Matlab analysis readme file

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# data extraction and variability Analysis

# **(related to figure 1A, S2)**

## extracting files passing criterion

file\_seperation.m

* Copies files that pass the necessary criteria into separate folder.
* 367 cells: noncircular, gridness>0.3, MD <0.15, #PF>=3.
* 248 cells: noncircular, gridness>0.3, MD <0.15, #PF>=7.
* Extracted files from Sargolini, Derdikman, and Bonnevie original datasets saved in ('\\192.114.21.198\Dori\_Data\data\rebekkah\data sets\ …)

## function main

MainUpdated.m

* Creates rate maps (CreateRateMap.m) using spike and position information. For smoothed rate map, bin size of 3 used and sigma of 1.5. For nonsmoothed, bin size of 6 used.
* Creates autocorrelation maps of the smoothed rate map (Cross\_Correlation.m). Finds size of fields (PF\_radius) using autocorrelation by taking around 70% of the half distance from the autocorr center to the closest local maximum. Finds local maxima (max\_inds) in the rate maps (removes any closer than the PF\_radius to remove points too close together- RemoveTooCloseMaxInds.m). Takes the peak rates at these indices to find all the firing rates of all the fields (peak\_rates).
* Takes the variability of peak\_rates divided by mean of peak\_rate to find Fano factor (Figure 2A). For analysis uses smoothed rate maps (less noisy, fano factors are smaller). Control (simulations) also smooths the generated data for fano factor analysis.
* Finds the location of the maximum-firing field (hyperfield) and calculates the normalized distance from the border (findDistPtToBorder.m) (Figure 2C). Uses nonsmoothed data for this (to control for smoothing artifacts).
* All info and results saved as '3sets G3MD15 data and results'.

## rescaling data function

RescalingArenaInfoAnalysis.m

* Properties extrapolated according to readme file provided by Kate Jeffery lab.
* Rate map created and smoothed.
* Output 27 cells that pass criteria (at least one gridness >=0.3, at least one MD <= 0.15).
* Info saved as 'rescaling info data'.

## remapping data function

makeRemappingDB.m

* Converts Axona data to MATLAB format.
* Files saved in ' N:\data\rebekkah\All rats\all cells with no pos data fixing'.

MainRemappingUPDATED.m

* Uses Kate Jeffery's data to find the zone mats, hyperfield normalized indices, and arena context types for each cell and each arena type.
* Finds the correlations of the two same context arenas, labeled "remap level" (higher scores indicate less realignment).
* Info saved as 'remapping info data'.

# spike train Simulations

# **(related to Figure 1B-D, 3D-F)**

## Create gaussian matrixes

GaussianMatsandPFRadii.m

* Takes original rate map of each cell to find field center indices and mean peak firing rate of all the fields. Uses this information to generate a rate map (termed gaussianMat) with fields of equal firing and at the same locations. Uses this map to simulate spike trains.

## simulation function

AnalysisSimulations.m

* Re-analyzes the data to find the distribution of Fano factors and hyperfield rate over rest of field rates to compare to real results.

## plotting simulation examples

ImageSimulationExamples.m

* Plots examples of the original rate maps, generated equal firing rate map, and rate map created from the simulated spike trains.

# Firing Rate Stability analysis

# **(related to Figure 2, 3A-C, 4)**

## Correlation Coefficient of first half versus second half of arena

* Data set of 367 cells (gridness>=0.3, HD<0.25, PF#>=3, square arena).

FiringStabilityWithinSession.m

* Sessions divided in half. Zone mats created from rate maps of first half and second half of session, and local maximas taken from full session. Firing rates of all fields taken from first half and from second half using indices of field centers from entire session.

## Correlation Coefficient of two same arena contexts

* Data set of (28 from rescaling dataset and

SameArenaFiringStability.m

* Takes max indices from first arena and overlays it on second arena zone mat to find corresponding fields.

## Correlation Coefficient of original versus rescaled arena

* Data set of (28 from rescaling dataset and

RescalingArenaFiringStability.m

* Stretches arenas to maximum x and maximum y size of the two arena pairs.
* Takes stretched max indices from first arena and overlays it on second arena zone mat to find corresponding fields.

## shuffling firing stability analysis

shuffleStabilityAnalysis3.m

* For within session arena halves data.
* Opens saved files and shuffles arena rates in zone map. The mean correlation coefficient between the two halves of the entire data set is saved for each shuffle.

shuffleStabilityAnalysis.m

* For across sessions and rescaled sessions data sets.
* Opens saved files and shuffles second arena rates in zone map. The mean correlation coefficient between the two arenas of the entire data set is saved for each shuffle.

## firing stability with remapping analysis

FiringCorrRemappingVsNonRemap.m

* Finds the correlation coefficient of the firing rates of each corresponding field by category (remapping vs non-remapping). Determines corresponding field by distances, since remapping arenas will have less overlap.
* Only takes cells which were stable in the same context arenas.
* Nonremapping determined by no phase shift and high gridness score of the cross correlation of the 0s and 1s zone mats.

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# Fourier transform analysis

# **(related to Figure S3)**

## extrapolates fourier grid components for rate map reconstruction

CreateFourierTransformMat.m

* Creates Fourier Transform and extrapolates six grid components.

InverseFourierComparison.m

* Takes grid component Fourier transform matrix-reconstructed rate map and compares variability of it to the original rate map.

PrintFourierAnalysisImages.m

* Print Images of the Fourier Transform.