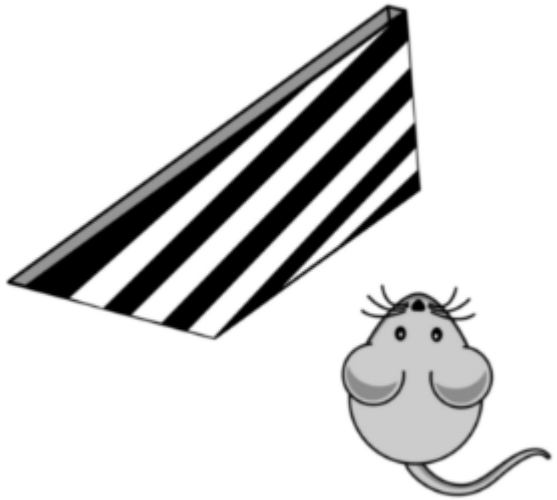
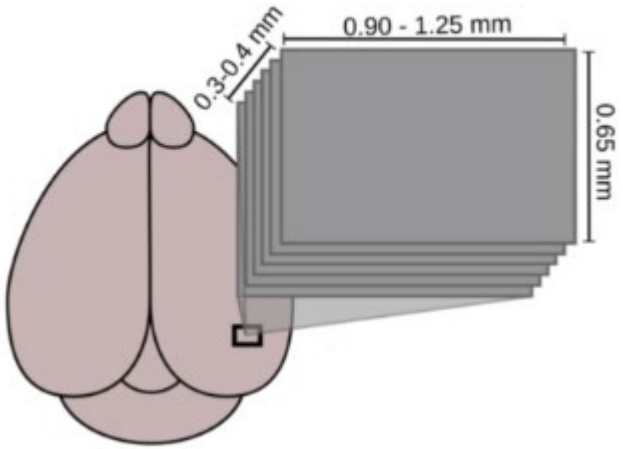
Mixed representations in V1 neurons

Wistful Wolves (Neuronas Stringer)

