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*Sparta Lab - SIMPLIFIED WORKFLOW: CeA CRF EPHYS DATA [05-02-19]

ANALYSIS FILES (PRISM, ILLUSTRATOR, EXCEL) AND SCRIPTS (MATLAB AND NEUROEXPLORER) ARE ON GITHUB.

- https://github.com/jirvingphd/Sparta-Lab-CRF-Ephys-Paper-Scripts-and-Data
- ON MAIN PAGE, CLICK GREEN 'Clone or download' button to download a .zip archive of files.

Pre-Matlab CRF Paper Ephys Workflow - Addendum - Saving final data file (.pl2 -> .nex5)

Fast Method – If Just need DIDSessionInts and do not have bad time periods to remove from analysis:

- **Open Final .pl2 file in NeuroExplorer.**
- **Identify the time range of phototagging (EVT25)**
- Select TimeStamps Tab at the bottom of the Variable Window.
- Scroll horizontally to the Light Pulse event (name = EVT25 for OmniPlex Recordings)
  - Make note of the both the FIRST and LAST timestamps for EVT25
- **Create an Interval Variable Called "DIDSessionInts" to exclude the phototagging time period**
  - From Menu bar > Edit > Add Interval Variable. (the Create New Interval Variable window will open.)
  - **At top of Create New Interval Window:**
    - enter the name as *exactly* **"DIDSessionInts"** (must match exactly)
    - Take note of the Last Timestamp in File (directly below name)
  - **Fill in Row #1's Interval Start and Interval End based on when phototagging was done.**
    - If phototagging was in the beginning:
      - Interval Start = EVT25's LAST timestamp plus *at least* 1 sec. [if 1299.7554 enter 1301 secs]
      - Interval End = The Last Timestamp in File (rounded down) [if 15777.8584 enter 15777 secs]
    - If phototagging was at the end:
      - Interval Start = 0 seconds (beginning of recording)
      - Interval End = EVT25's FIRST timestamp minus 1 sec [if 14888.1245 enter 14997]
  - To Verify Interval Looks Correct (optional):
    - Select Intervals Tab on bottom.
    - Each interval has 2 columns.
    - Should see an "AllFile" start and end columns.
    - Should see new DIDSessionInts columns.
- **Now, save file as .nex5 file. [File > Save As Nex5 File.]**
- **Move to same folder as all other .nex5 recordings for analysis)**

- **Edit the nex filename to include the drink type ('water','ethanol','sucrose') and day## (required for ethanol, optional otherwise)**

SIMPLIFIED MATLAB WORKFLOW: CeA CRF EPHYS DATA [05-02-19]

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UP TO DATE WORKFLOW:

This workflow starts after all of the cleaning the .pl2 files in OfflineSorter, opening them in NeuroExplorer (Nex), and after identifying the good intervals for each DID session (DIDSessInts variable), and then saved as .nex5 file.

- **START BY PUTTING ALL RAW .NEX FILES IN ONE FOLDER**
  - ☐ **Must have "DIDSessInts" interval variable [see addendum above]**
  - ☐ **Place all .nex5 files into one folder.**
  - ☐ **Add drinktype and drink day to filenames.**

- **#1) In Matlab, run import_nex_files_spikes_and_bursts**
  - communicates with Nex to extact all variables and info
  - **Dialog box opens asking user to select files. Navigate to folder and highlight all file names and click open.**
  - **Main variable containing all information is DATA**
    - DATA(#).fileinfo:
      - contains filename, events, intervals, drink types, and drink days.
    - DATA(#).units(#):
      - Has all timestamps and waveform data for each each unit.
  - **Exports bursting analysis to BURSTunits.**
    - which is processed to match DATA's indexing (BURSunits(#).units(#).

- **#2) Run calculate_light_lick_responses**
  - Classifies light responses and lick responses.
  - Performs classification analyses and stores them in **DATA(#).units(#).finalLightResponse and finalLickResponse.**
    - **To change the timebins for analyses edit nexOptionsCriteria.m**
  - If you edited the filenames to include the **drink type and day t**hey will be auto-recognized.
    - **Stored in DATA(#).fileinfo.drinkType and drinkDay**

- **#3) Run calc_spike_binned_data_remove_outliers.m**
  - Analyze binned firing rates to find & replace outliers.
  - Uses the raw timestamps to calculate average firing rates across session in 5 minute bins
    - Finds outlier timebins by using a sliding window of 30 mins
    - Criteria: bin is more than 3 scaled deviations from the median away from median of data in sliding window.
    - Replaced with linear interpolation to fill removed outliers
  - **Processed firing rate data is stored in DATA(#).units(#).spikeRate.ratesClean**
    - This data is used for normalized firing analysis later
  - **Correlation data between spikes and licks is stored in CORR structure**

- **[!] SAVE DATA .MAT FILE NOW. [!]**
  - **In Matlab: save('DATA-processed_pre-norm-firing.mat' , '-v7.3')**
  - Must use '-v7.3' tag since file is so large.

- **#4) Run print_results_table_to_excel.m to create Unit Results Summary Table.xlsx**
  - **THIS EXCEL SHEET CONTAINS DATA FOR PRISM FILES.**
    - Use the data filtering options in Excel to easily copy and paste unit type data.

