# Careers in Behavioural Ecology

Dr Alice Morrell
Postdoctoral Research Associate, University of Oxford

# What is a Postdoctoral Research Associate?

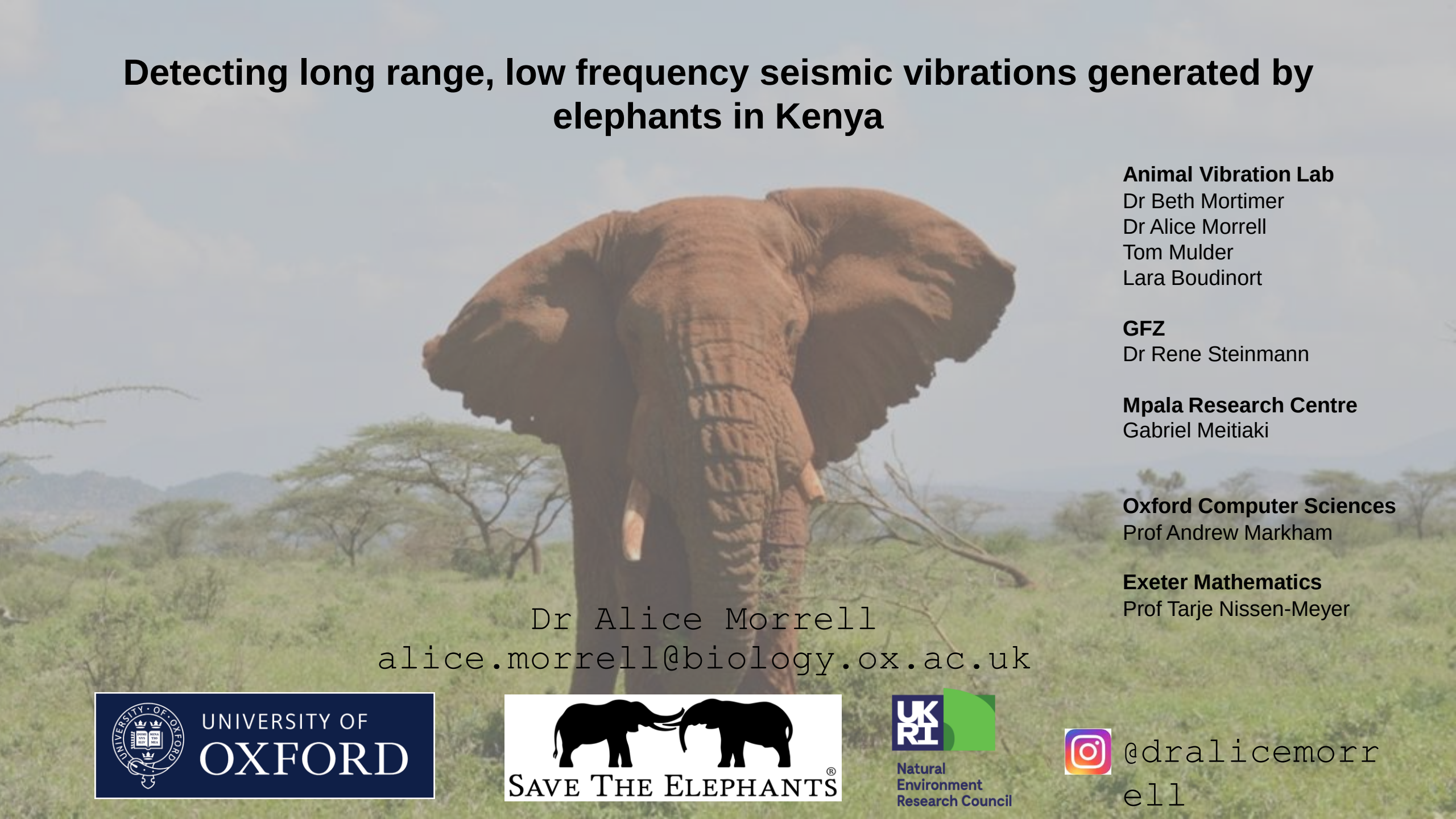
- Postdoc~~toral Research Associate~~
- BSc -> MSc -> PhD -> Postdoc -> Senior Postdoc (Fellow) -> Lecturer -> Associate Professor -> Professor

- Academica – University
- Have a PhD
- Carry out research
- Contract 1-3 years

| Pros | Cons |
| --- | --- |
| • Working on ground-breaking research (on something you love)<br>• Travel/exciting collaborations<br>• Problem solving<br>• Creative | • Short contracts<br>• Paid less than industry<br>• Problems can be hard to solve |

# What do I research?

# Detecting long range, low frequency seismic vibrations generated by elephants in Kenya




**Animal Vibration Lab**
Dr Beth Mortimer
Dr Alice Morrell
Tom Mulder
Lara Boudinort

**GFZ**
Dr Rene Steinmann

**Mpala Research Centre**
Gabriel Meitiaki

**Oxford Computer Sciences**
Prof Andrew Markham

**Exeter Mathematics**
Prof Tarje Nissen-Meyer

Dr Alice Morrell
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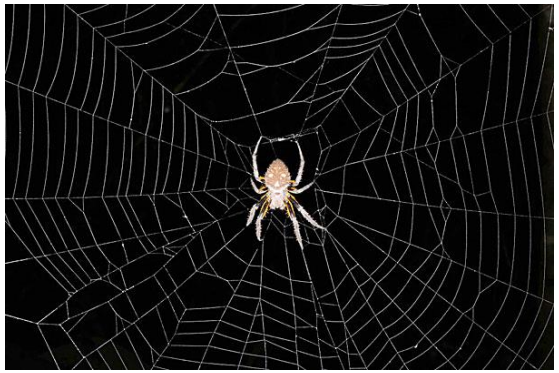
# Animals and vibrations

Animals use vibrations that travel within and along materials to gather information




Decision Making

# Elephants and seismic vibrations

Specialised mechanoreceptors - Pacinian corpuscles (Bouley et al., 2008)

Ground-based vibrations

# What we know

**The social contexts of some very low frequency calls of African elephants**

Joyce H. Poole[1,3], Katherine Payne[2], William R. Langbauer Jr.[2], and Cynthia J. Moss[3]
[1] Biology Department, Princeton University, Princeton, NJ 08544, USA
[2] Laboratory of Ornithology, Cornell University, Sapsucker Woods Rd., Ithaca, NY 14850, USA
[3] Amboseli Elepl
Received June 1(

MARCH 01 1997

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David Larom; Michael Garstang; Malan Lindeque; Richard Raspet; Mark Zunckel; Yvonne Hong; Kevin Brassel; Sean O'Beirne; Frank Sokolic

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ELSEVIER

Animal Behaviour
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Nachiketha Sharma [a d], Vijay Prakash S [b], Shiro Kohshima [a], Raman Sukumar [c d]

CORRESPONDENCE · Volume 28, Issue 9, PR547-R548, May 07, 2018 · *Open Access* Download Full Issue

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Beth Mortimer [1,2] · William Lake Rees [3] · Paula Koelemeijer [3] · Tarje Nissen-Meyer [3]

- Elephants generate seismic vibrations through low frequency rumbles and movement
- 20-40Hz
- Modelled to propagate up to 6km

# What we don't know

**The social contexts of some very low frequency calls of African elephants**

Joyce H. Poole[1, 3], Katherine Payne[2], William R. Langbauer Jr.[2], and Cynthia J. Moss[3]
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- Elephants generate seismic vibrations through low frequency rumbles and movement
- 20-40Hz
- Modelled to propagate

- Communication – to what extent?
- Purpose
- No fine scale empirical evidence
- Noise interference