Julián Guiral

Adrián Alemán-Zapata

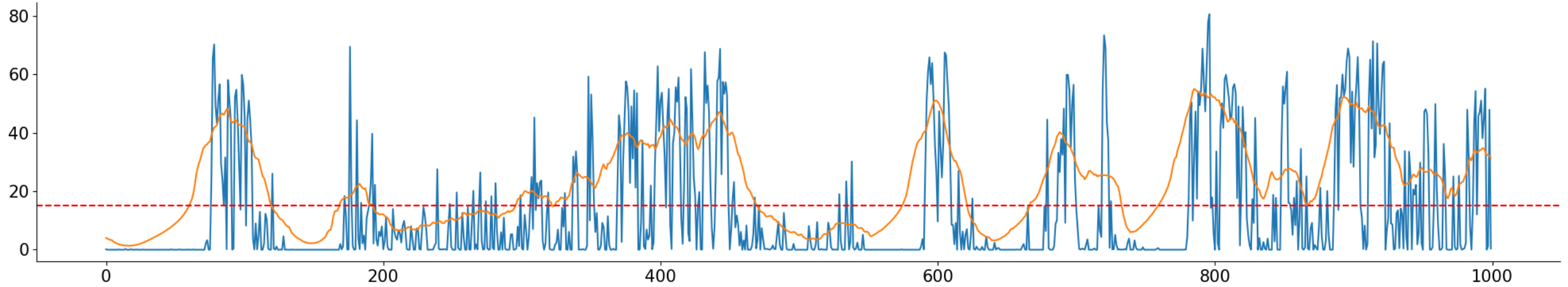




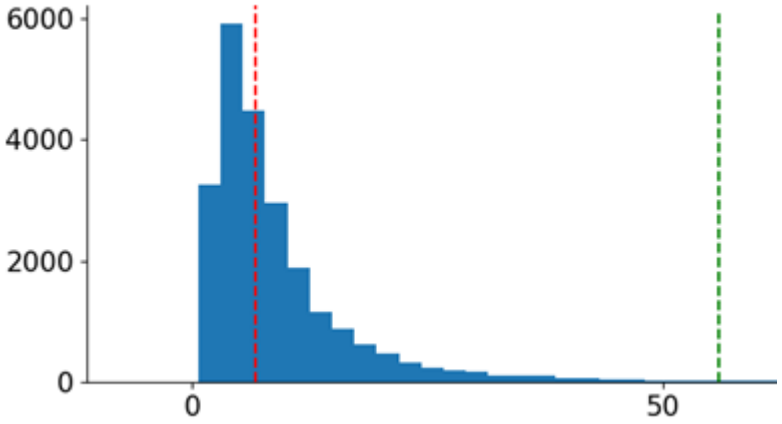
Background and goals

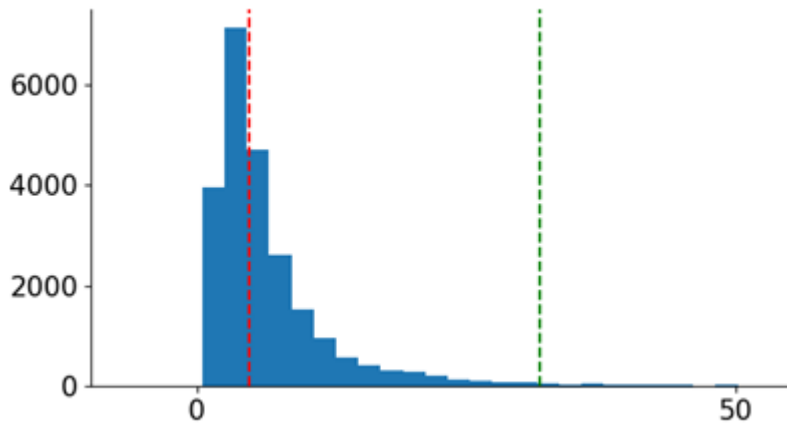
- Mixed neuronal representations (Stringer et al. 2019).
- **Question:** Do the combined motor and sensory information increase the accuracy of a predictive model describing the population activity of V1 cortex neurons, compared to models trained with individual motor or sensory variables?
- **Hypothesis:** The prediction of neural activity should improve with a model trained using motor and sensory features.
- **Methodology:** We trained several regression models with 1) Sensory, 2)Motor and 3) Combined information during periods of high and low motion.

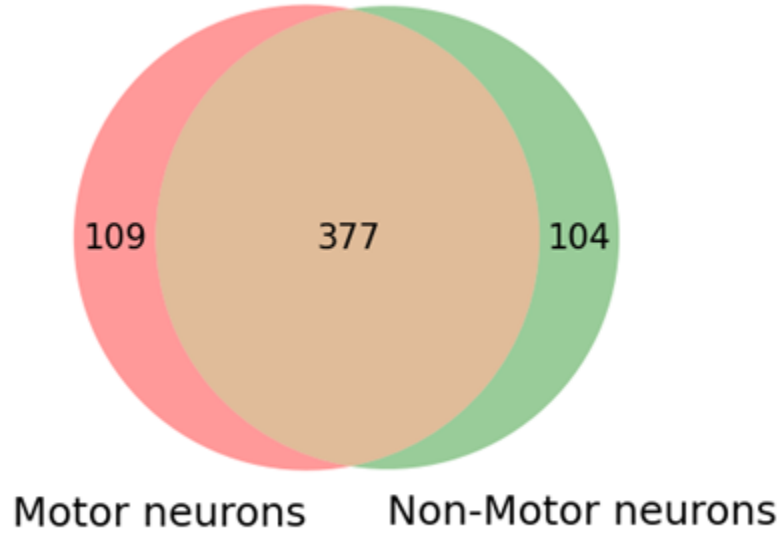
High-motion and Low-motion states



Thresholding neuronal activity during High and Low motion periods.





