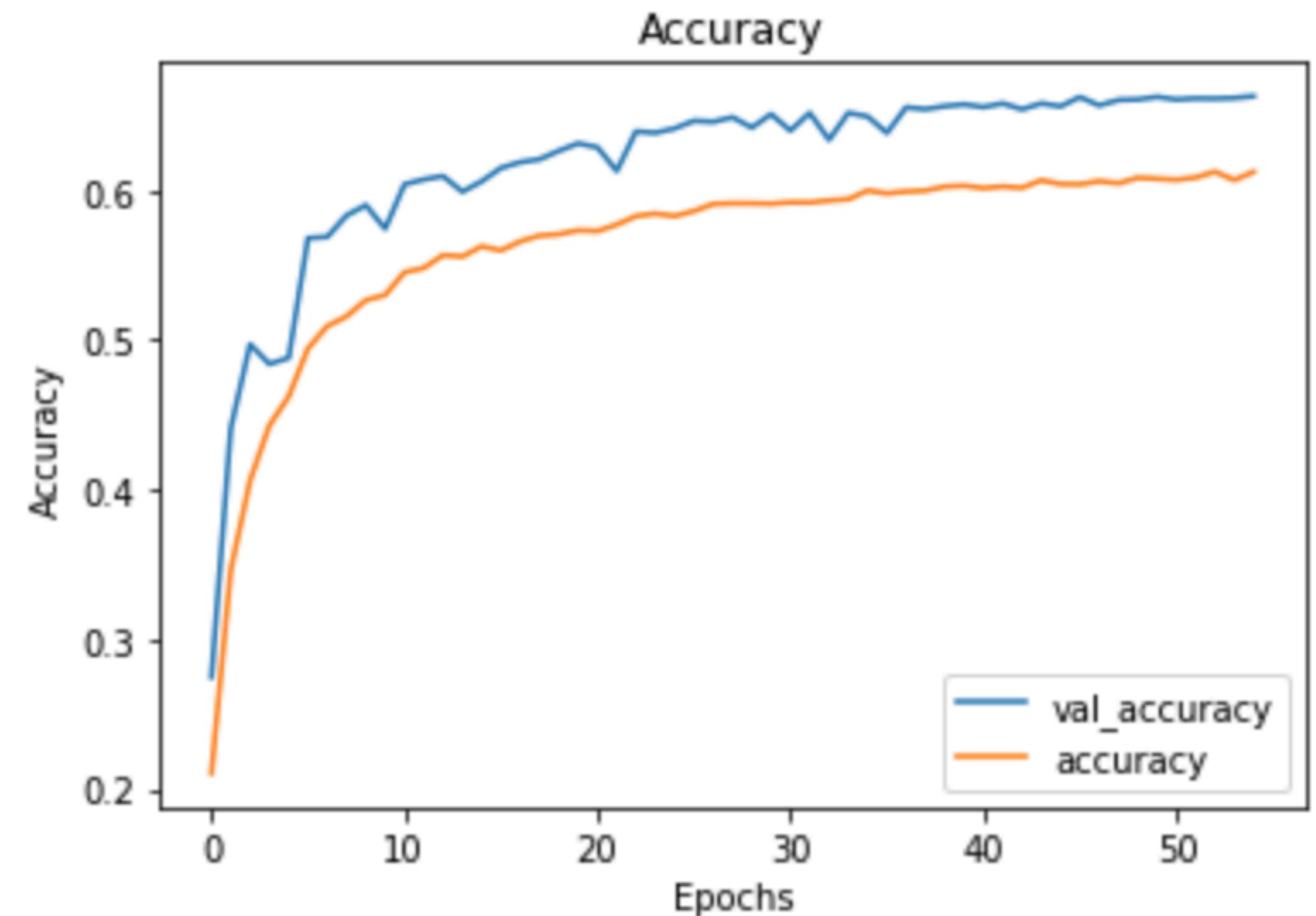
RESULTS

- Baseline model:
 - Training: 60.3% accuracy.
 - Testing: 43.6% accuracy.
- LSTM model:
 - Training: 65.7% accuracy.
 - Testing: 42.7% accuracy.
- Tuned model:
 - Training: 72.1% accuracy
 - Testing: 66.3% accuracy

Baseline model:

