



AI for Behavioral Discovery

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The Team

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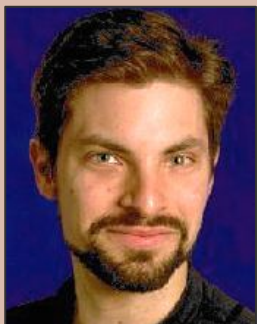
Hannah

CS + DS '28



Advisors

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Dr. Ben Firner



Dr. Rich Howard

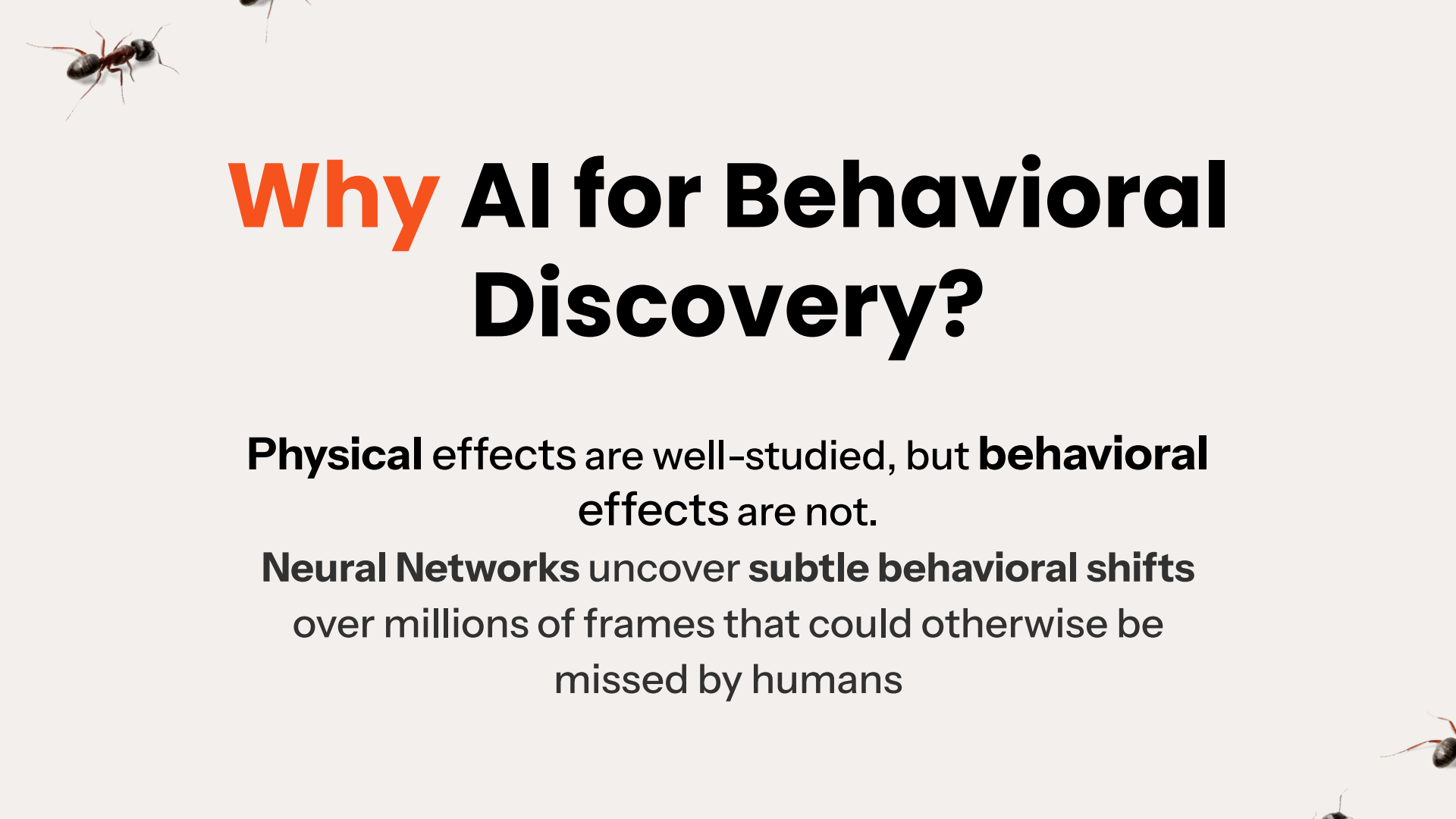




What is AI for Behavioral Discovery?