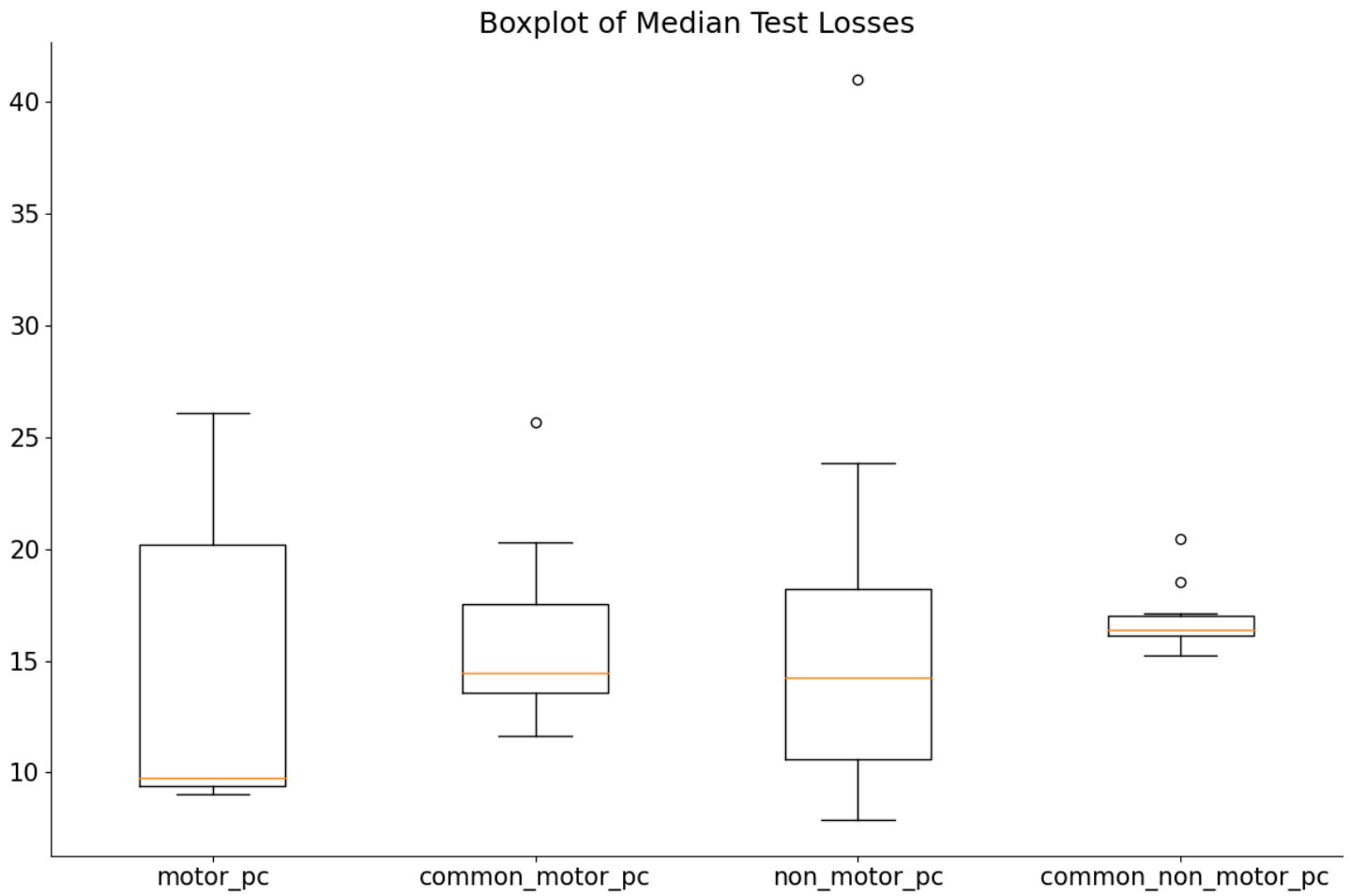


Prediction of principal components per neuron type: Motor, Non-Motor, Common (High-motion) and Common (Low- motion)

