

# Animal sound collections and machine learning

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# About me: Associate Professor in *AI and Biodiversity*

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Tilburg University Cog Sci & AI

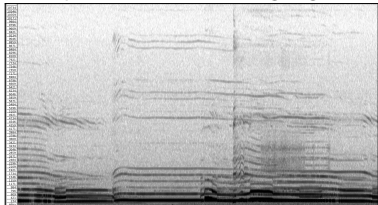


in partnership with Jheronimus Academy of Data Science (JADS)

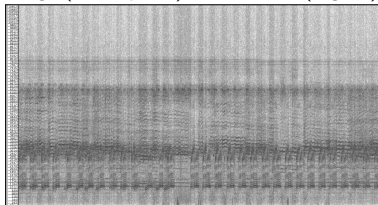


# Animal sounds, spectrograms

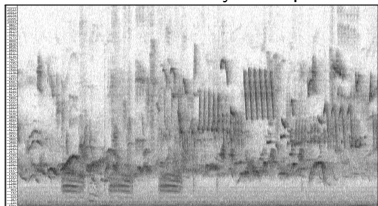
Small pack of wolves howling together



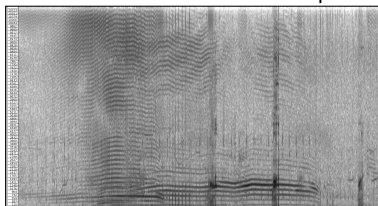
Frogs (lower pitch) and insects (higher)



"Dawn chorus" of many bird species



Risso's & Pacific White-sided dolphins



World's largest open database of bird sound

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

Foundation for majority of bird sound recognition ML projects

The screenshot shows the Xeno Canto website interface. At the top, there is a search bar with the text "Turkus merula csc 'Merula csc'", a search button, and a "Remember search" option. Below the search bar are navigation links: "Home", "Explore", "Upload Sounds", "FAQs", "My Sounds", "Articles", and "Logged in as Dan Stowell". The main content area is titled "Recordings" and displays search results for "Turkus merula csc 'Merula csc'". It shows 321 results from 1 species. Below this, there are several recording cards, each with a spectrogram, a play button, and a duration indicator. The cards are arranged in a grid. The first card shows a spectrogram with a duration of 0:00. The second card shows a spectrogram with a duration of 0:00. The third card shows a spectrogram with a duration of 0:00. Each card also includes the species name "Common Blackbird (Turkus merula - vohci, European Black Song)" and the location "Alder or Ankerloch, Langenbrunn, Zentralschweiz, Switzerland".





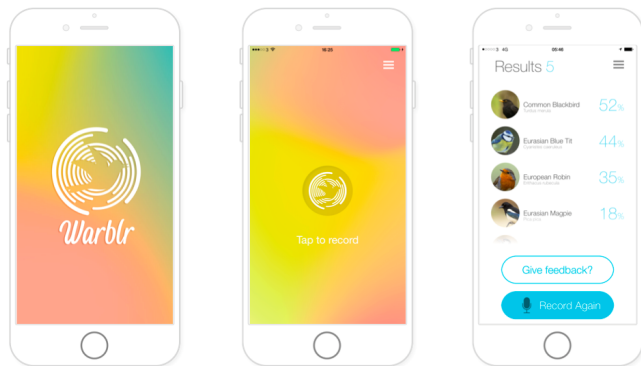
# Bird species classification: Warblr



'Warblr' app – for Android and iOS



# Bird species classification: Warblr



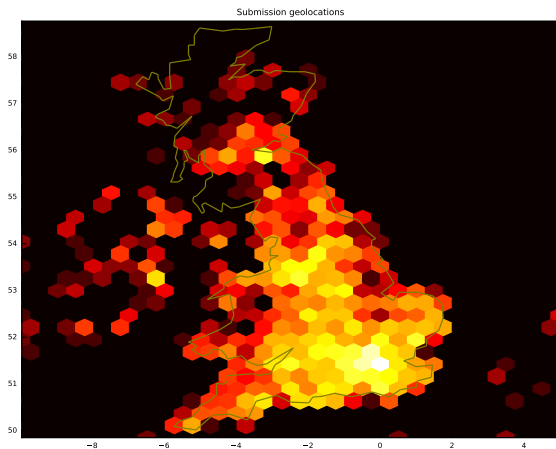
'Warblr' app – for Android and iOS



# Warblr: who are our users?

5,000+ paying users since August 2015

Over 200,000 recordings submitted to our database ( $\approx 80$ /day)



Some of our users...