Our project aims to use CNNs (Convolutional Neural Networks) to **find patterns of change** in the **behavior of animals** like bees, ants, or roaches in response to electromagnetic fields.



A large ant is in the top-left corner, and two smaller ants are in the bottom-right corner.

Why AI for Behavioral Discovery?

Physical effects are well-studied, but **behavioral** effects are not.

Neural Networks uncover **subtle behavioral shifts** over millions of frames that could otherwise be missed by humans

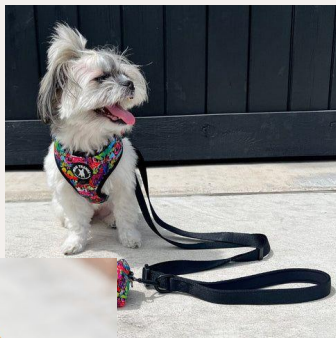
Work so Far

In the past 5 years, **a lot** of progress has been made with this project

- Built a data processing system
- Experiment setup
- Gathered a lot of data
- Tested on various animals like **bees, roaches, and ants**

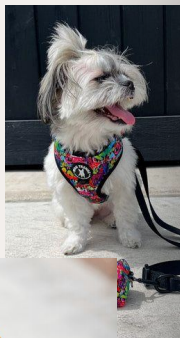
What is a Confounding Variable?

Confounding Variable: Something the model uses to try and **cheat**

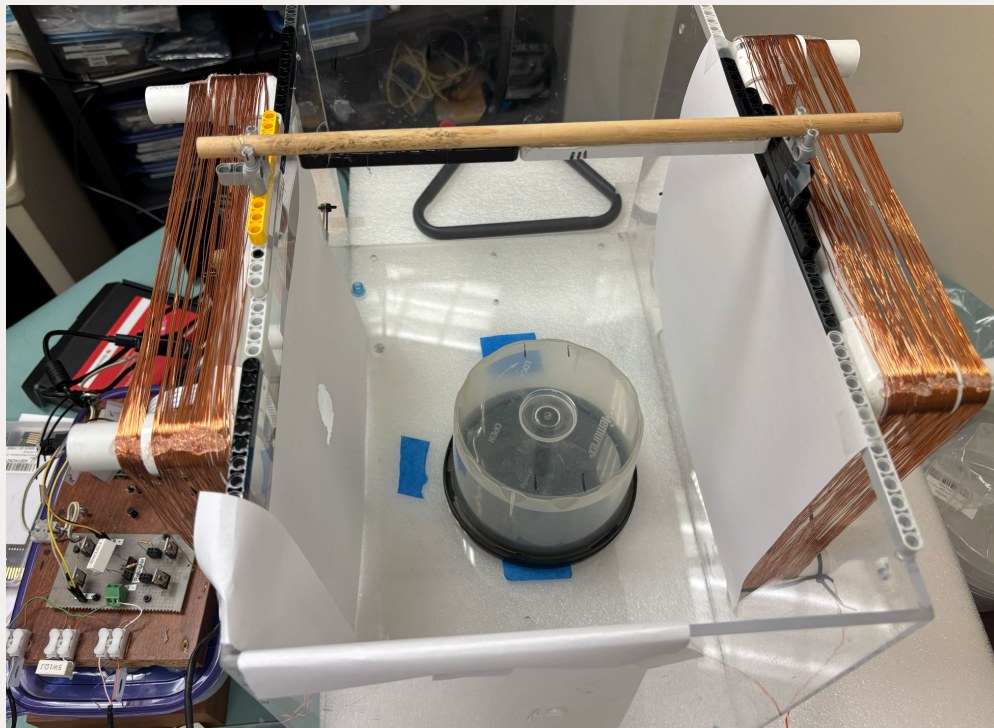
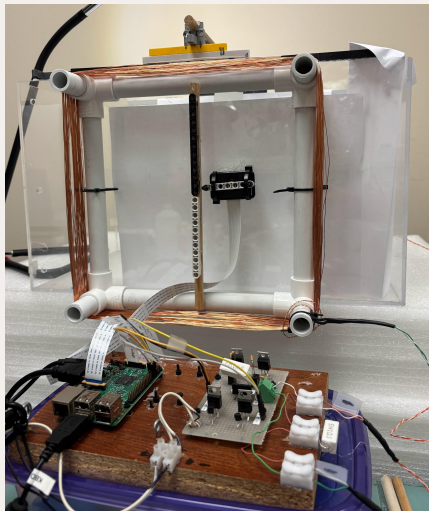