- **#5) Run prep_data_for_norm_firing_fig.**
  - Performs all matrix-creating prep, analysis, and plotting for the normalized firing rate data, and %SiB data.
    - Needed to produce output data for to paste into Graphpad templates for bar and line graph files. (done at end using "copyPaste..." scripts)
  - **Makes normalized firing of all CRF vs all non-CRF.**
  - Creates:
    - RATEScut data structures
      - **EXPORT FIRING_RATES_TABLES.XLSX**
        - Firing rates of all cells in 5 min bins.
    - **SORTtracker data structures for data sorted by rate change.**
      - SORTtracker
      - SORTtracker_CRF

- **#6) plot_normalized_firing_CRF_by_lick_types.**
  - **Creates normalized firing plot used in figure.**

- **#7) The final 3 scripts are indended for copy and pasting into Prism.**
  - Tables for group averages and normalized firing rates.
  - copyPasteSORTdata
  - copyPasteSORTdata_EarlyVsLate - Data separated by early vs late ethanol days.
  - copyPasteSORTdata_EarlyVsLateSPLITS - Data separated by early vs late ethanol days and normalized firing split.

- ○ **ADDENDUM ORIGINAL FOR DETERMINING DIDSessionInts:**
  - ▪ **Saving session intervals for accurate session-wide firing rate data [creating "DIDSessionInts.csv"**

i. In same folder as final cleaned data file, save a new Excel workbook as a .csv file called "DIDSessionInts.csv"
  1. This .csv file will determine the good, non-phototagging, non-erroneous intervals that Nex uses for using data for firing rate histograms
ii. Use timeline view with EventPulse (Event25/MAP Data event?) turned on to find timestamps.
  1. Bottom of offlinesorter has a status bar that displays the voltage and time at the location of the mouse cursor.
  2. Identify timestamp of last light pulse, then use mouse to find timestamp shortly thereafter
    1. If theres a gap immediately following, use timestamp of first wave after gap.
    2. If no gap and no obvious change in spikes on timeline, then use ~100ms+ as timestamp
  i. In DIDSessionInts.csv, each interval to include is a separate row [Need at least one interval]
  1. Each interval row needs 2 columns to define intervals that are included in the DID session

Start of good interval	End of good interval

  2. If there's NO wide gaps or bad time periods to remove:

Right after last pre-PT event	Right before first post-PT event

Right after last pre-PT event	Before first BAD interval
After first BAD interval	Before second BAD interval
After second BAD interval	Right before first post-PT event

  3. If there's large gaps or bad data periods to exclude:

UPDATED SIMPLIFIED WORKFLOW INCLUDING SCRIPTS NOT DIRECTLY RUN BY USER

Run By User	Order	Simplified Script Name	Description	Changed	Original Script Name
Y	1	import_nex_files_spikes_and_bursts.m	Saves all units, neurons, intervals into DATA, calculates BURSTunits. Runs Nex templates.	x	NexCombinedDATAstruct
N	1B	minimal_burst_analysis	Separates nexResults for bursting analysis into BURSTunits structure.	x	BURSTunits_Analysis
Y	2	calculate_light_lick_responses	Process each unit's timestamps to calssify its lick and light-responsiveness	x	nexDATAclassificationFixWIP2
N	2B	detect_or_fill_drink_day.m / deect_drink_type_and_day	Automatically recognizes drink type and day # from file names.	x	nexDATA_fillDrinkDay
N	2C	count_unit_responses_for_table	Creates a structure of tables with the count of all light and lick responses.	x	nexDATAcountUnitsFinal_v2
Y	3	calc_spike_binned_data_remove_outliers.m	Uses rolling window to calculate outlier-removed binned data. Runs counts_unit_responses_for_table	x	findOutliers_DATA_RawSpikes_SaveBins_CutLicks
N	3B	calc_perc_bursts_by_hour	Calcualtes % of spikes in bursts by hour.	x	nexBurstByHourUsingCalcPercBursts
N	3C	make_RATES_structure_and_table.m	Makes RATEScut structure and triggers rates_table_to_excel	x	first half of nexPrepForAll..plus new rates_table_to_excel
N	3D	rates_table_to_excel	export firing rates data to excel spreadsheets.	x	
N	3E	calculate_corr_spikes_bursts_licks	calcualtes corerlations between spikes and licks	x	corrSPIKESandLICKSv2_updateMatchV3

Y	4	**print_results_table_to_excel.m**	prints out a table of all unit's results	x	printUnitNamesDetailsOutRem
Y	5	**prep_data_for_norm_firing_fig**	Calculates normalized firing data and creates structures for color plot	x	nexPrepAll_forNormFiringFigsSplitByDeltaRate
Y	6	**plot_normalized_firing_CRF_by_lick_types**	Generates normalized firing rate figure	x	plotNormFiringFromSORTtracker_V2WIP plotNormFiringFromSORTtracker_V3WIP
Y	9	copyPasteSORTdata	Prints out grouped data for Prism/Excel		copyPasteSORTdata
Y	10	copyPasteSORTdata_EarlyVsLate	Prints out grouped data for Prism/Excel		copyPasteSORTdata_EarlyVsLate
Y	11	copyPasteSORTdata_EarlyVsLateSPLITS	Prints out grouped data for Prism/Excel		copyPasteSORTdata_EarlyVsLateSPLITS