# The study questions

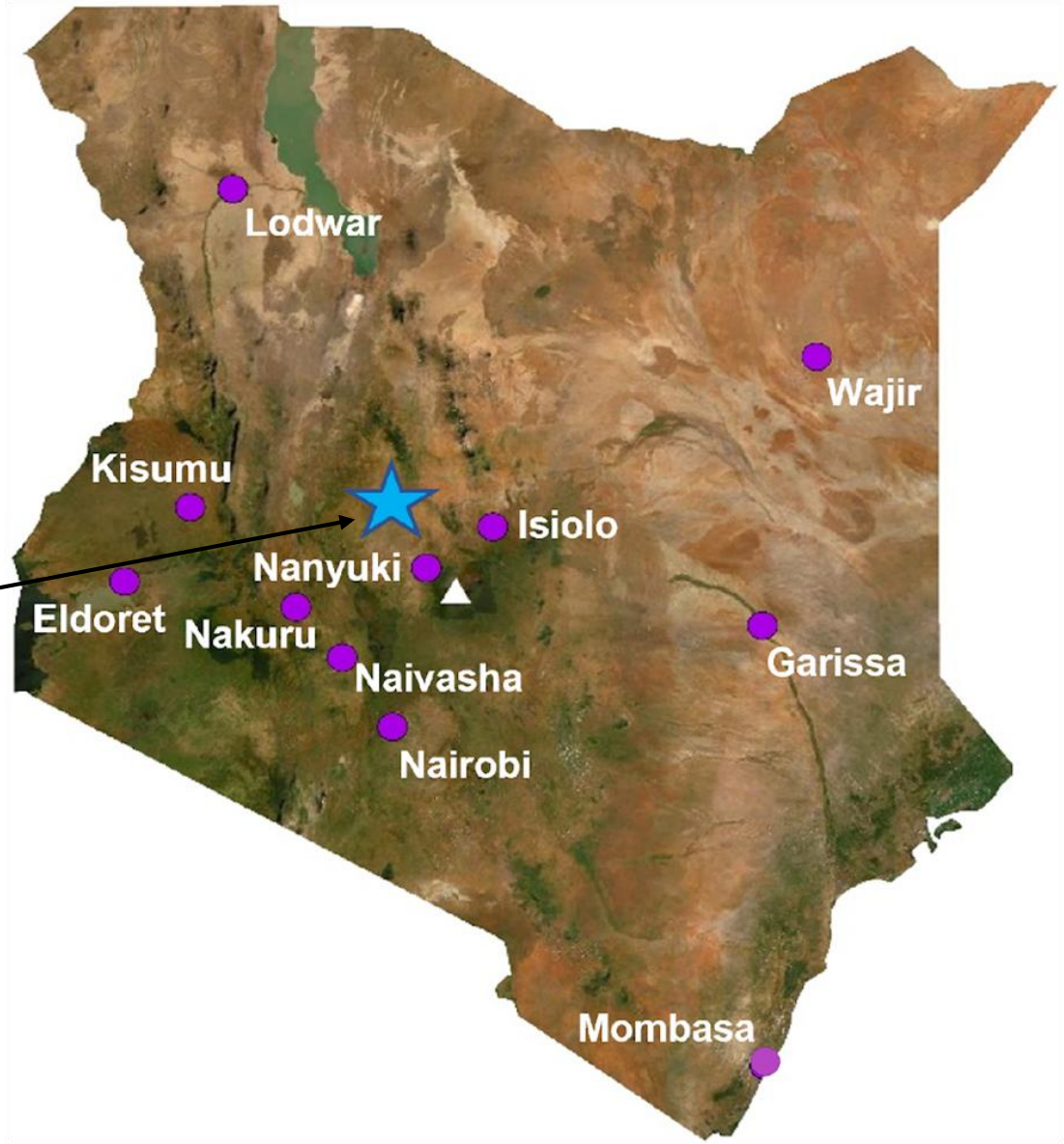
What benefits, if any, do seismic vibrations offer for elephants to communicate in their natural habitat?

Do seismic and acoustic vibrations generated by the same rumble differ in information content for elephants?

Can we use seismic vibrations to remotely monitor wildlife?

# Study Site


Mpala Research Centre




Dr Dan Hending

# Equipment

- Ultra-dense array
- Seismic sensors
  - Stryde nodes
  - 1220
- Acoustic sensors
  - 4-way microphones
  - 56
- Camera traps
  - 30