# Some of our users...



# Insect sound recognition—pilot study

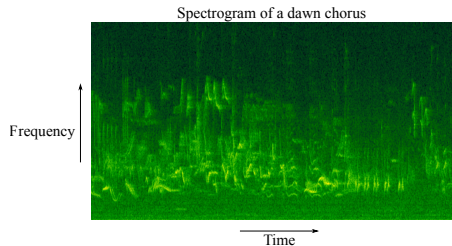
Audio of 9 Orthopteran species, courtesy of Baudewijn Odé



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

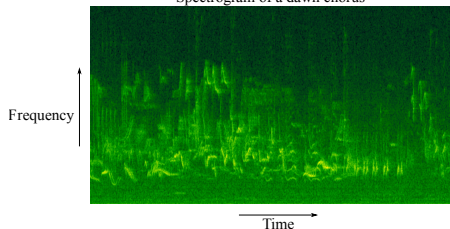


# Species recognition ... But that's not all!



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

Spectrogram of a dawn chorus



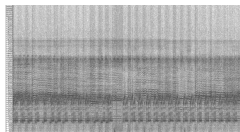
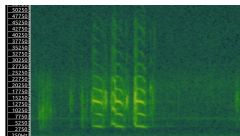
- ▶ Which species?
- ▶ How many individuals?
- ▶ Responding to neighbours?
- ▶ Warning about predators?
- ▶ In territory / newly arrived?





# Challenges

1. Bridge the gap: in collection — in situ



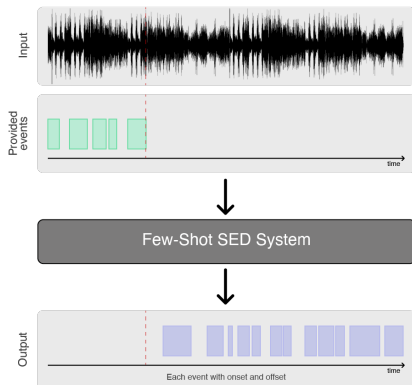
→ *Many* recordings needed, good and bad!

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



# Conversation analysis



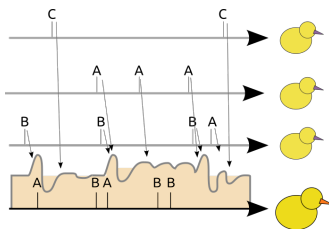
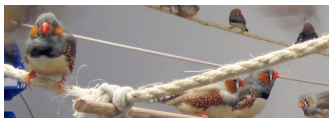
# Conversation analysis



# Conversation analysis...?



# Bird communication networks



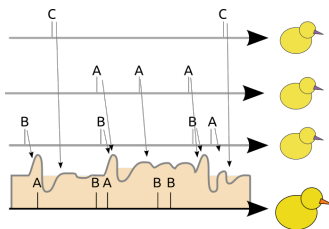
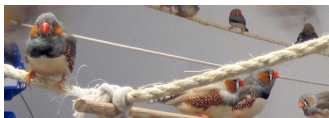
Stowell et al. (2016) Royal Soc Interface

10.1098/rsif.2016.0296

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



# Bird communication networks



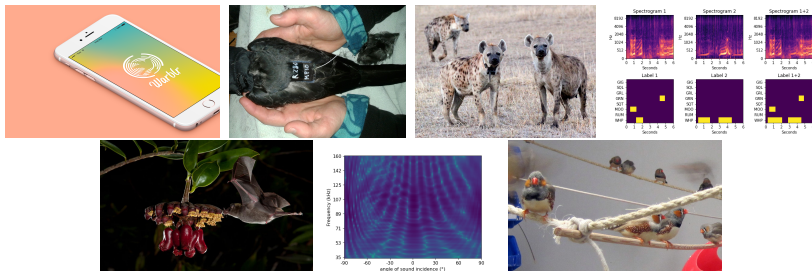
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→Future: Analyse inter- and intra-species interactions in the wild



# Summary: sound + animals + machine learning...



## High-resolution acoustic AI for biodiversity monitoring

