BMI Spring - Pre-Competition Homework

Before you start with the BMI competition you will try to get comfortable with the dataset by playing around with it. You will visualize parts of the dataset by writing and performing calculations in matlab. First, download the monkeydata_training.mat file from \Course Content\The Competition location in Blackboard. Start matlab and set the working directory to the location of the monkeydata_training.mat file. Load the data set by either dragging the file into the matlab workspace or by using the following command

```
>> load('monkeydata_training.mat');
```

Read the file 'Description of the dataset' from the same Blackboard location to familiarize yourself with the fields in your workspace.

Once you are comfortable with the data fields in your workspace, try the following exercises:

1) Familiarize yourself with raster plots and for a single trial, compute and display a population raster plot .
   A population raster would have time on the x-axis and neural units on the y-axis. A sample raster plot can be found here:
   http://en.wikipedia.org/wiki/File:Sample_raster_plot_from_Brian_neural_network_simulator.jpg

2) Compute and display a raster plot for one cell over many trials (suggestion: try using different colours for different trials to help with the visualization)

3) Familiarize yourself with what peri-stimulus time histograms (PSTH's) are and compute these for different neural units.
   Refer to http://icwww.epfl.ch/~gerstner/SPNM/node7.html for more information on PSTH's. Try smoothing your histogram to get a continuous rate estimate.

4) Plot hand positions for different trials. Try to compare and make sense of cross-trial results.

5) For several neurons, plot tuning curves for movement direction. Tuning curves measure directional preference of individual neural units. Different neural units will have different directional preferences.
   Get the tuning curve, by plotting the firing rate averaged across time and trials as a function of movement direction. To get an idea of the variability, compute the standard deviation across trials of the time-averaged firing rates. You can use the matlab command 'errorbar' to plot the tuning curve with error bars indicating the variability.

6) Think about other ways that you can play around and visualize the data in order to understand the nature of the experiments.

7) If you are feeling clever: implement the population vector algorithm and use it to predict arm movements.