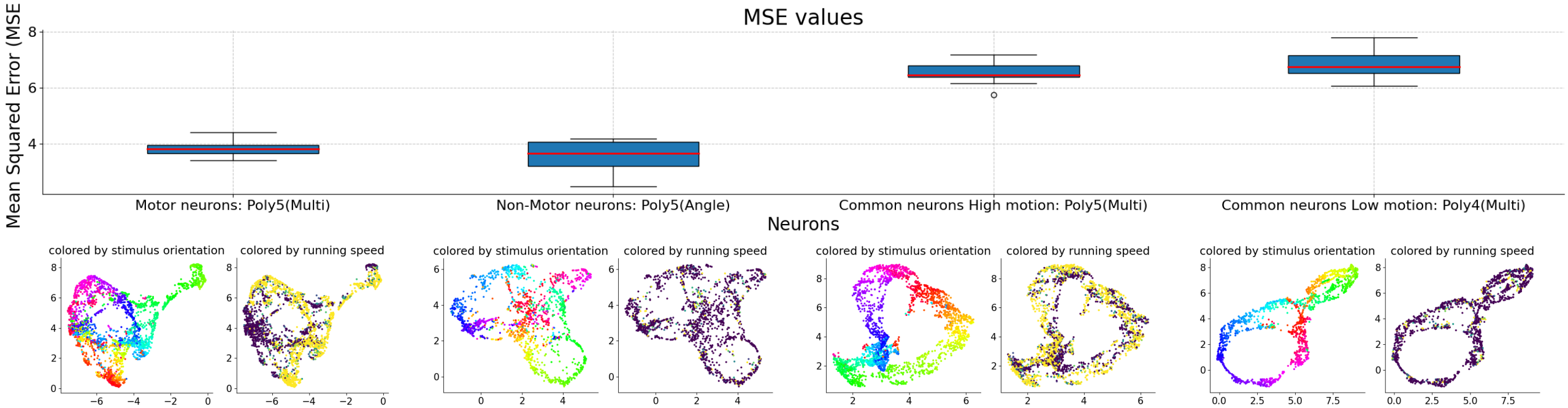
Neural Network model

- Prediction of PC neuronal activity from speed and stimulation angle data.
- Combined speed+angle input.
- Fully connected network.
- Three layers:

60/30/1 neurons.



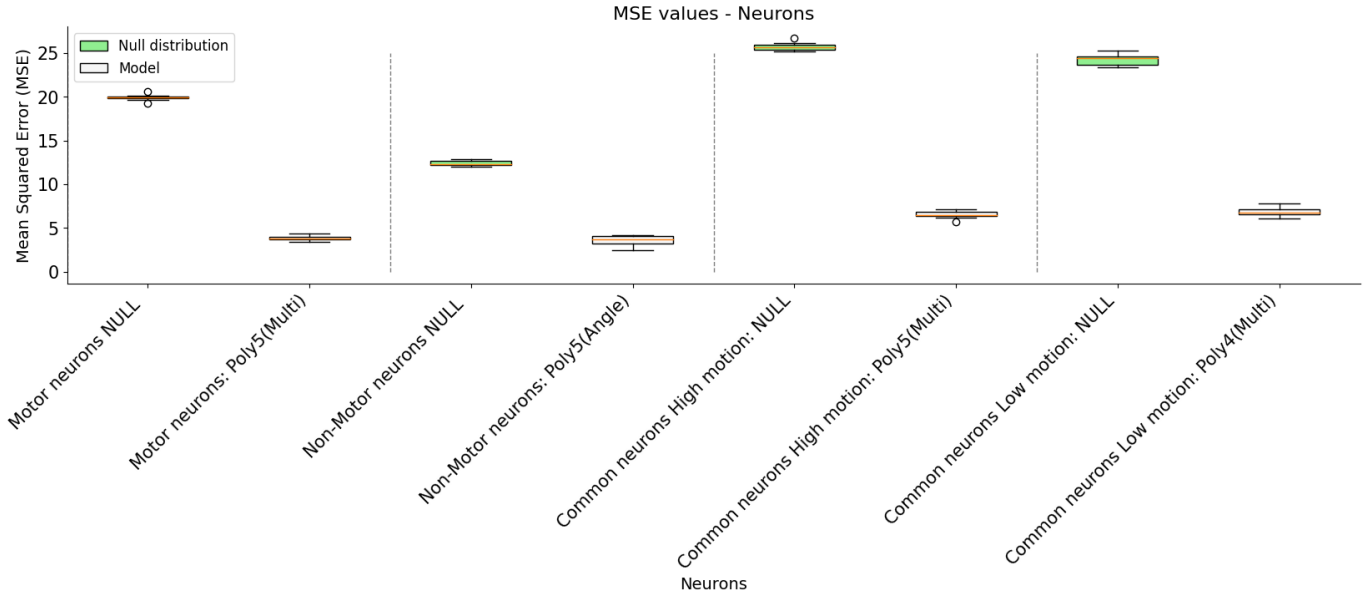
Best models per Neuron type during stimulus



Neurons active during High-motion period
Showed higher mixed-representations.