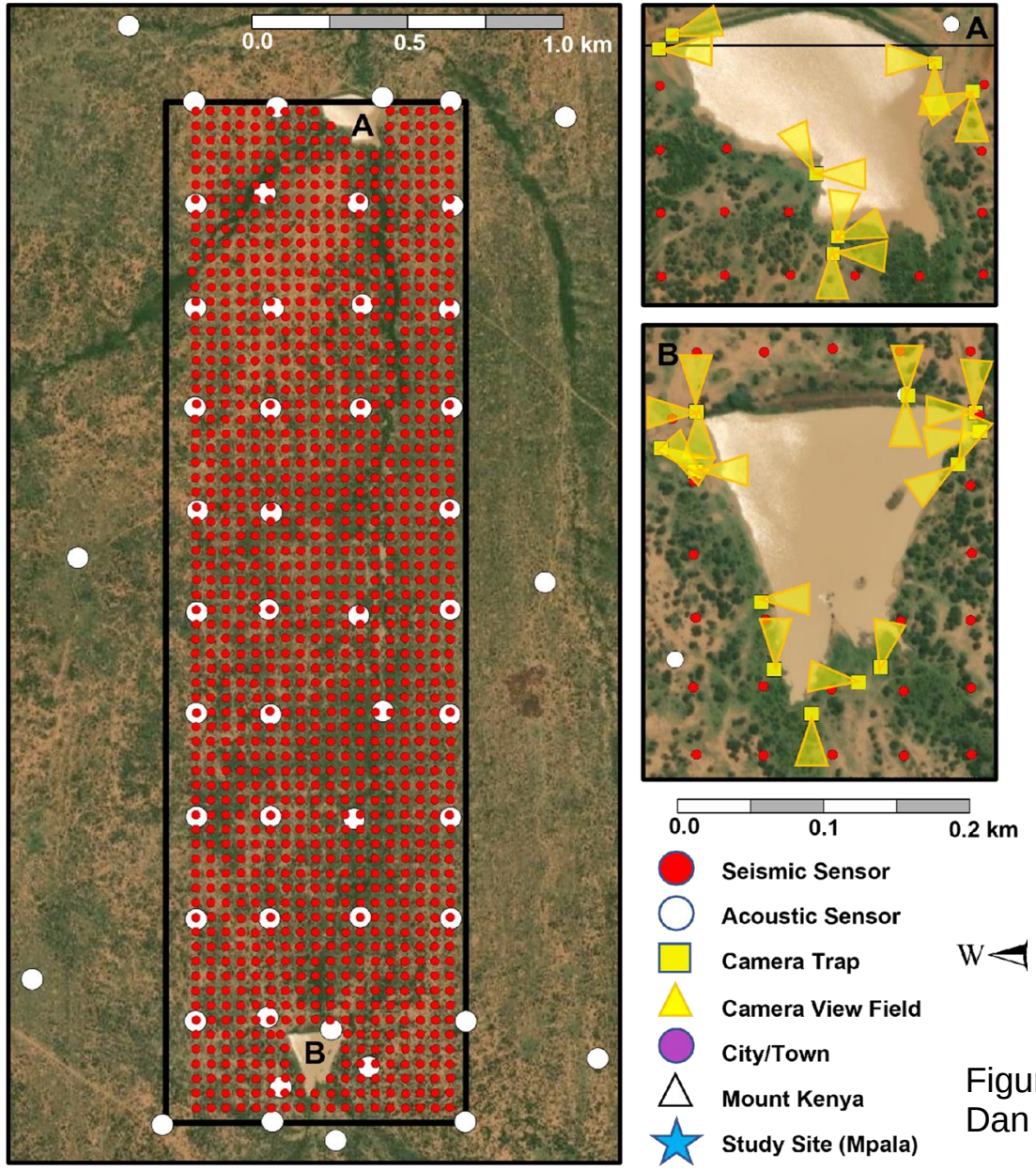



Figure: Dr Dan Hending

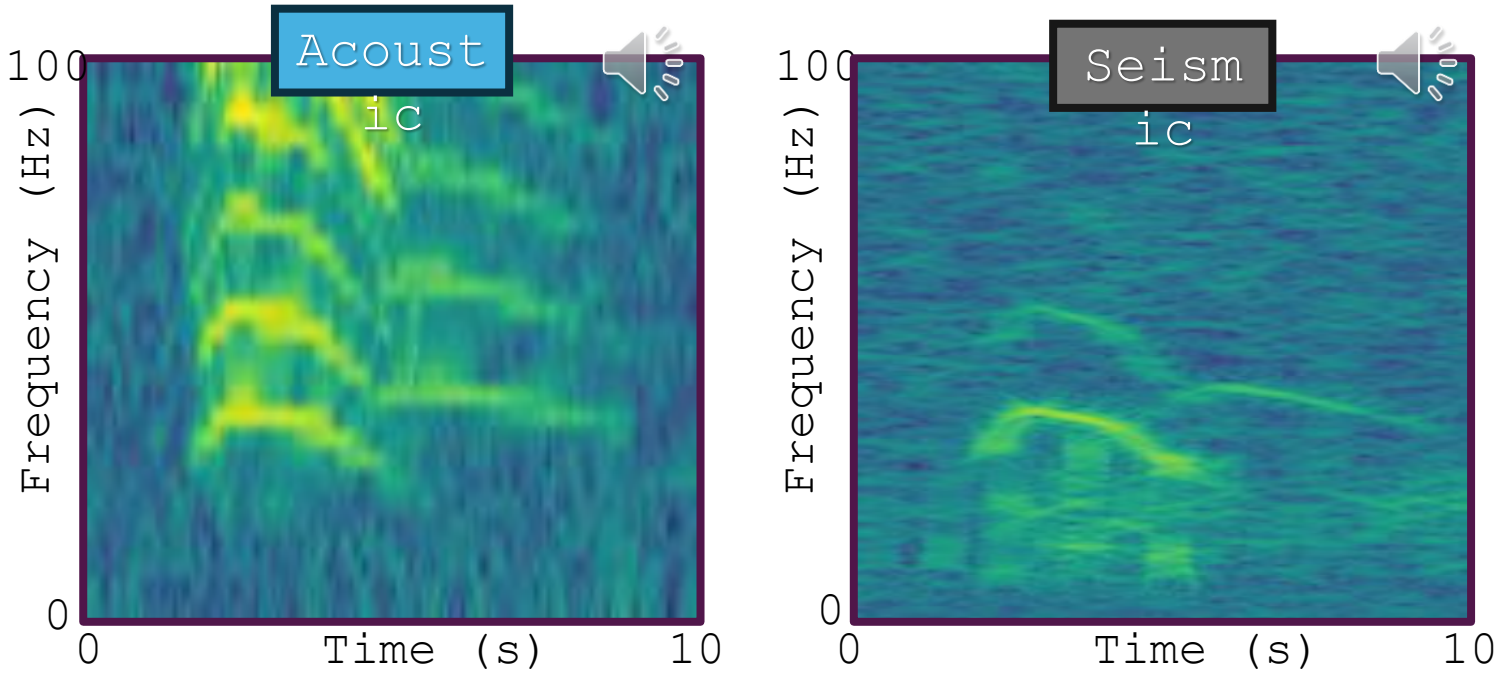
# Deployment



# Results

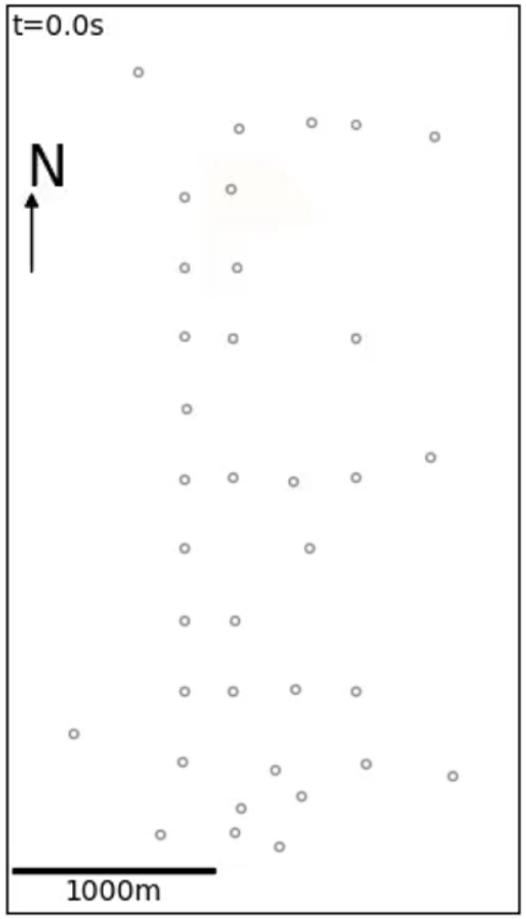
**Results for detection:**

- Seismic recordings to spectrograms
- Seismic and acoustic recordings of rumbles show differences
- Propagation differences?

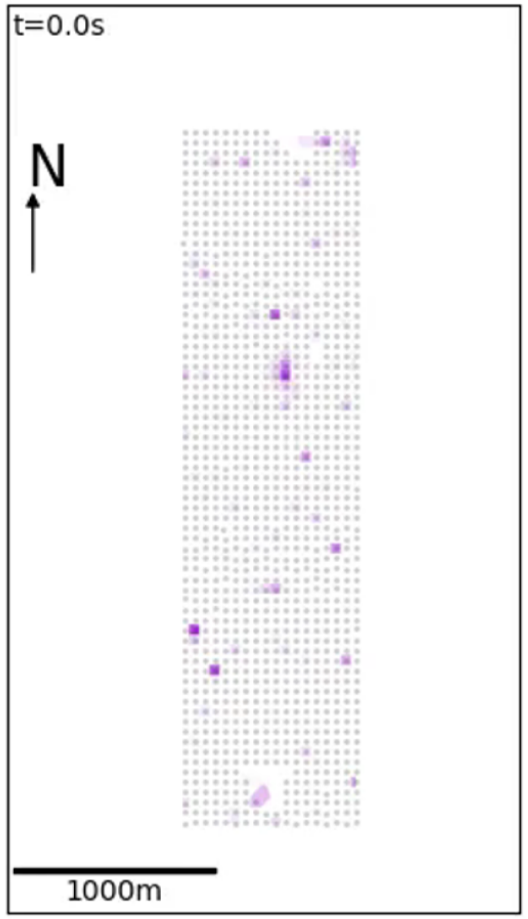



Mortimer, B. *et al.* 2018. *Curr. Biol.*, 28, R547-R548, Szenicer et al. 2021. *Remote Sens. Ecol. Cons*