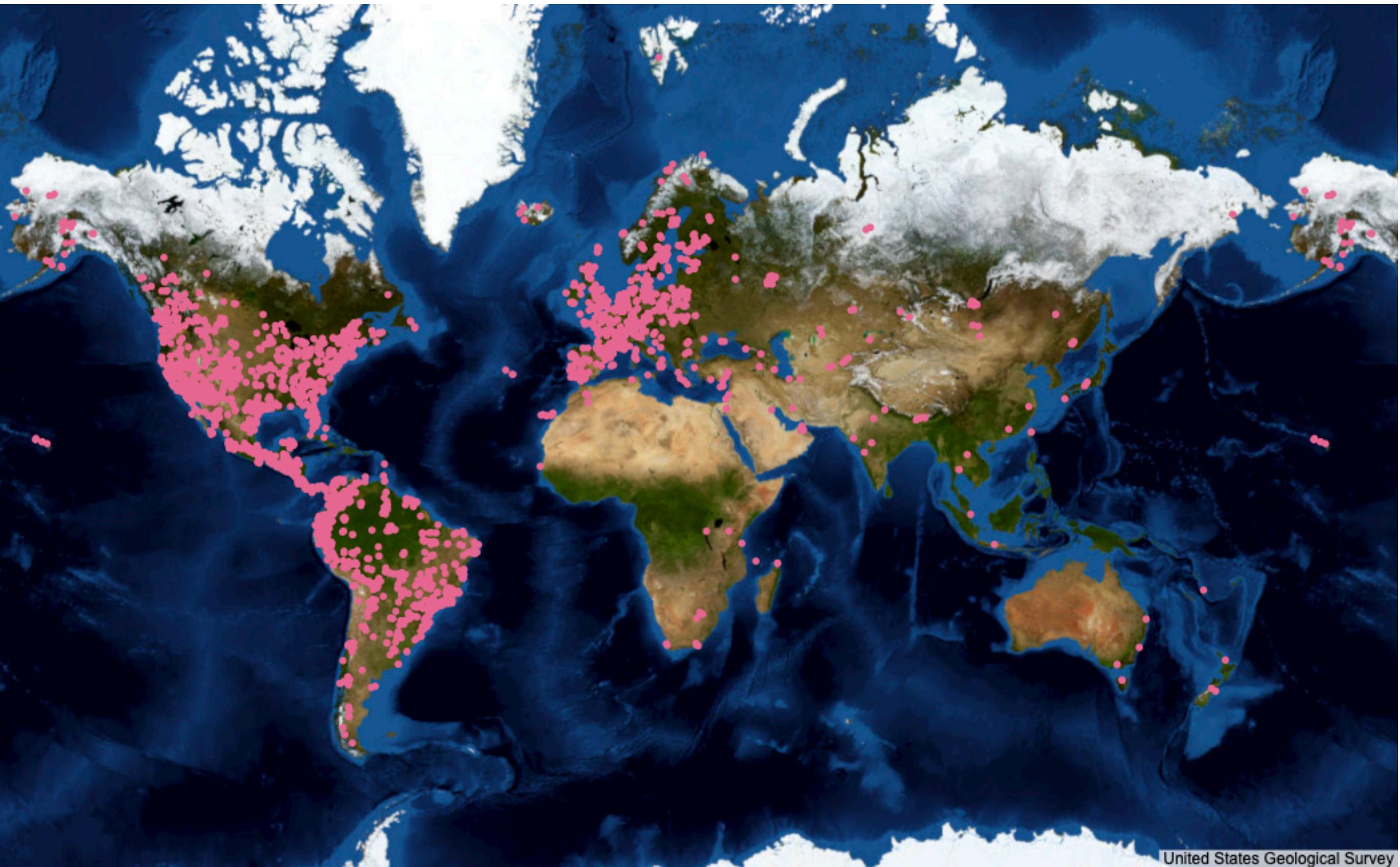


Tuned model:



FUTURE WORK

- Optimize model architecture.
- Expand to more species of birds (adding more data).
- Integrate geographical data for information on habitat.
- Generalize to music tasks.



REFERENCES

- [Stefan Kahl](#)
- [DrCapa](#)
- [Andrey Shtrauss](#)
- [Valerio Velardo](#)
- [Francois Lemarchand](#)
- [Seth Adams](#)
- [Adam Sabra](#)



THANK YOU!

Contact info: [E-mail](#) | [Github](#)