**Attractor Dynamics in Neural Activity During Motor Task Learning**

| Final Project Report | Ian Jackson | ECE590: Brain-Computer Interfaces |

Troubleshooting

* Why only -90 to 90 degrees showing?
* Check the movement data (show a plot of movement video)
* Try averaging instead of summing spike counts to account for noise (maybe even normalize to reduce noise)

Characterizing the Spiking Data

*Plotting spikes*

* Figure: show the spiking

*Gaussian windowing*

* Figure: compare the raw spiking activity with and without a Gaussian window

*Channel-based and unit-based spiking*

* Figure: compare spiking from units vs. channels

*Directional Tuning*

* Figure: angular preferences for each unit
* Figure: angular preferences for each channel

Attractor Dynamics

*What is an attractor?*

* Examples: Hopfield Network, strange attractor (Lorenz system)

*Why attractors for neural networks?*

* Examples: [Lukashin et al. (1996)](https://pubmed.ncbi.nlm.nih.gov/8867471/), [Stringer et al. (2003)](https://www.sciencedirect.com/science/article/pii/S089360800200237X?via%3Dihub), [Khona & Fiete (2022)](https://www.nature.com/articles/s41583-022-00642-0#Sec5)

*Modeling Spiking Data as an Attractor Network*

* Method: use just the time varying spike rate (Khona & Fiete), will have to look at individual cases of movement angle
* Figure: plot movement angle by firing rate
* Figure: plot movement angle by firing rate standard deviation
* Stationary, periodic, or chaotic?

What’s Next / What I Missed

* Noise modeling to increase SNR
* Channel summing/averaging for spike counts
* Could be that their unit detection algorithm is just wrong
* Maybe I should look at the waveform rather than the spikes