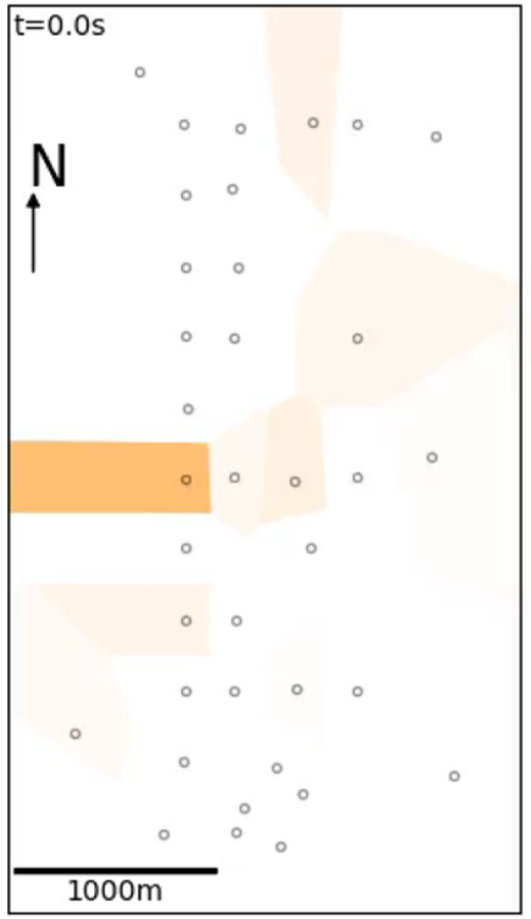
# Propagation




Acoustic




Seismic

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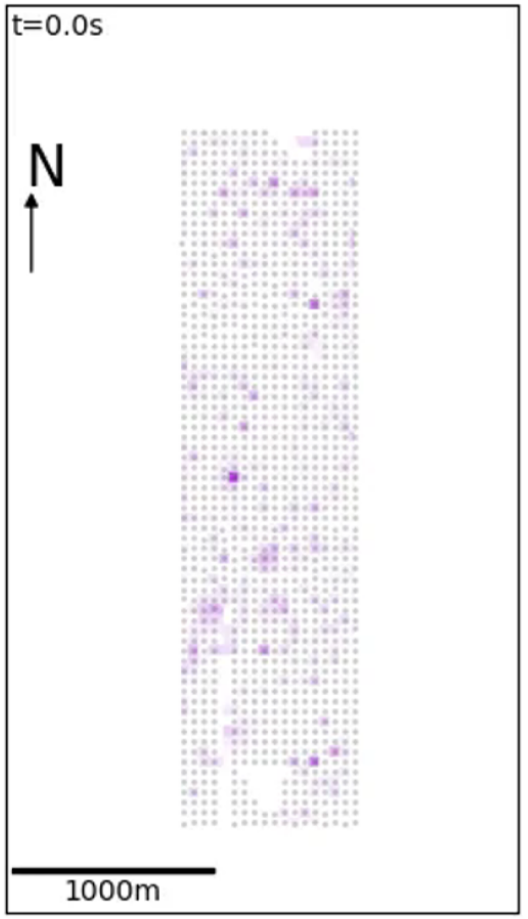
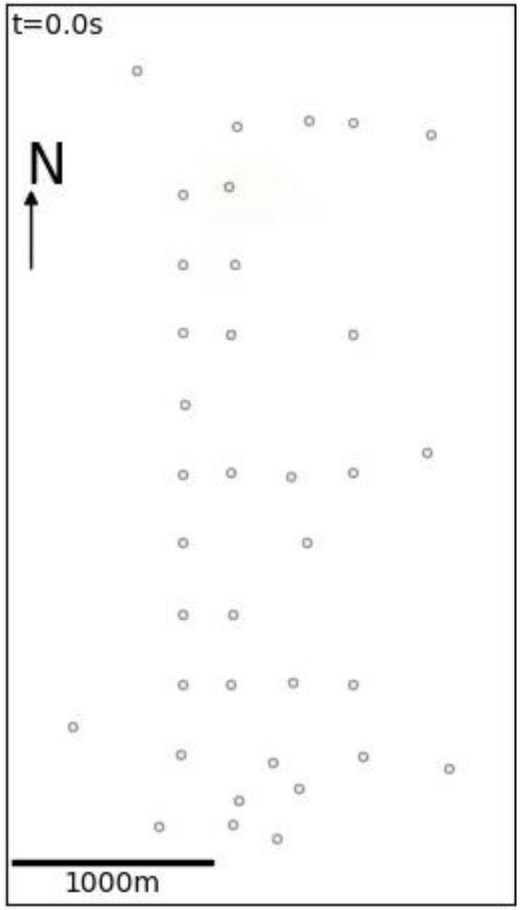
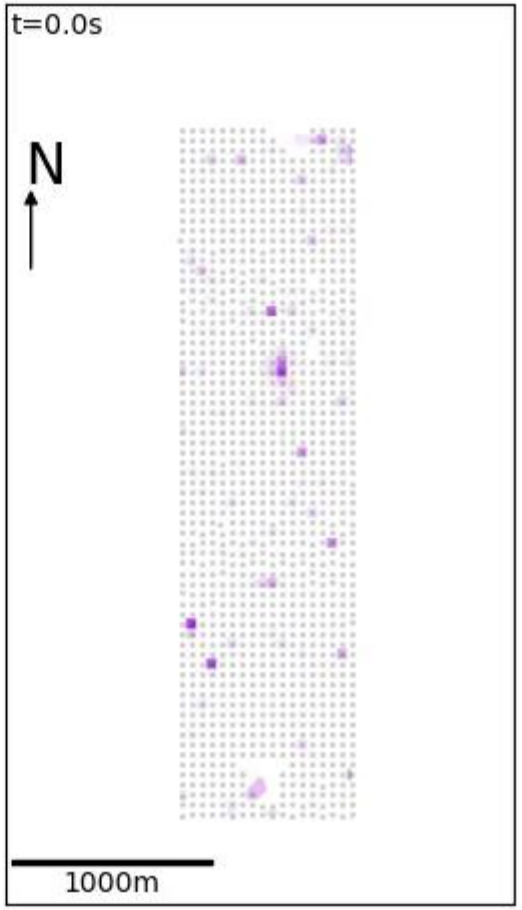



