Assignment 3 - Neural Decoding

NEUR503: Computational Neuroscience

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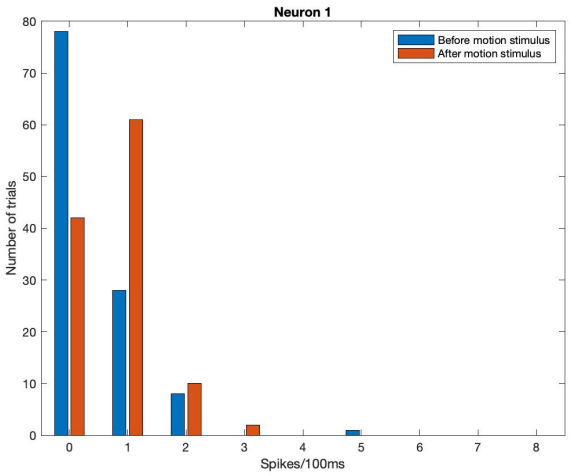
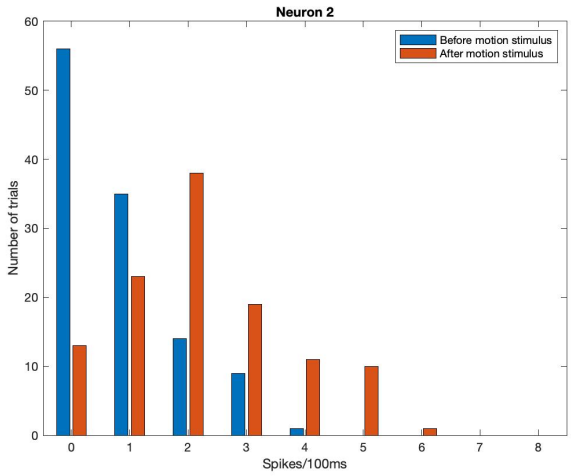
The coding portion of the assignment was done in collaboration with Austin Cooper.

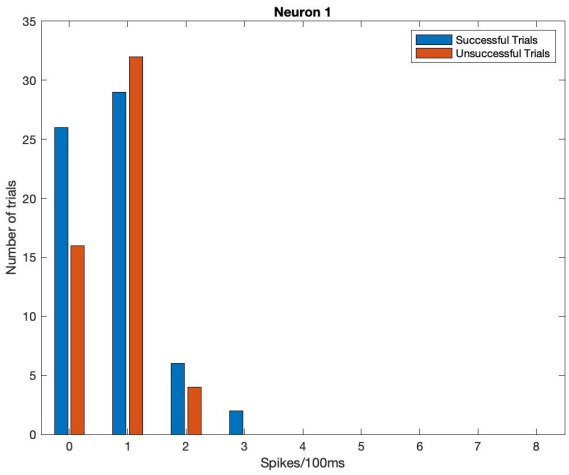
Q3: ROC Neurometric Analysis

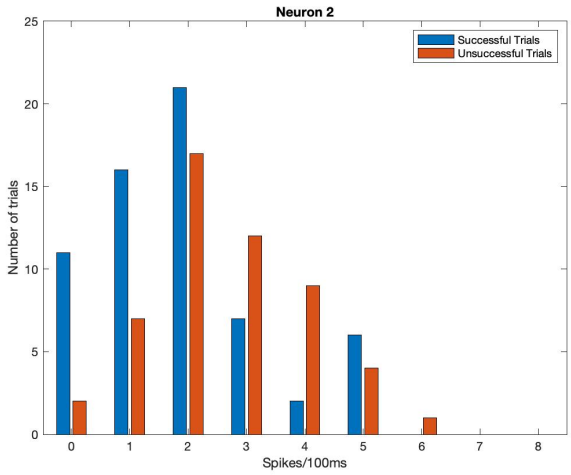




The ROC score of each neuron tells us how likely it is that the neuron's firing is correlated with the occurence of a motion stimulus. In other words, it is a metric of how much an ideal observer can rely on the signal from a given neuron to infer that the motion stimulus has occurred or not. Given that neuron 1 and 2 have scores of 0.6486 and 0.7851 respectively, we know that the signal from neuron 2 is more informative about the occurence of the motion stimulus than neuron 1. Both neurons are relatively informative about the occurrence of the motion stimulus.

Q4: ROC Detect Probability





In this case, the ROC score is a metric of how informative the signal is about the occurence of the animal's behaviour (e.g. pulling the lever) as a response to the motion stimulus. The score of neuron 1 was 0.5299 which implies that the occurence of the behaviour and the firing of the neuron has a probability barely above chance level. It is an unreliable source about whether the animal pulled the lever. The score of neuron 2 was 0.6735, implying that the probability of accurately predicting the animal's behaviour given the neuron's firing pattern is higher than that of neuron 1 and therefore more reliable.

An alternative analysis one might perform on this data is to instead perform a likelihood ratio test. This ratio test (as discussed in the D & A textbook) is a ratio of probabilities which is equivalent to the ROC curve and for which we can integrate the area to get a similar score to the ROC score.