Animal sound collections and machine learning

Dan Stowell

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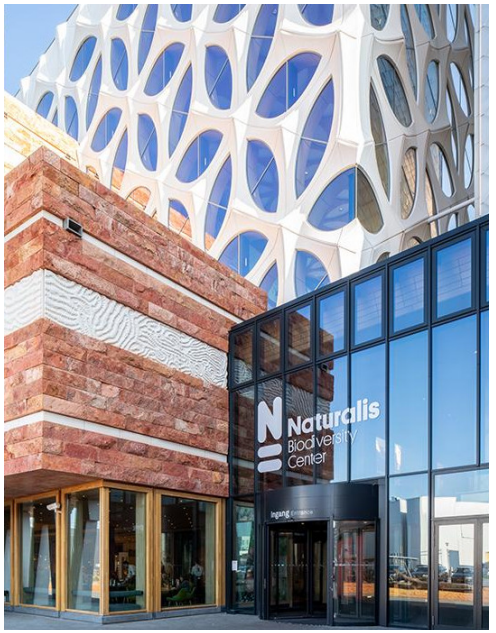
About me: Associate Professor in *AI and Biodiversity*

Naturalis Biodiversity Centre

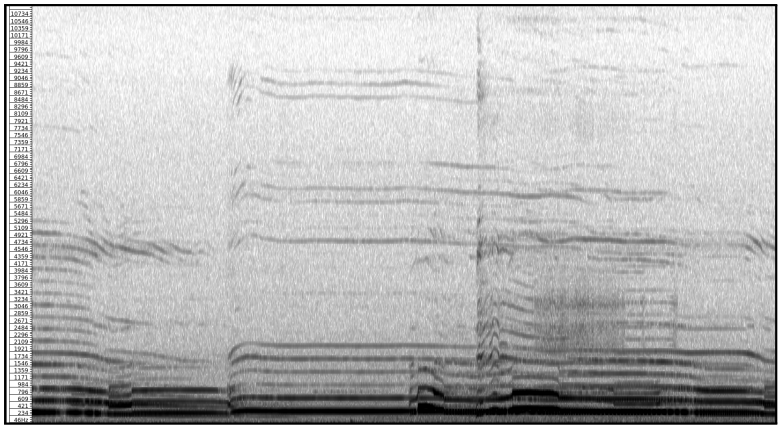


Tilburg University Cog Sci & AI

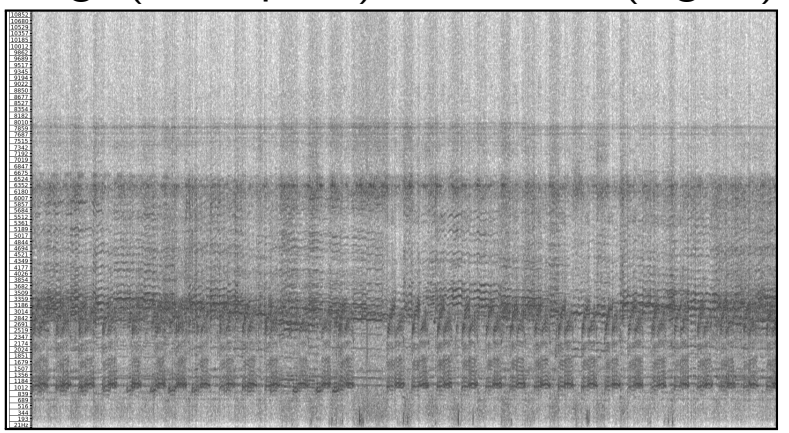
in partnership with Jheronimus Academy of Data Science (JADS)