Seismic

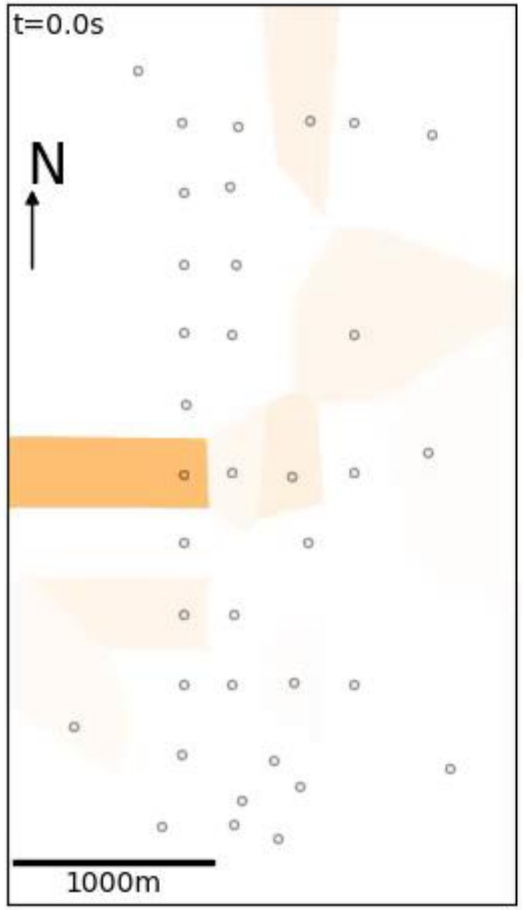
# Propagation



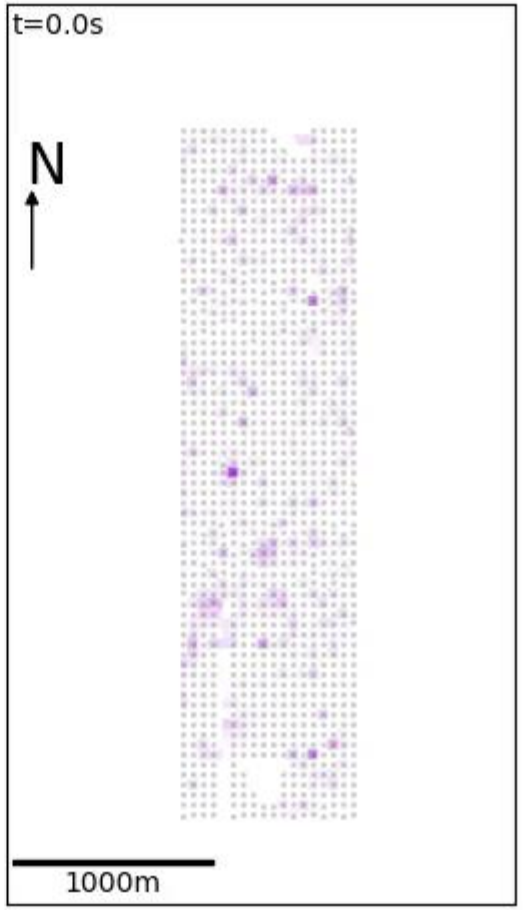

Acoustic




Seismic

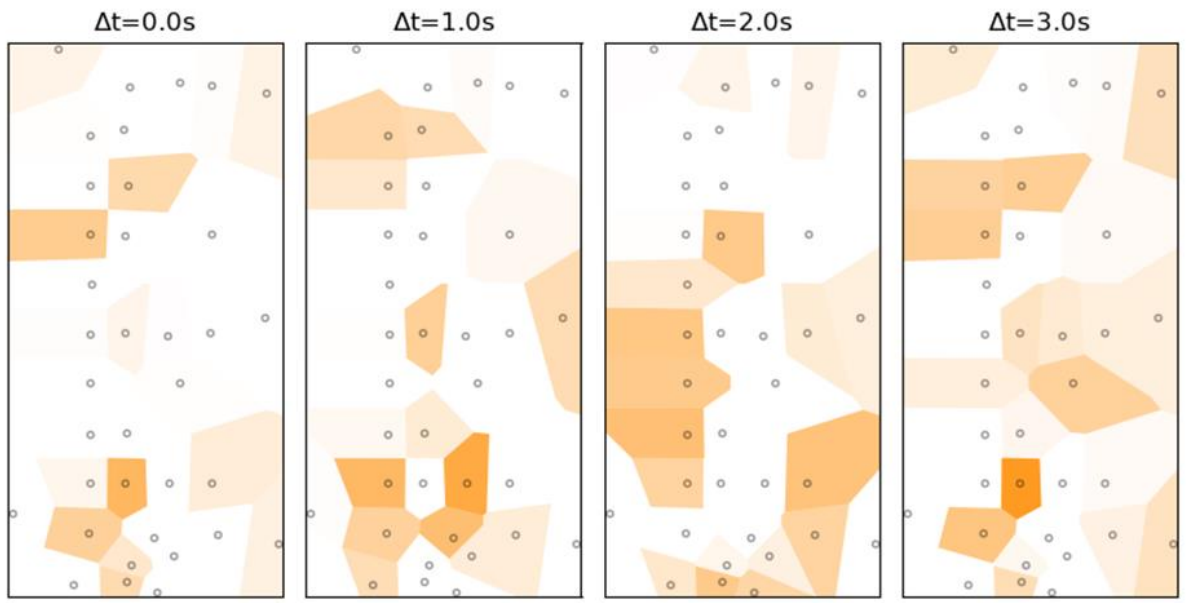


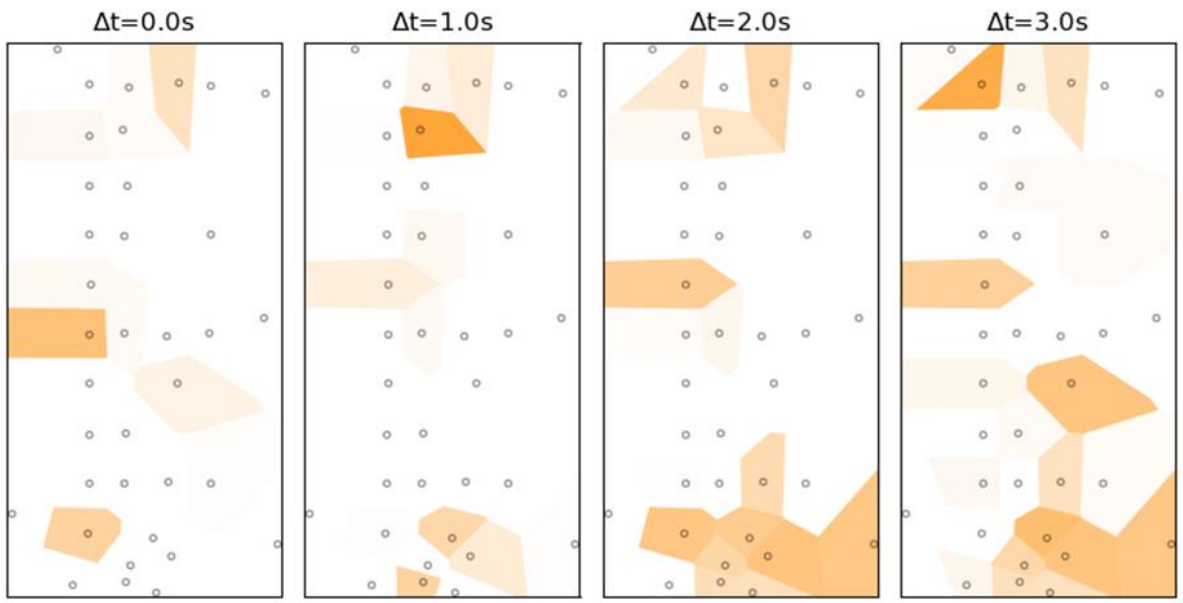

Acoustic




Seismic

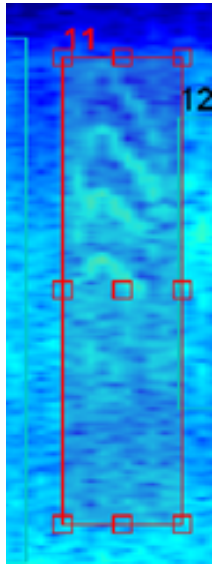
# Propagation




Figures from Hending et al., 2024 *in press*

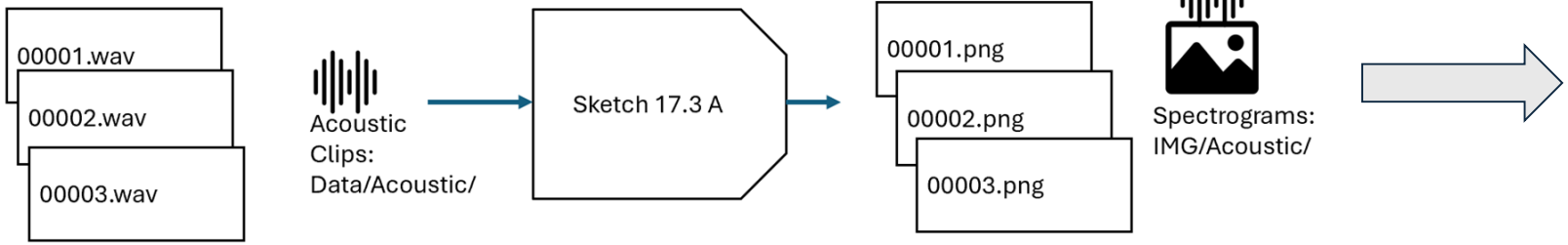
# Rumble detection using machine learning



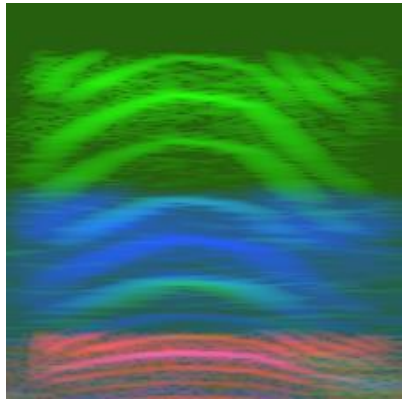

```
'rumble': 5068,
'not sure if rumble': 2358,
'wind strong': 2289,
'wind av': 776,
'wind quiet': 470,
'vehicle': 265,
'trumpet': 71,
'plane': 60,
'unknown': 40,
'unknown animal': 26,
'nan': 26,
'roar': 18,
'rumble roar rumble': 15,
'cry': 13,
'rumble very weak': 8,
'possibly vehicle': 7
```

Taylor Bi
Ayse Gorbon

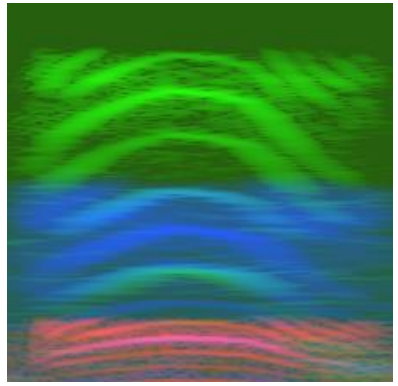
- Manually label rumbles in Raven Pro software
- Supervised machine learning:
  - Annotation amalgamation
  - Clip extraction
  - Preprocessing
  - Model training using ResNet-18 architecture

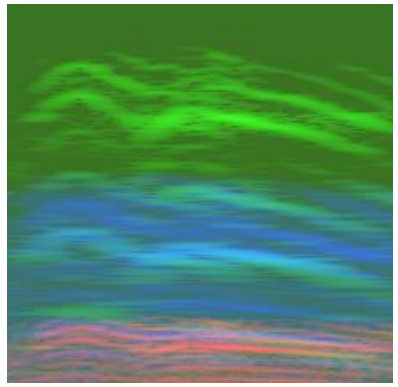


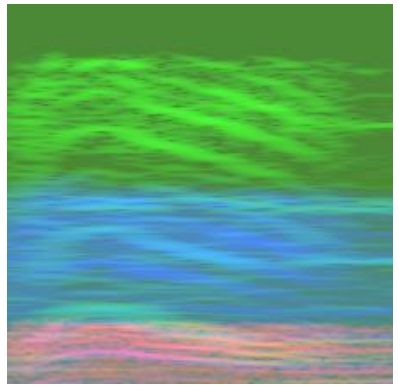

Preprocessing



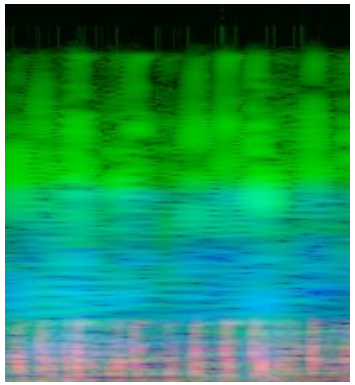
Positive (Rumbles)

