

Exam Matlab Skills (MKI54) – 7 October 2016 – 13.45:16.45h

This exam contains two programming exercises. Make sure you write functioning code, that is well documented and efficient. You do not have to write a report, just the m-files will suffice. Upload your results to Blackboard.

Each assignments is worth 50 points.

Assignment 1: Archery

Target archery (or bow-and-arrow shooting) involves shooting an arrow at a circular target, with the target's 'bull's eye' having the coordinates $x = 0$, $y = 0$. A contestant is allowed 13 shots and of each shot the x-y coordinates are recorded. You are expected to write a script that will allow the results to be analysed. For a trial run, start with shots having the following x-y coordinates:

```
x= [-1, 2, 2, 1, 2, 0, 2, -3, 2, 1, 2, 3, -1];
```

```
y= [2, -1, 2, 0, 0, 1, 3, 2, -1, 0, 1, 3, 1];
```

1. Copy these coordinates to your script.
2. (10pts) Write a function 'plot_shots' that plots the shots as small closed (!) circles in a figure, seeing to it that the x- and the y-axes have the same proportions (command: *axis equal*) as well as the same limits (range: -10 to +10 – using 'XLim'). Also plot a horizontal and a vertical line running through the bulls eye.
3. (10pts) In the same function, also plot a target divided into several concentric circles (with radii 2, 4, 6 and 8). To do so, use 'viscircles.m'.
4. (10pts) Write a new function 'plot_spread' that computes the 'midpoint' (mean) of the 13 shots and plots this average position as an asterisk in the target. We define the distribution (or spread) d as the average distance of the shots to this midpoint. Calculate d for our example and plot a circle with a radius d around the asterisk (mean). Make sure this circle has a different color than the target circles.
5. (10pts) Write a script that generates n shots drawing from a random normal distribution (normrnd) centered at (0,0) and a standard deviation of 2.
6. (10pts) Create a *for* loop that calculates d for n running from 1 to 100. Plot the evolution of d as a function of n (labels!).

Assignment 2: Hand selection

Here is a real dataset about an experiment where subjects had to make reaching movements to one out of 11 targets and had to choose with which hand to move to the target. Obviously, you choose your right hand to move to target on your right and your left hand to move to targets to your left. Write a single script based on the requirements below.

1. Open the dataset using 'load data'. This will provide you with variables pxl, pyl, pxr,pyr, speed_l,speed_r, time, targets.
2. (10pts) First, plot pxl vs pyl in red and pxr vs pyr in blue. Make the 'axis equal'. Add labels to the axis (think about the units).
3. (15pts) You can see that for targets in the middle the subject sometimes chooses the right and sometimes chooses the left hand. Now determine for each trial which hand the subject choose. First plot a couple of *speed_r* traces (trials are in the rows) and determine a speed criterion on which you can decide whether the right hand moved. Now write a for-loop that determines whether the right hand moved (coded as '1') or the left hand (coded as '0') based

on your chosen threshold. Store this in a vector *choices* (isempty might be a useful function here)

4. (15pts) Now that you have the hand choice per trial, you can compute for each target (coded in targets) the proportion of right hand choices. Write a for loop that fills the vector *PrRight* and plot this as a bar graph with correct axis labels.
5. (10pts) All trials were aligned on the target presentation onset. With a speed criterion of 150mm/s, determine the reaction time per trial (make sure that you use the correct hand!). Plot separate histograms for the left and right hand, using time bins of 0.05s, running between 0 and 0.5s. Also plot a vertical line at the average reaction time.