Animal sounds, spectrograms

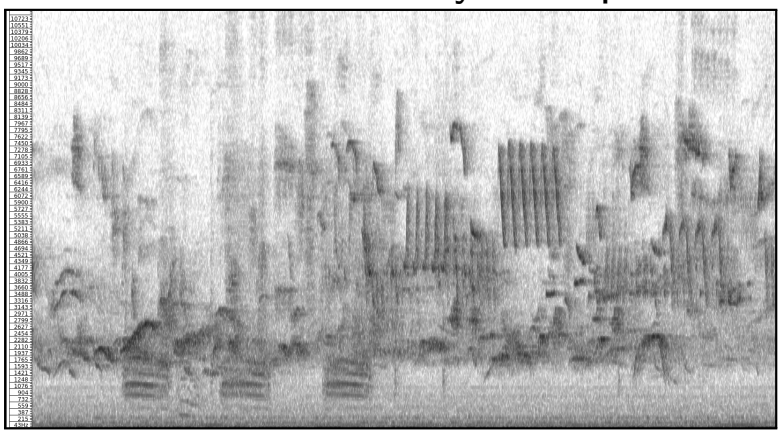
Small pack of wolves howling together



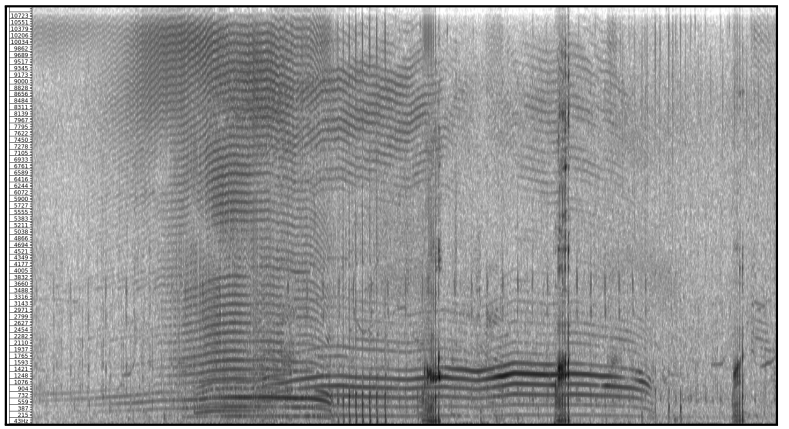
Frogs (lower pitch) and insects (higher)