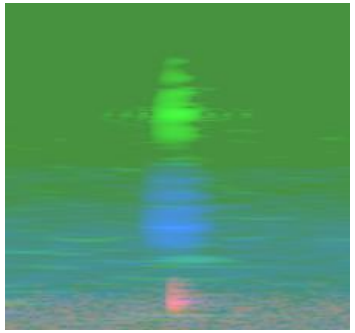


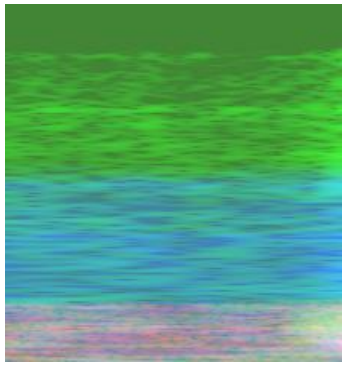


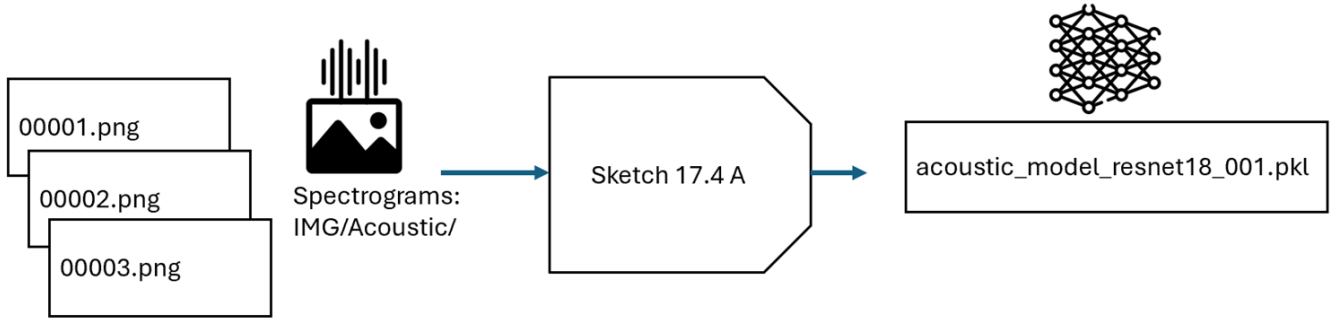


Negative (Not Rumbles)