What is a Confounding Variable?

Confounding Variable: Something the model uses to try and cheat



Experiment Setup

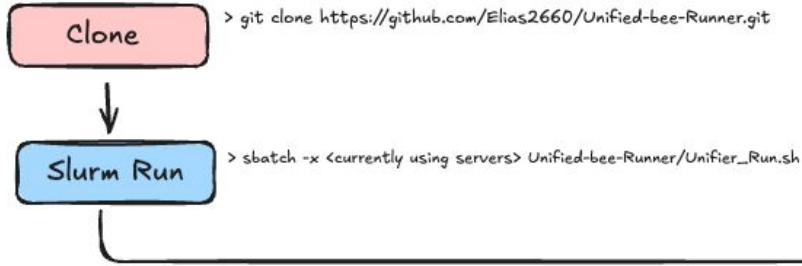


Aiming to reduce **as many** confounding variables as possible

- Model could learn from all kinds of factors like: **time of day, movement of wires, lights, etc**

Data Processing System

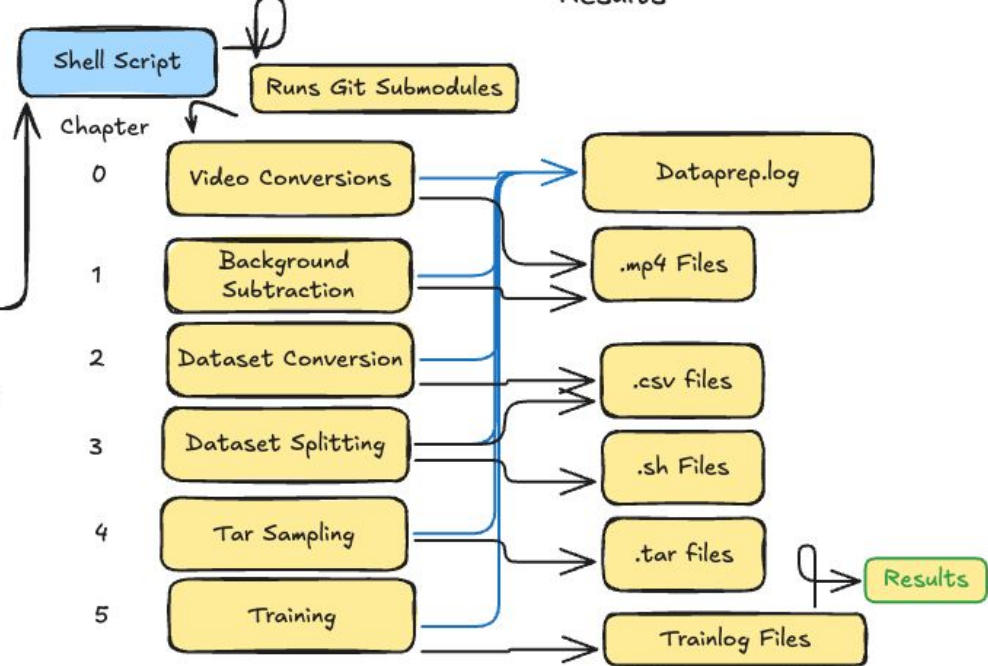
Stuff You Run



Prerequisites

Preferably a directory that is empty except for video files and .txt files
Slurm and usable servers

Under The Hood



Where did we start?