"Dawn chorus" of many bird species



Risso's & Pacific White-sided dolphins

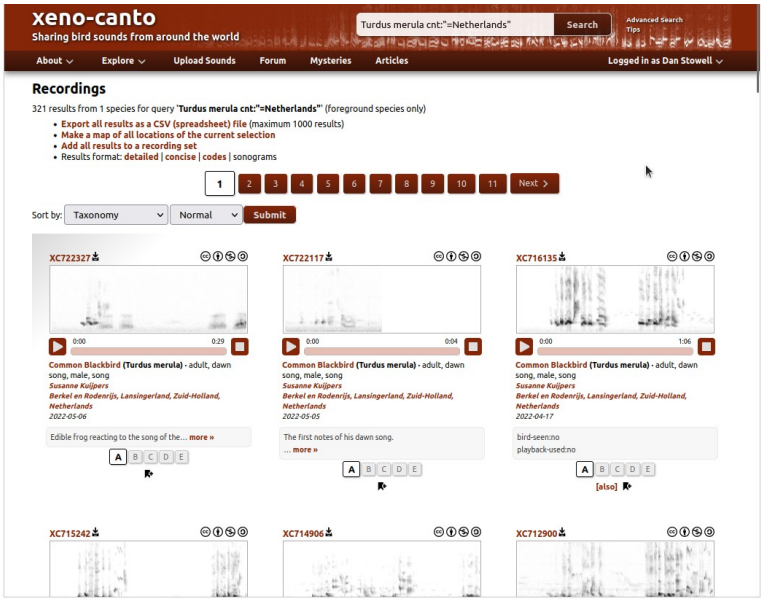


Xeno Canto

World's largest open database of bird sound

- 200,000+ recordings
- 10,000+ species

Foundation for majority of bird sound recognition ML projects



Bird species classification: Warblr

'Warblr' app – for Android and iOS

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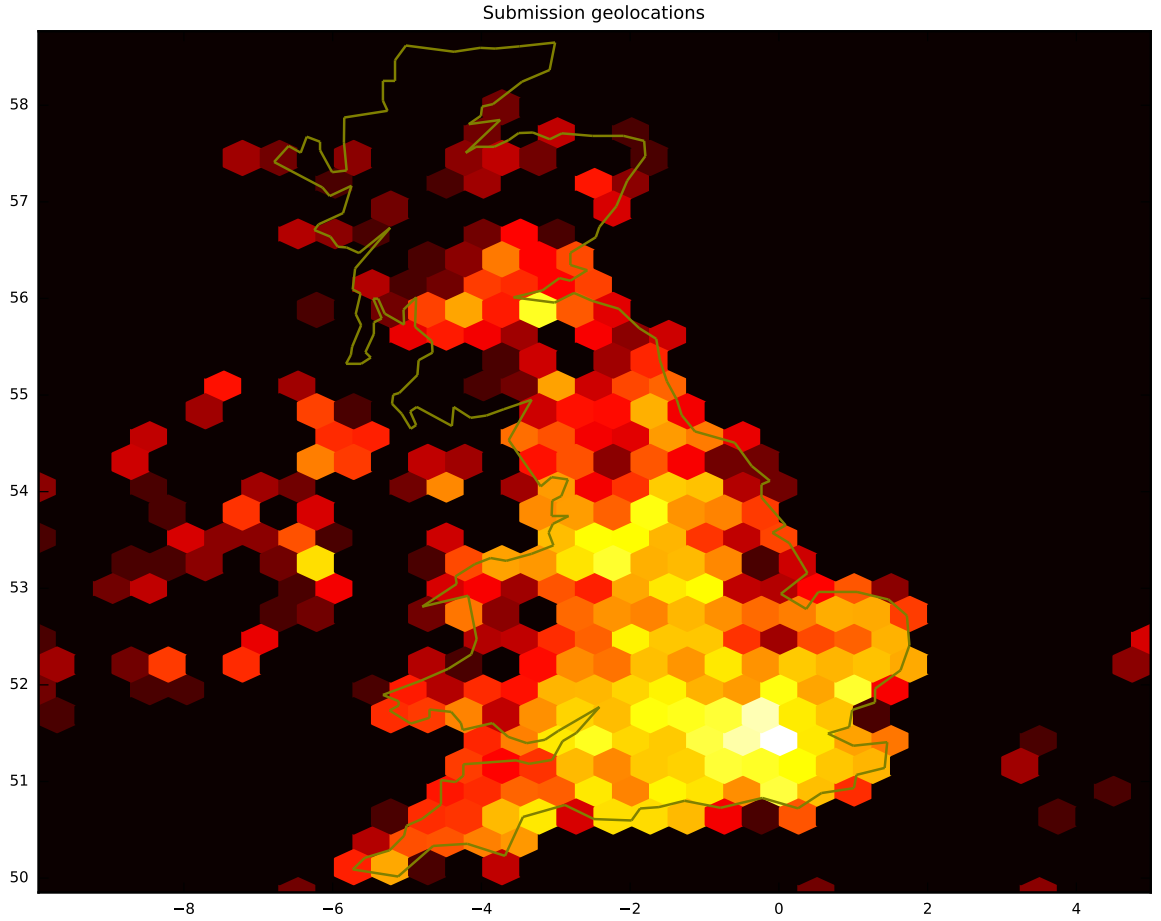
Warblr: who are our users?

5,000+ paying users since August 2015

Over 200,000 recordings submitted to our database (≈ 80/day)



Some of our users...