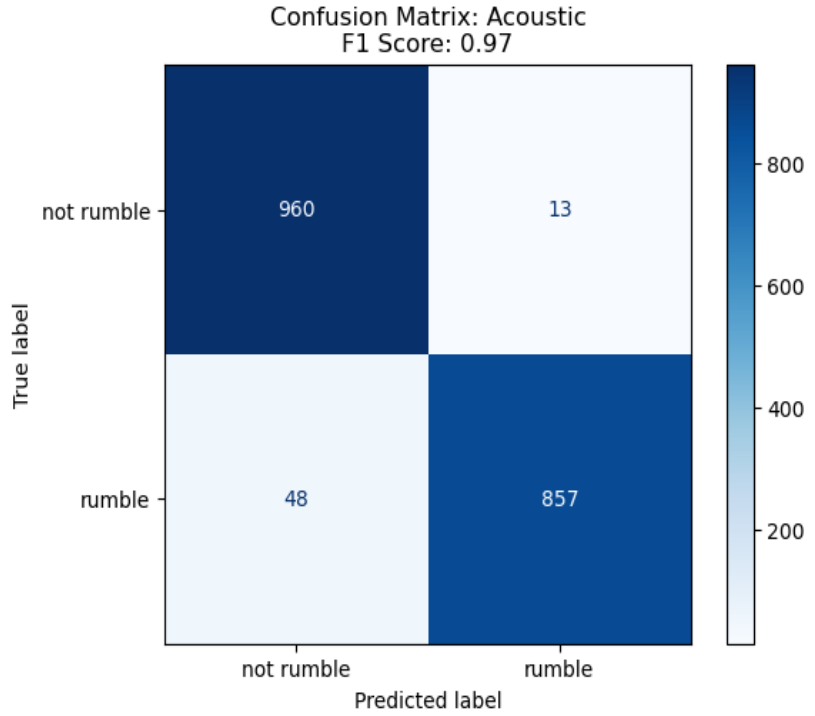




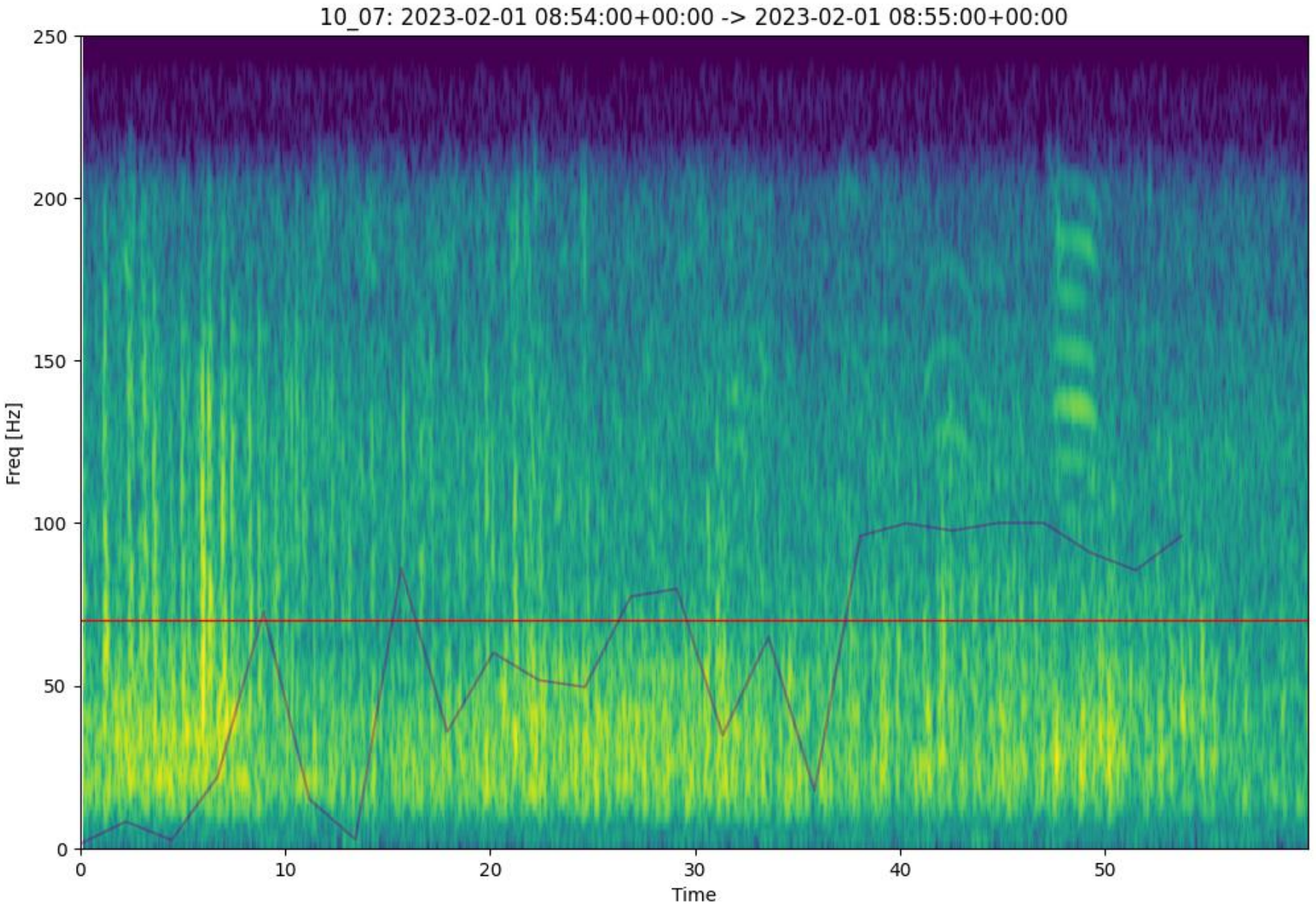





## Model Training



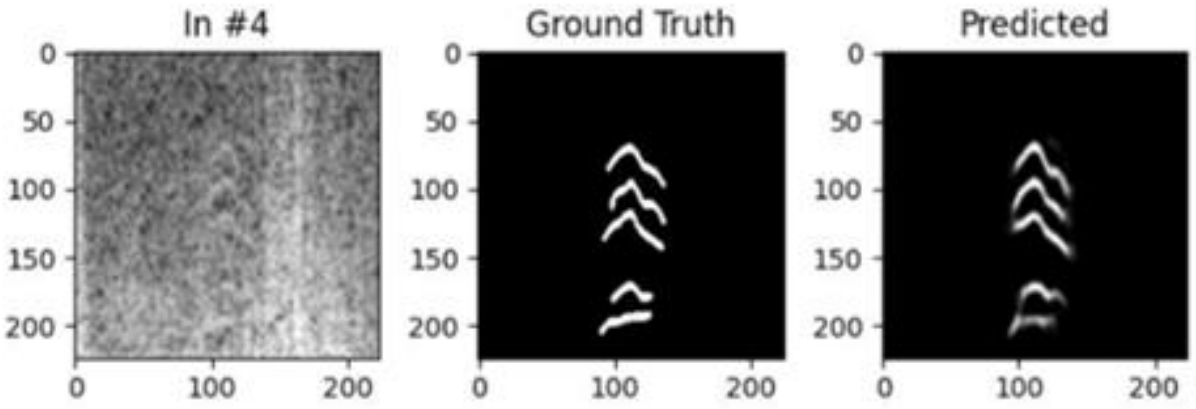
# Results - Seismic

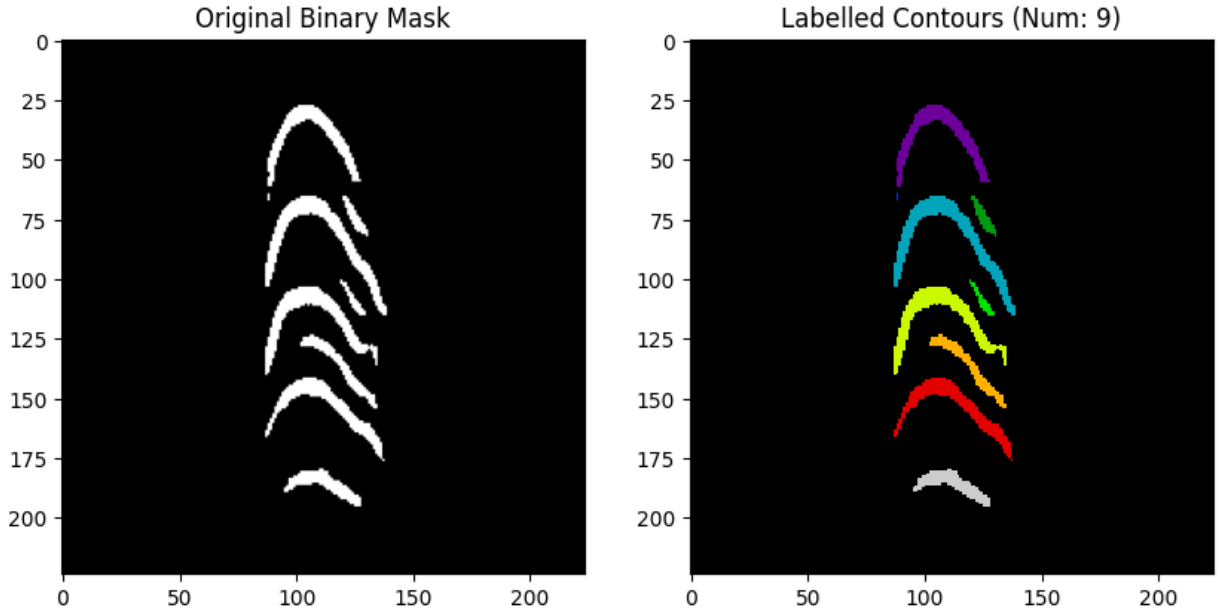



## Next steps:

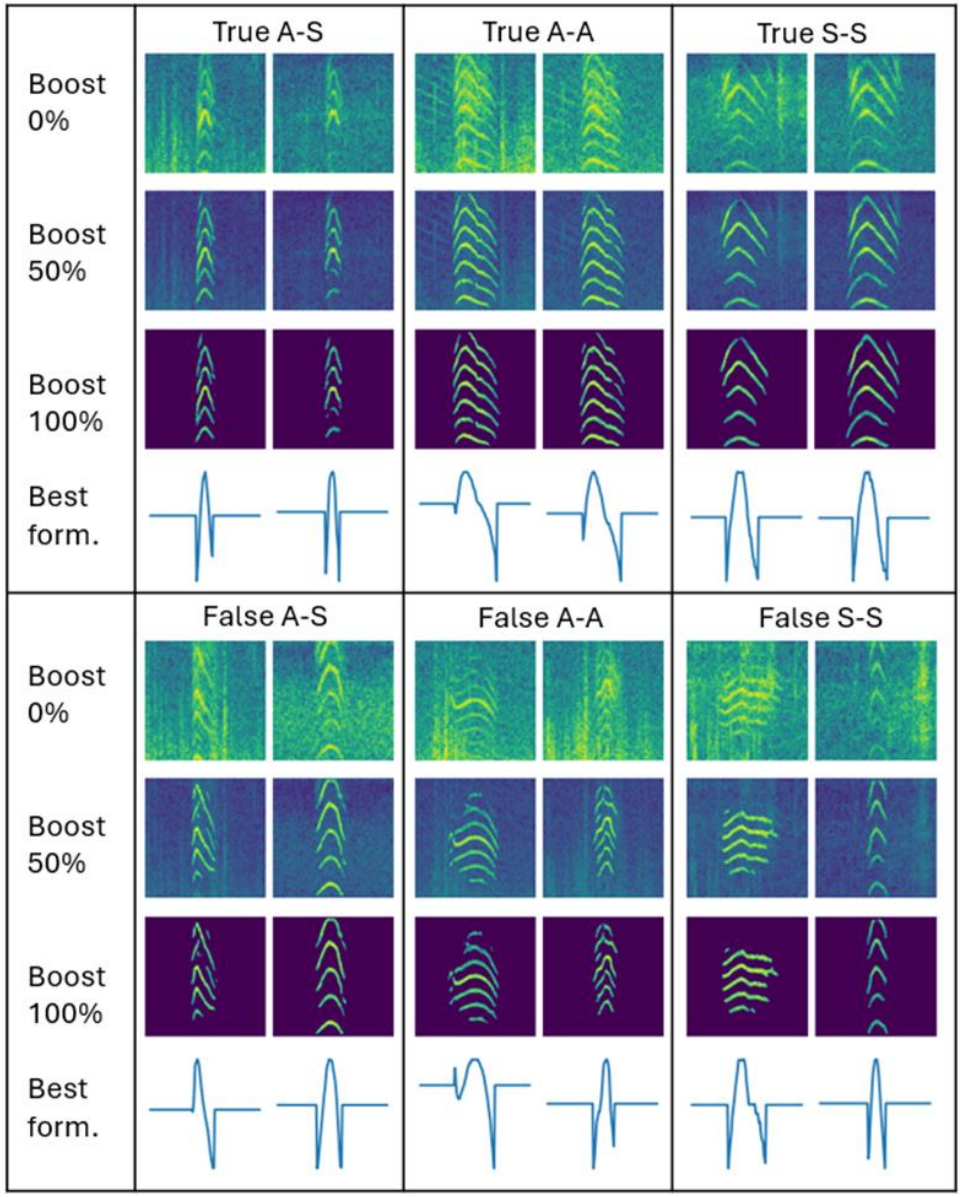
- Refine seismic detector
- How much impact does noise have on rumble detection?
- Detect rumbles across the array
- Introduce multiple classes e.g. vehicles, other animals

