Neural Networks for Feature Analysis

Daksh, Mayank, Katie
Motivation

- **Animal behavioral studies**: Hypothesize some response to a stimulus and use statistical methods to test the hypothesis
- **Issue**: Someone needs to guess what the behavior will look like in the first place
- **Solution**: We can use machine learning (ML) to analyze features of behavior we wouldn’t expect

**What’s our objective**: How well can neural networks analyze behavioral response to stimuli?
Our approach

- **Dataset**: Generate samples of unbiased or biased behavior (bias indicates stimulus)
- **ML model**: Neural network predicts if a sample was biased or unbiased
- **Report accuracy**: Accuracy indicates the ability of model to learn features

How does the accuracy depend on amount of bias?
Software Stack

ML stack: [https://github.com/bfirner/bee_analysis](https://github.com/bfirner/bee_analysis)

Dataset format: Each dataset is tarfile of samples
- Each sample contains frames and class information

Model: Modified version of AlexNet
- Input is series of depth-stacked frames
- 1st layer Conv2D kernels must fit number of frames (e.g. 4 frames → 12 layered kernel)
- Output: Either class 1 or class 2
Testing the Stack

- We trained the model using simple test cases
- This was to validate that the software stack works as expected
- Main test cases:
  - Black/White Frames
  - Left/Right Chequered Pattern
  - Clockwise vs Anticlockwise Test
CW vs CCW Test

Testing the model with Patterns

- Time varying features

4 frames – 100%       1 frame ~ 50%
Simulation for Feature Recognition

Random

Bias (30° shown)

+-10°

+-10°

+30°

Only Right
Accuracy vs Bias

Ability of NN to distinguish 3 transition Pacman
Next Steps—More Complex Behaviors

- Agent
- Unbiased
- Bias = 30°
- Dest.

Graph: Ability of NN to distinguish biased vs direct navigation

Accuracy vs Field Susceptibility (Degrees)
Next Steps—Under the Hood

- Saliency graphs
  - Right now, we have no idea what the model learns
  - Black box
  - Next step is to see what the model is actually picking up