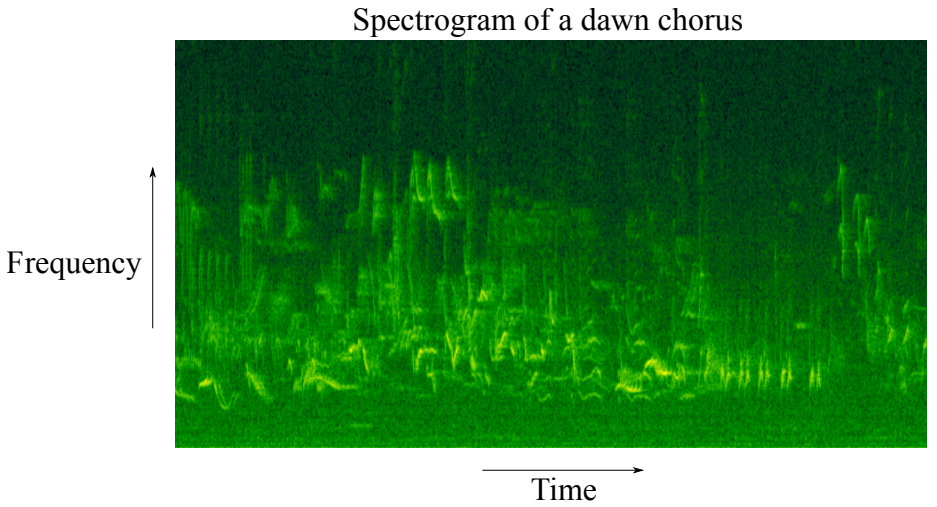
Some of our users...

Insect sound recognition—pilot study

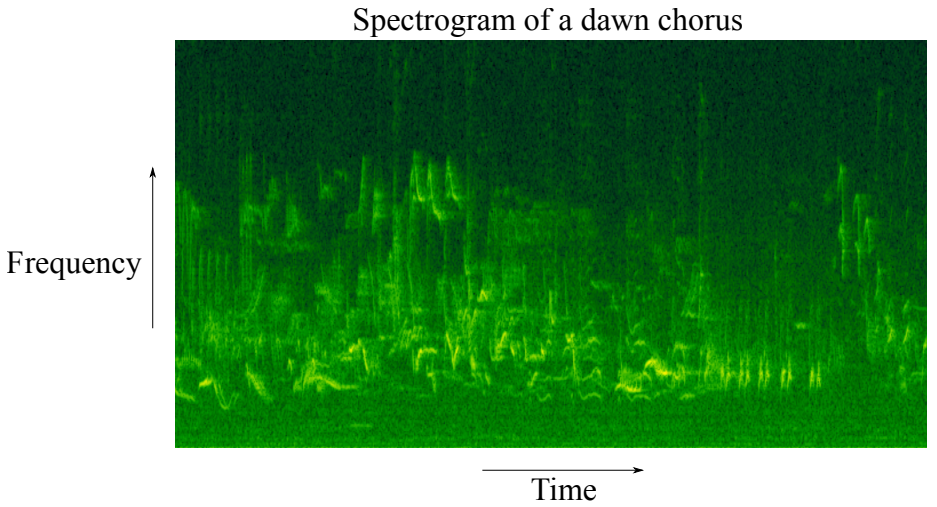
Audio of 9 Orthopteran species, courtesy of Baudewijn Odé

Model	Test accuracy (%) Original (158 files)	Augmented (1422 files)
Baseline (LeNet-5)	55	**90**
Raw waveform (EnvNet)	50	72

Species recognition ... But that's not all!



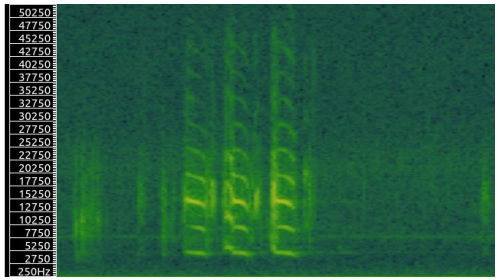
Species recognition ... But that's not all!