# Noise Reduction



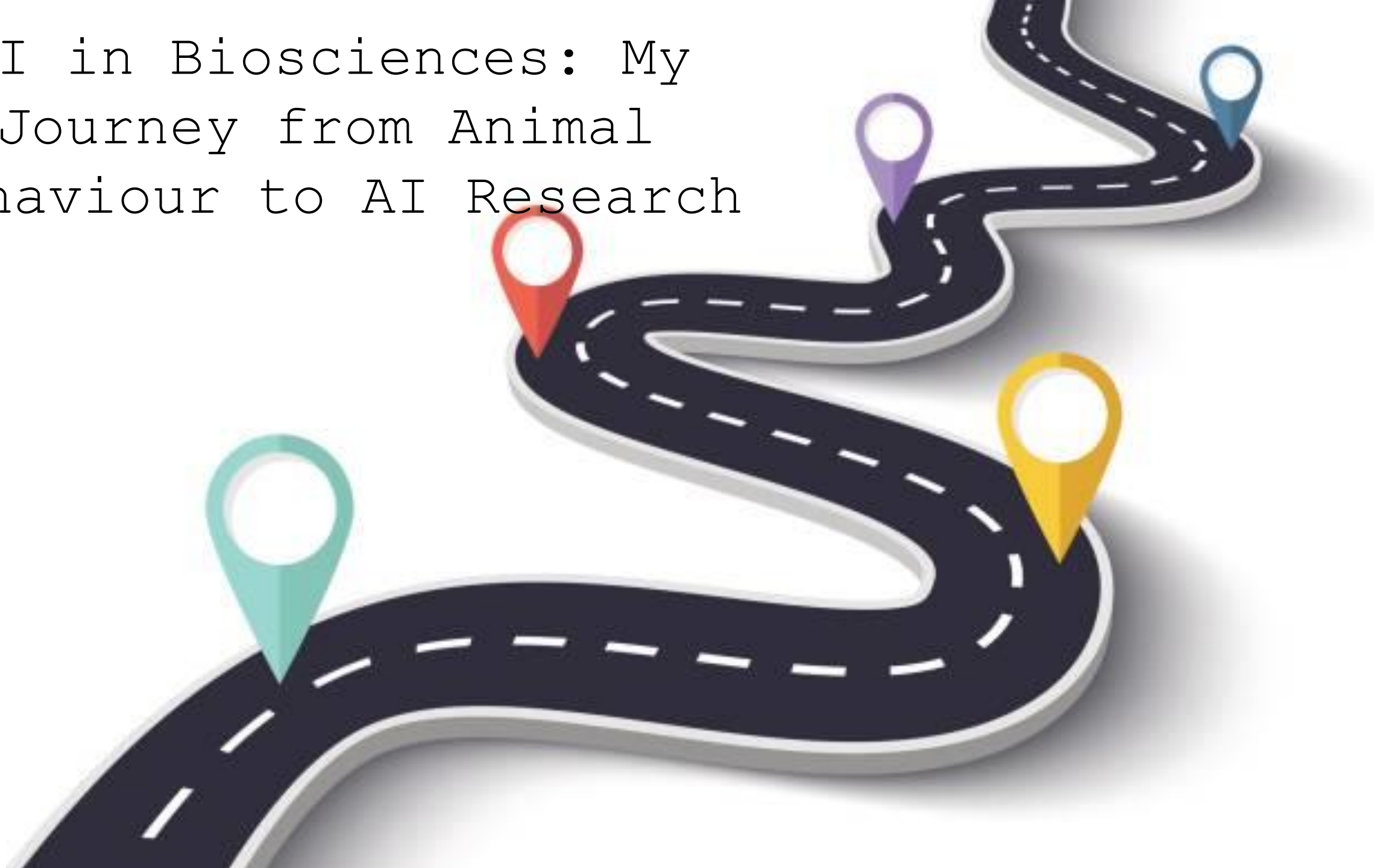

Figures: Tom Mulder



# How AI & Machine Learning Are Transforming the

- AI is revolutionising biosciences
- Helps analyse massive datasets in biology in less time.
- Only as good as the input provided to it.
- Your generation will work with AI-driven bioscience breakthroughs!

# AI in Biosciences: My Journey from Animal Behaviour to AI Research



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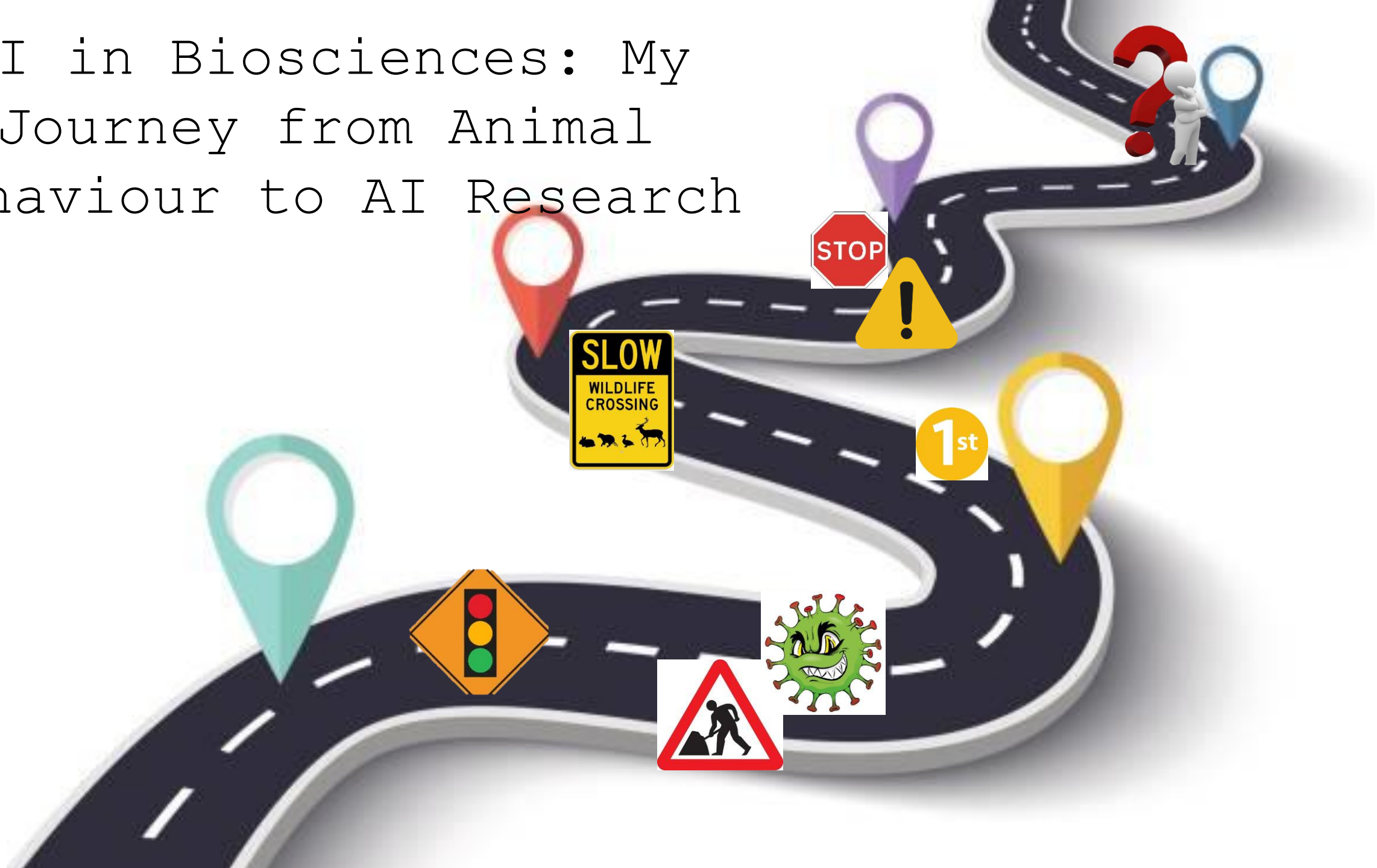

BSc Animal Behaviour and Welfare (University of Bristol)

Research Assistant - Dwarf Mongoose Project


Lecturer in Animal Management

BSc Animal Behaviour and Welfare (University of Bristol)

Research Assistant - Dwarf


Lecturer in Animal Management

On 20 April 2016 at 12:41, [redacted]

[redacted]

[redacted] Also, she is not SO strong academically to make me think it would be a relatively easy case of supervising. So, on balance, sadly not. [redacted]

[redacted] Thu, 21 Jul 2016, 12:08

Dear Alice

It was great to meet you on Tuesday. I'm sorry to have to tell you that we gave the post to one of the other candidates. [redacted], your application was very strong and you might well have got the post if we had not had such a very experienced selection of candidates.

Many thanks for your application and very good luck in your future career.

Yours

BSc Animal Behaviour and Welfare (University of Bristol)

Research Assistant - Dwarf Mongoose Project

MSc Evolutionary and Adaptive Systems (University of Sussex)

Lecturer in Animal Management

Partnerships Coordinator (Gent University)

Data Manager (University of Oxford)

Postdoc (University of Oxf

Bioinformatics Intern (Wellcome Sanger Institute)

PhD Biosciences (Royal Veterinary College

# Lessons from My Journey

- Interdisciplinary knowledge is powerful – blending biology & AI
- AI & ML are shaping the future of biosciences
- Rejection is inevitable
- Data science skills open doors – Python, R, MATLAB are valuable
- Your future job might not exist yet

# How You Can Get Started

- Learning AI & Data Science:
  - Online courses (Coursera, edX, Kaggle, etc.)
  - Hands-on projects (wildlife tracking, bioinformatics)
- Career Advice:
  - Stay curious & interdisciplinary
  - Seek internships & opportunities

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