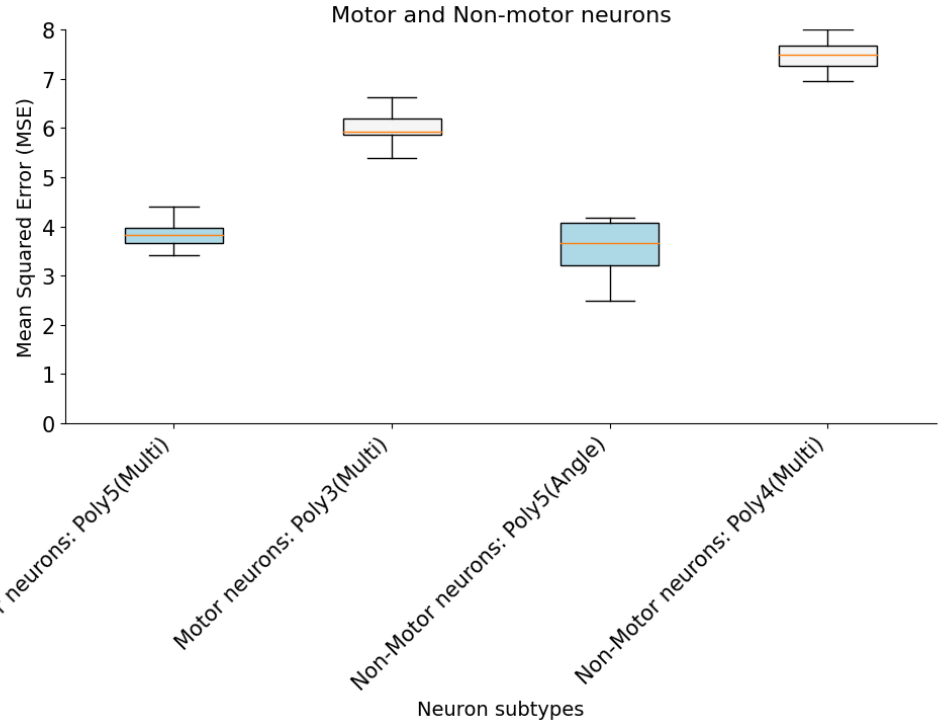
Non-motor neurons
Model with lowest error.
Best prediction when only using angle.

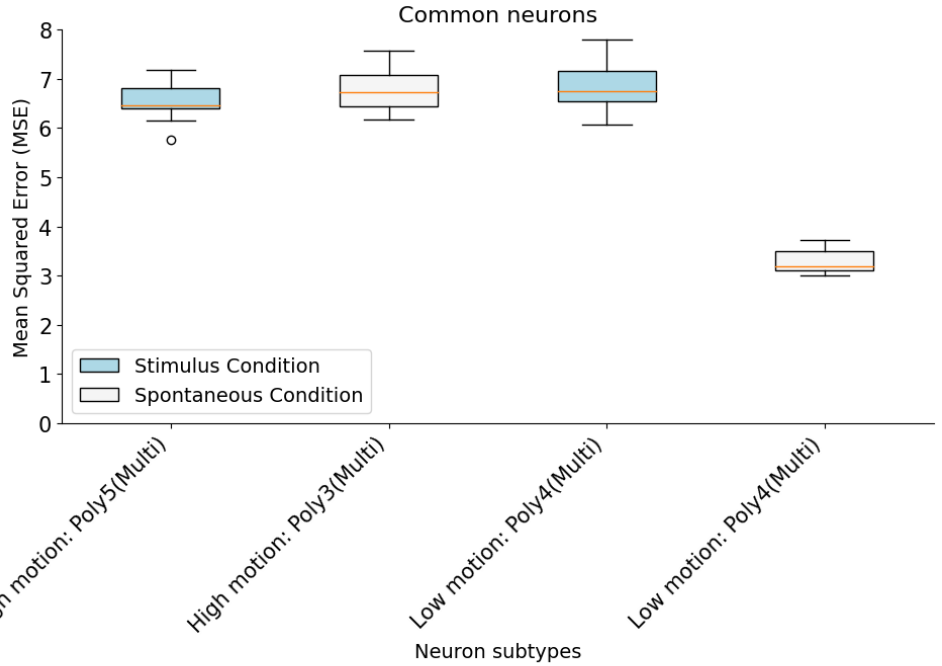
Common/multistate neurons:
Less error during High motion compared to Low motion.
They benefit from Angle+ Speed to improve prediction.



Improvement with respect to Null distribution (Shuffled timestamps)

Comparison against Spontaneous condition. (No-stimuli+ Darkness)





Conclusions

- Neurons active during High-motion period showed higher mixed representations.
- Prediction improved with combined sensory+motor features as inputs, except for non-motor neurons.
- Lack of stimulus in spontaneous condition led to worse prediction.
- Common neurons (Low-motion) during spontaneous condition potentially a signature of resting-state replay.

Acknowledgements:
José Rey Lopez (TA) and other pod members.