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## Assignment 04

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### **1) Spike triggered average (Matlab)**

The file 'STA.mat' contains a stimulation signal presented to a neuron and its corresponding resulted spike train. The signal is sampled at 2000 Hz.

- a) Plot using Matlab the spike triggered average of this signal-spike train pair using a +/-500 ms window. The signal amplitude can be represented in arbitrary units ("au").
- b) What would be the optimal sine frequency to activate this neuron?

### **2) Optimal Kernel (Matlab)**

The file **kernel.mat** contains the results of an experiment for describing sensory neurons in the Magical Toad. The file contains two variables: **stim** – a vector (1\*60000) of the white noise magical stimulus played to the toad (measured in MU) and **resp** – a matrix (100\*60000) of the spiking activity of a neuron during 100 exposures to the stimulus. All variables are 60 seconds long and recorded at 1000 samples/sec:

- a) Find & draw the rate function ( $r$ ) of the neuron. Choose the preferred window size in the range 100-1300ms by means of trial & error.
- b) Find & draw the optimal kernel of the neuron assuming it is linear.
- c) Explain (qualitatively, in 1 or more short sentences) the computation performed by the neuron.

### **3) ROC (analytic solution, don't use Matlab)**

Given the following probabilities of evoked potential amplitudes:

P314 ( $\mu$ V)	0	1	2	3	4
Disorder	0.1	0.2	0.2	0.3	0.2
Control	0.3	0.3	0.2	0.1	0.1

N271 ( $\mu$ V)	0	1	2	3	4
Disorder	0.2	0.2	0.2	0.2	0.2
Control	0.2	0.3	0.5	0	0

- a) Plot the ROC curves of both statistics.
- b) Which statistic is better for identifying the disorder? Why?
- c) What is  $p[\text{success}]$  for the two statistics?

#### **4) ROC (Matlab)**

The file Q4data.mat contains two vectors *leftRate* and *rightRate* each containing 1000 responses of the neuron to left or right moving dots accordingly. Let's assume that we would like to identify the movements to the right as the positive ( $H_1$ ).

- a)** Draw the ROC curve differentiating the left and right movement.
- b)** What is the rate limit ( $Z$ ) providing 80% true positives?
- c)** What is the rate of false positives for this rate?