Notes about SpikeTrain data

**Data:** the spike trains recorded from two CA1 place cells. These two cells have an overlapping field on the turn of the right arm (please see place\_field.tiff).

Spiketrains\_running.mat is their theta-related activity (SWRs excluded, speed filter applied).

Spiketrains\_SWRs.mat is their activity during SWRs/ripples (-500 to 500 ms related to SWR onset) organized in a trial-by-trial basis. This data also allows you to compared the activity during awake vs. (post-task) sleep SWRs.

**Code:** the main script is WT\_CCG\_example\_main.m with two companion functions (spiketrainxcorr.m computes CCG using discrete spike events; rast2mat.m). If you run the main script, it will give you:

1. CCG during theta or running, besides the synchronization at time = 0,  you can also see the oscillations at theta frequency;

2. It will plot simple rasters and PSTH during awake vs. sleep SWRs. You can see a better synchronization during awake SWRs;

3. It will plot CCG during SWRs for both sleep and awake states.

Things to try:

- Try using the Matlab default function xcorr.m to plot auto-correlation and cross-correlation for the spike trains (Spiketrains\_running.mat).

Use help xcorr.m -> the function is quite intuitive to use

- Plot ISIs for the spike trains using the function plotisi.m. Use both a linear and log scale.

- Calculate Fano Factor and Coefficient of Variation (CV) for the spike trains

- Plot autocorrelation of spike trains spikes1.mat and spikes2.mat. Compare to their ISI plots – what kind on information do you get from the two plots?

- Use your own code to see how different binning and smoothing methods will affect the PSTH and CCGs.

- For the SWR activity, check how the trial-by-trial cross-correlation is different from avg. cross-correlation (i.e., PSTH to PSTH correlation; or how to calculate cross-correlation of discrete vs. continuous events).