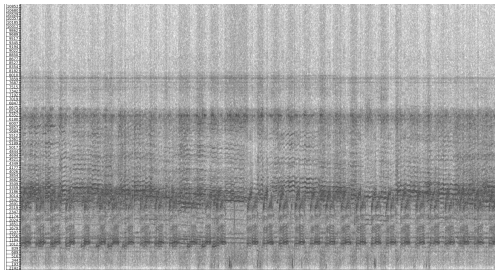


- Which species?
- How many individuals?
- Responding to neighbours?
- Warning about predators?
- In territory / newly arrived?

Challenges

1. Bridge the gap: in collection — in situ



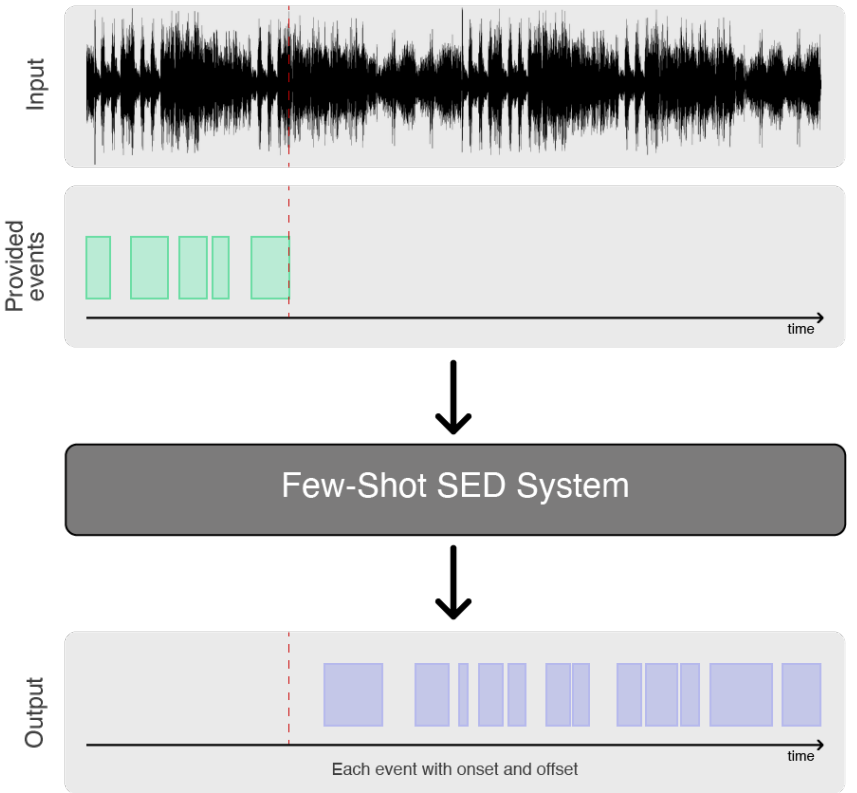


→*Many* recordings needed, good and bad!

2. Equal representation/sensitivity across common–rare
3. Looooooooong audio (24 hours +)
4. Analyse interactions (“conversation”)

