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Computational Neuroscience II: Foundations of Neural Coding PROF. DR. A.V.M. HERZ, M. STEMMLER PHD

! Login procedure has changed!

We have reinstalled the Linux server and the X-Windows clients in order to recruit more operable workstations. The good news is that we now have 12 computers available, which means that all of you have their own workspace. The not so good news is that you have to adapt to a new login procedure, which is as follows:

- Double-click the F-SSH icon on your desktop
- A window appears that offers you a profile button. Click on it and choose "pool#".
- In order to connect to the Linux server press Space and Enter simultaneously.
- You will be asked for a pass phrase, which you can find written on the white board. DO NOT SHARE THIS PASSWORD WITH ANYONE OUTSIDE THE COMPUTER COURSE!

Type the password and press enter.

• Start matlab with matlab as usual.

6. '.m-files' I: Scripts

In last week's tutorial we have learned how to plot graphs and histograms. We have experienced that it takes a lot of time to repeatedly type commands at the Matlab prompt. It is possible to circumvent this by means of scripts. When you invoke a script, Matlab simply executes the commands found in the file. Scripts can operate on existing data in the workspace, or they can create new data on which to operate.

• Explore the contents of

MATLAB: Getting Started: Programming with MATLAB: Scripts in the online documentation. *Hint: type* \gg doc.

Start an editor (kwrite,emacs, or vi) in a terminal window (not the one running Matlab). We will now create an M-file, which we will name timebinning.m. You will subsequently execute the M-file by typing its name at the Matlab prompt (without the suffix .m). Repeat step by step the problems given in exercise 5 of last week's work sheet but this time do not type the commands at the prompt but edit the file timebinning.m. Hints: 1) Use the sheet 'Solutions', which has been distributed last week and can be found in the tutor's directory /home/tutor/CompNeuroII/Assignment2/Solution.m. 2) Test whether your script is working by invoking >> timebinning every now and then.

7. '.m-files' II: Functions

Functions are M-files that can accept input arguments and return output arguments.

- Explore the contents of MATLAB: Getting Started: Programming with MATLAB: Functions in the online documentation.
- Open a new file called overallrate.m with your preferred editor. Write a function which takes as arguments a spiketrain (vector of firing times) and returns the overall firing rate. Test the function >> overallrate(sX) with spike trains from last week. Write a script to do so.
- Write functions which take as argument a spiketrain and return 1) the mean inter-spike interval $\overline{\tau} = N^{-1} \sum_{i=1}^{N} \tau_i$, 2) the variance $\operatorname{var}(\tau) = N^{-1} \sum_{i=1}^{N} (\tau_i \overline{\tau})^2$ and 3) the coefficient of variation

$$CV = \frac{\sqrt{var(\tau)}}{\overline{\tau}}$$

and test them with a script. *Hint: Recall how you have calculated inter-spike intervals* τ_i in exercise 5.

8. One for the specialists. Write a function that calculates the spiketrain autocorrelation function (see Lecture) within the interval $s \in [-1s, 1s]$.

$$Q_{\rho\rho}(s) = \frac{1}{T} \int_0^T dt \, [\rho(t) - r] [\rho(t+s) - r]$$

for a given spiketrain

$$\rho(t) := \sum_{i=1}^{N} \delta(t - t_i)$$

of length $T = t_N - t_1$ and rate $r = T^{-1} \int_0^T dt \,\rho(t)$. Try to solve this problem as far as possible without matlab. Use the **hist** command to plot Q.

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