Lecture 2: Neural Decoding

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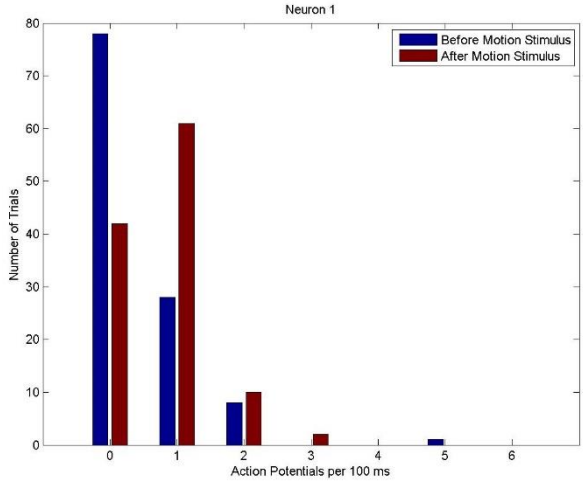
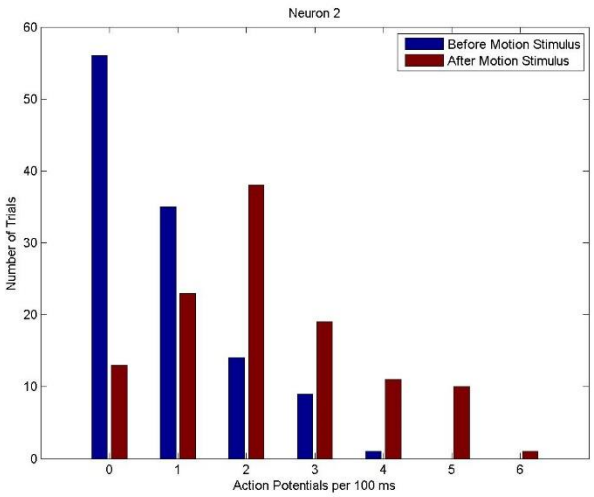
Note: The assignment's instructions do not specify whether the time window after the motion stimulus is relative to its onset (500ms) or its end (550ms). For the following report, the 100ms window after the motion stimulus is set as 40ms to 140ms after **the onset** of the motion stimulus (540:639, rather than 590:689).

3) ROC NEUROMETRIC ANALYSIS

3a) Histograms of the number of spikes before and offering the motion stimulus





3b) ROC Neurometric Score

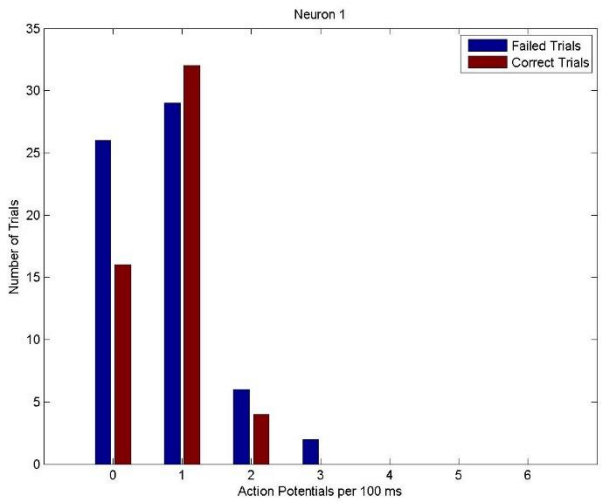
```
rocNeuron1 = 0.6486
rocNeuron2 = 0.7851
```

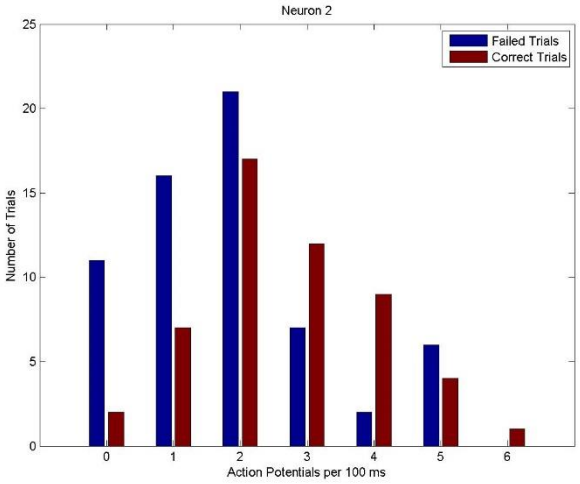
3c) ROC Score Discussion

In this example, the ROC score gives the likelihood of the recorded neuron to detect the motion stimulus, assuming an ideal observer (an observer detecting motion directions on the basis of two opposite neurons). Since neuron 2 has a higher ROC score, neuron 2 is more responsive to the stimulus, and thus more reliably signal the occurrence of the motion pulse than neuron 1.

4) ROC DETECT PROBABILITY

4a) Histograms of the number of spikes for correct and failed trials





4b) ROC Detect Probability Score

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rocNeuron1 = 0.5299
rocNeuron2 = 0.6735
```

4c) ROC Score Discussion

In this example, the ROC score informs us about whether the neuron is correlated with the animal's detection of the motion stimulus (behaviour). Since neuron 2 again has a higher ROC score, neuron 2 can more reliably inform on behaviour. By contrast, neuron 1 has a ROC score close to 0.5, and thus barely distinguishes correct trials from failed trials.

4d) Alternative analysis method

The animal's perception of the motion stimulus can be measured in reaction times rather than % correct detection of the motion stimulus. Thus, a different analysis would be to correlate neuronal response with reaction times.