Long audio

“Few-shot” sound event detection



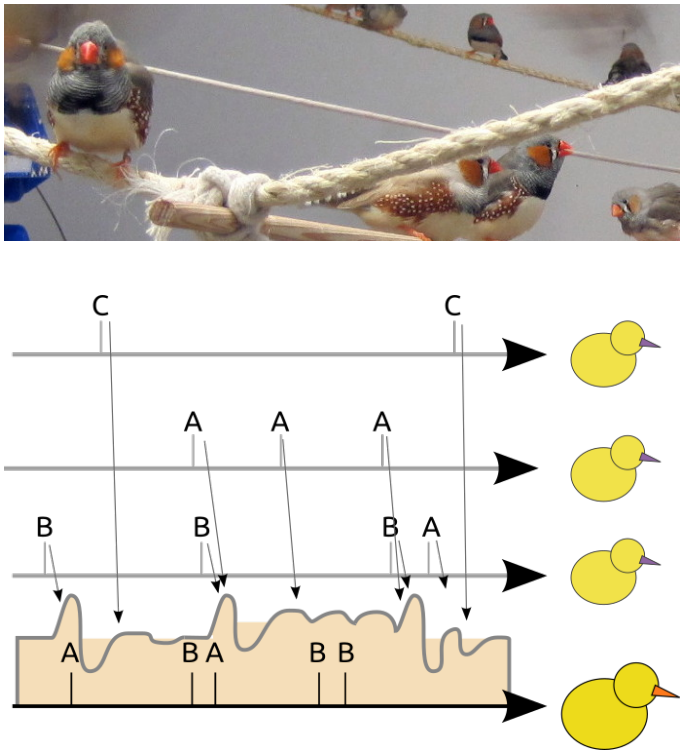
https://dcase.community/challenge2022/task-few-shot-bioacoustic-event-detection

Conversation analysis

Conversation analysis

Conversation analysis...?

Bird communication networks

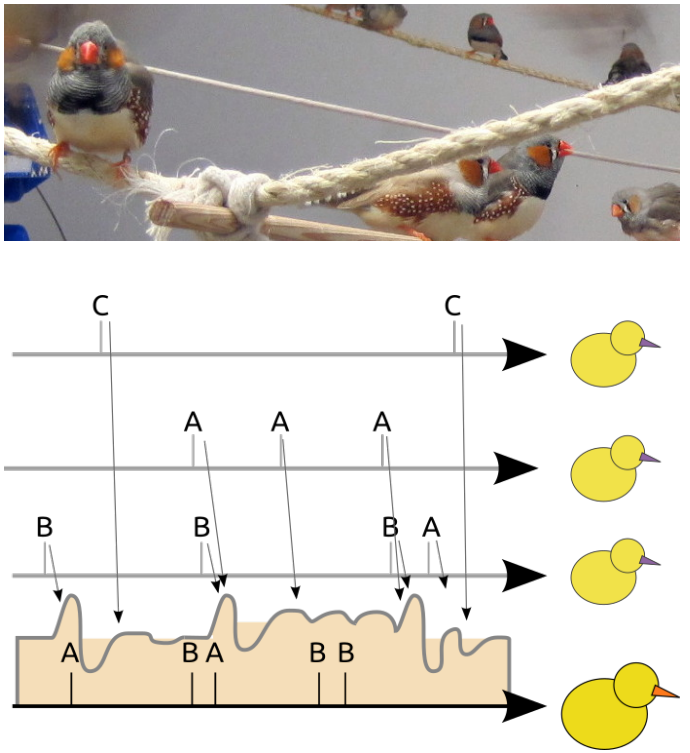


Stowell et al. (2016) Royal Soc Interface

`10.1098/rsif.2016.0296`

→Future: Analyse inter- and intra-species interactions in the wild

Bird communication networks



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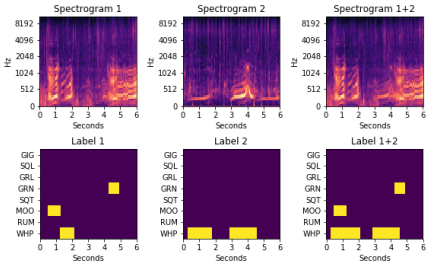
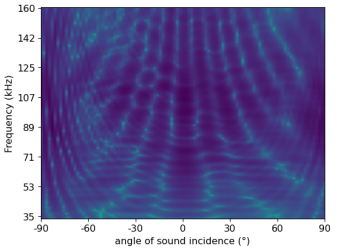
→Future: Analyse inter- and intra-species interactions in the wild

Summary: sound + animals + machine learning...





High-resolution acoustic AI for biodiversity monitoring