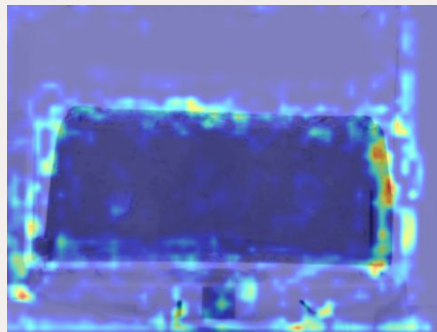
- Data processor only working with ant data
- **Super slow**, and there were various issues with data processing
- Issues with **memory management and disk space**
- Didn't know if the Neural Network is actually working or using shortcuts to detect the field states

Visualizations

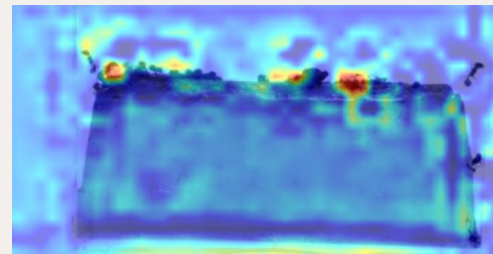
Fixed and **improved**
visualization functionality

Heatmaps to visualize
what model is looking at

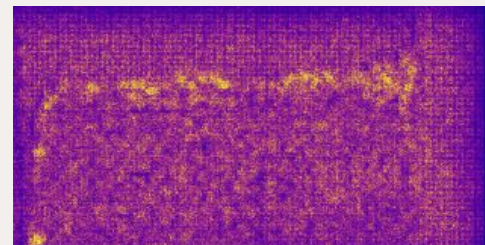
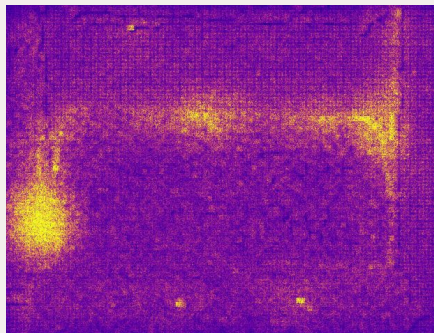
Both are results with high
accuracy



Looking at something
outside the ant farm.

