Deliverable Blueprint – Vanderbilt Matlab Demo

Working w/ Prefrontal Neuron Activity during Spatial working memory tasks

1) Multi-Epoch tuning analysis
   - Fixation period (pre-cue bias/anticipatory tuning)
   - Cue period
   - Delay period – WM persistent activity
   - we want to:
     - plot 3x3 Spatial maps for each epoch
     - Compute:
       - > Selectivity index
       - > ANOVA p-values
     - Classify neurons:
       - > tuned in fixation only
       - > cue only
       - > delay only
       - > across multiple

2) Population level Summary
   - Heatmaps (neurons x cue classes) each epochs
   - Histograms:
     - SI values (Selectivity Index)
     - p-values
     - preferred cue locations
   - Venn diagram or bar chart for overlap of tuning neurons across epochs

3) Top Neurons of interest report
   - all 3 tuning maps
   - include SI and P-values
   - Raw spike raster or PSTH if possible

4) Clear 1-page Summary
   "Neural Tuning in Prefrontal Cortex During WM, task
   - include:
     - goal
     - methods
     - Results
       - > Number of tuned neurons in each epoch
       - > Example tuning maps
       - > Key trends
     - Interpretation

5) Technical Delivery – (Another Github? Document?)
   framework:

Final Deliverable

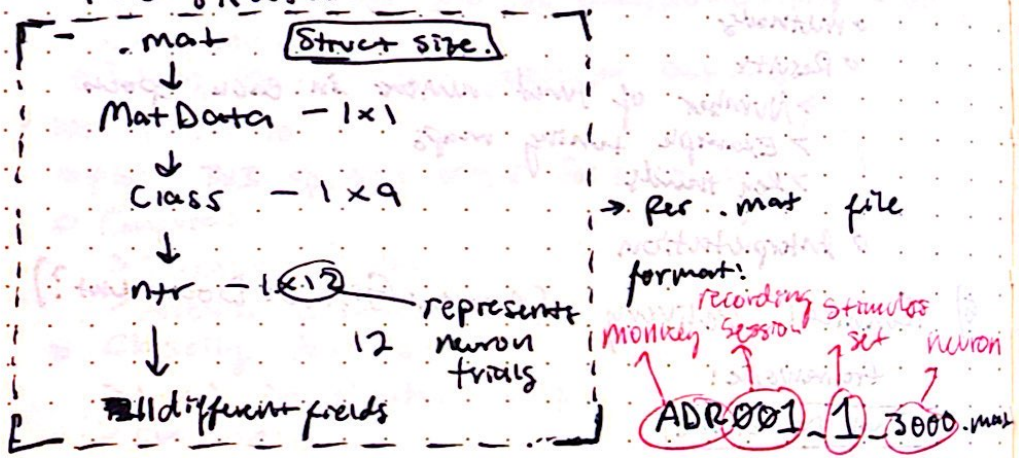
- ReadME
- code
  - analyze all epochs
  - analyze epoch spikes
  - epoch summary plots
  - helper plots?
- figures
  - population heatmaps for fixation
  - top neuron grid maps
  - SI histogram

} MATLAB Code

- Data
  - fixation summary cleaned up
- Summary PDF

Steps taken:

① fixationPeriodActivityAnalysis.m
- Standalone script
- Created to understand/test/Apply given .mat file structure



- loads a .mat, extracts spike count during fixation period, computes per class avg.
- plots bar chart of 9 cue classes and 3×3 spatial grid.

☆ Base prototype/testing ground.

② analyzeSingleNeuron.m
- generalized ① to be a function
- any .mat
- extracts FixationSpikesperClass
- Returns:
  - spike counts
  - monkey ID
  - neuron ID

☆ will use this for batch scripts

③

③ analyzeAllNeurons.m
- first batch script
- loops thru all .mat files
- skips non-spatial neurons
- calls analyzeSingleNeuron.m
- Collects all results in resultsTable
- saves to fixation_spike_analysis.mat

④ analyzeFixationSummary.m
- Summary/visualization
- makes heatmaps for all neurons
- finds SI / ANOVA p-vals
- visualize top neurons in 3×3 grid
- saves output to fixation_summary_enriched.mat

Next Steps as of 5/10/25 - 3:43p:

① generalize fixation analysis for: cue and delay periods

② make a master resultsTable for all ANOVA + Comparisons

⋮

(2.5) → visualize tuning evolution over time.

③ Summary report w/ all plots and interpretation.

NOTE: it's now 3:46am.. I'm just now planning how I'm going to make a report on this.

④