CRCNS.org pfc-2 (prefrontal cortex number 2) data description
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Simultaneous electrophysiological recordings of ensembles of isolated neurons in rat medial prefrontal cortex and intermediate CA1 area of the hippocampus during a working memory task.
Recorded by Shigeyoshi Fujisawa in the lab of György Buzsáki

This dataset of multi single neuron recording was acquired in rats while performing a working memory task. Neuronal activity was monitored simultaneously in the PFC (64 channels) and the intermediate area CA1 of the hippocampus (32 channels) in three rats (EE, FF, GG). In one rat (EE), sleep was also recorded before and after the task. Total duration of the recorded data from all three animals is approximately 23.37 hours. Details of the task were described in the following paper:

Behavior-dependent short-term assembly dynamics in the medial prefrontal cortex. Fujisawa S, Amarasingham A, Harrison MT, Buzsáki G. Nature Neuroscience 2008 Jul;11(7):823-33.
doi: 10.1038/nn.2134.

Data structure
Data structures and file name conventions are similar to those in the hc-2, hc-3 and hc-4 data sets at CRCNS.org. See the documentation in those data sets for a description of the files. Sampling rate for raw data '.dat' files is 20k hz. Sampling rate of low-pass filtered files (.eeg) is 1,250 hz (20k / 16).

Channel structure of the '.dat' (raw wideband binary) and '.eeg' (low-pass filtered binary) files:
Rat EE contains 104 channels.
1-64 ch: PFC (Buzsaki64 probe)
65-96 ch: CA1 (Buzsaki32 probe)
97 Optic sensor signals for detection of nose-poking (Right trials)
98 Optic sensor signals for detection of nose-poking (Left trials)
99 Not in use
100 Not in use
101 Encoder signal #1 for the spontaneous alteration task with wheel
102 Encoder signal #2 for the spontaneous alteration task with wheel
103 Not in use
104 Sync signal

Rat FF and GG contains 101 channels.
1-64 ch: PFC (Buzsaki64 probe)
65-96 ch: CA1 (Buzsaki32 probe)
97 Optic sensor signals for detection of nose-poking (Right trials)
98 Optic sensor signals for detection of nose-poking (Left trials)
99 Encoder signal #1 for the spontaneous alteration task with wheel
100 Encoder signal #2 for the spontaneous alteration task with wheel
101 Sync signal

Behavior and data processing

In each folder containing the recording session during the working memory task, a matlab file called 'XXX_Behavior.mat' (where XXX is the session name) contains basic parameters for behavior.

(1) SessionNP : Time information of each trial. Only correct trials are listed.

    Each row: Each trial.

    1st column: Time when rat started the first nose-poking in each trial. (the unit is seconds.)

    2st column: Time when rat ended the last nose-poking in each trial. This time is defined as the "trial start time" in my paper.

    3rd column: Time when rat stared the reward consumption (i.e., chewing nose). This time is defined as the "trial end time" in my paper.

    4th column: Left or Right trials. R = 1 and L = 2.

(2) whlrl : Extended whl file.

    Each row: video frame of 39.0625Hz (=20kHz/512), as normal whl file.

    1st~4th column: [x1, y1, x2, y2], as normal whl file.

    5th column: Left or Right trials. R = 1 and L = 2.

    6th column: Trial number.

    7th column: Linearlized position, d. d =1 is the start position (the position at the time the end of last nose-poking in each trial), d=2 is the end position (the position at the time just before reward consumption.). d=0 means that the rat is not doing working memory trials.

    8th column: (Not in use.)

(4) spiket: spike times of all PFC units. (This is a concatenated vector of filebase.res.1 to filebase.res.8)

(5) spikeind: spike indices of all PFC units. (This is a concatenated vector of filebase.clu.1 to filebase.clu.8)

(6) spikeph:

    1st column: the list of spike indices. i.e., unique(spikeind)

    2nd column: the shank number from which the unit was recorded.

    3rd column: the indices in clu file.