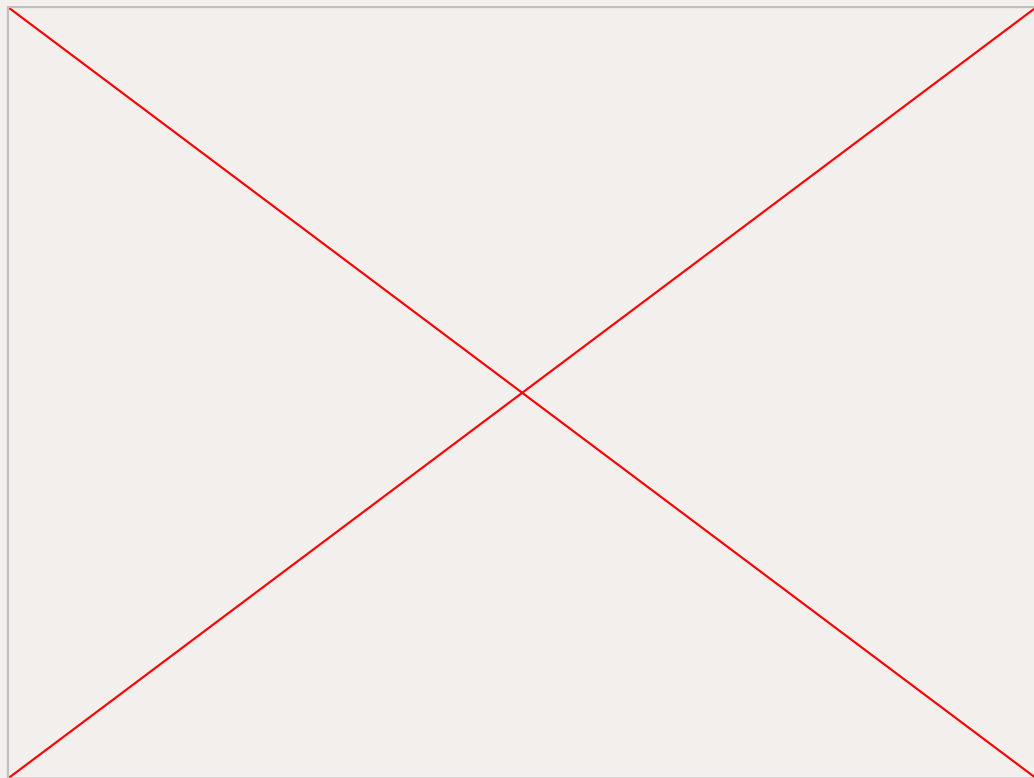


Looking at the ants



Visualizations

- **Visualizations** to see what the model is looking at.
- **Fixed** gradCAM visualization

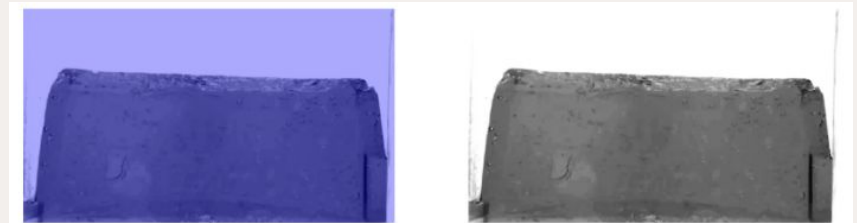
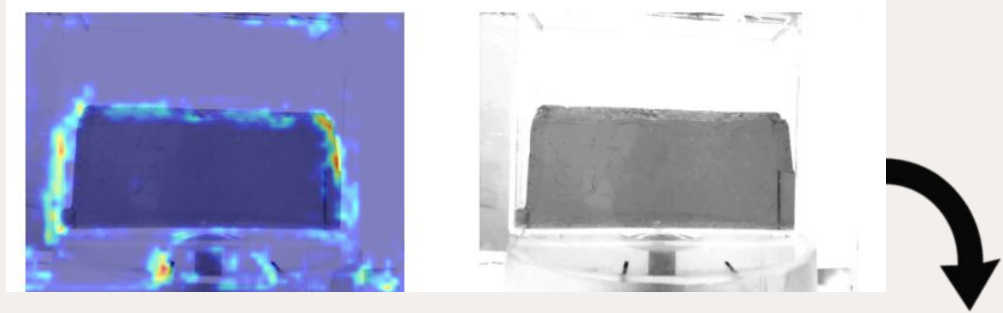


Results

Confusion Matrix

Label 0:	119683	0	0
Label 1:	119683	0	0
Label 2:	119683	0	0

Label 0:	24000	4096	1749
Label 1:	0	29845	0
Label 2:	0	931	28914

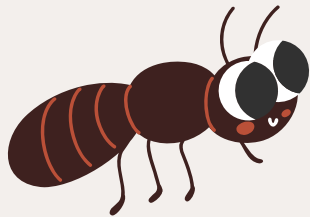


Data Processing System 20x faster (from 20 days to 24 hours approx.)

Conclusions & Future Work

- ★ The AI model will continue to attempt to shortcut learn by any biasing features in the dataset → **Further refine setup**
- ★ Finish and publish **research paper**
- ★ **Gather more data:** bee data, roach data, potentially bird data
- ★ **Rebuild documentation for next year** + maximize ease of use (so anyone can run it!)





Thank you!