(These matrices are obtained from Anton's function 'ReadEl4CCG.m'.)

(7) Cells: the neuron # whose max firing rates are more than 1 Hz in the trials.

Recording sessions

The recording sessions are organized into folders that are named with the animal name (EE, FF or GG) followed by four digits corresponding to the day the recordings were made. For animals FF and GG, there is only one recording session per day (made during the working memory task), except on one day (folder GG0330) in which both the spontaneous alternation task and working memory tasks were recorded. For animal EE, sleep was recorded before and after the task. Due to some instability in the recording, some neurons might not have been correctly recorded from during the entire day (i.e. across multiple sleep and behaving sessions)

Details of the recording sessions are given in the following table: Duration of each session (last column) is given in minutes.

Day (Folder)	Session	State	Duration
EE0622	EE.042	Sleep	16.55 min
	EE.043	Test	0.03 min
	EE.044	Test	0.02 min
	EE.045	Spontaneous alternation task	39.01 min
	EE.046	Sleep	2.33 min
	EE.047	Sleep	20.17 min
	EE.048	Sleep	17.26 min
	EE.049	Working memory task	29.81 min
	EE.050	Sleep	31.27 min
EE0627	EE.080	Sleep	14.59 min
	EE.081	Sleep	2.91 min
	EE.082	Sleep	22.23 min
	EE.083	Spontaneous alternation task	22.66 min
	EE.084	Sleep	28.41 min
	EE.085	Sleep	11.49 min
	EE.086	Sleep	2.53 min
	EE.087	Sleep	7.48 min
	EE.088	Working memory task	36.09 min
	EE.089	Sleep	34.30 min
EE0705	EE.146	Test	1.06 min
	EE.147	Sleep	9.81 min
	EE.148	Sleep	2.31 min
	EE.149	Sleep	24.31 min
	EE.150	Spontaneous alternation task	13.99 min
	EE.151	Sleep	29.16 min
	EE.152	Working memory task	42.54 min
	EE.153	Test	0.03 min
	EE.154	Test	0.88 min
	EE.155	Test	1.70 min
	EE.156	Sleep	30.72 min
	EE.157	Sleep	2.17 min
	EE.158	Sleep	29.06 min
EE0706	EE.159	Sleep	15.28 min
	EE.160	Test	0.60 min
	EE.161	Sleep	24.51 min
	EE.162	Spontaneous alternation task	20.77 min
	EE.163	Sleep	33.50 min
	EE.164	Test	0.06 min

	EE.165	Working memory task	49.06 min
	EE.166	Test	1.94 min
	EE.167	Sleep	36.45 min
	EE.168	Sleep	14.60 min
	EE.169	Sleep	3.56 min
	EE.170	Sleep	28.78 min
	EE.171	Sleep	7.99 min
EE0708	EE.185	Sleep	22.85 min
	EE.186	Spontaneous alternation task	22.12 min
	EE.187	Sleep	37.56 min
	EE.188	Working memory task	46.87 min
	EE.189	Sleep	11.94 min
	EE.190	Sleep	30.68 min
	EE.191	Sleep	36.76 min
EE0710	EE.196	Working memory task	47.40 min
EE0711	EE.210	Working memory task	40.20 min
FF1114	FF.103	Working memory task	49.20 min
FF1116	FF.130	Working memory task	34.84 min
FF1119	FF.167	Working memory task	33.94 min
GG0330	GG.063	Spontaneous alternation task	47.51 min
	GG.069	Working memory task	39.60 min
GG0401	GG.097	Working memory task	29.17 min
GG0406	GG.149	Working memory task	47.44 min

Also included in the folders for animal EE that have multiple sessions, is a file with suffix "_merged.tar.gz". This contains the merged files from all sessions recorded during that day (including the test sessions). All sessions recorded during a day were used for spike sorting.

Data file organization
Data recorded on each day is stored in a separate directory with name matching the first column of the above table (e.g., EE0622, EE0627, … GG0406). Within these, the data recorded within each session are stored in compressed files with the prefix matching the session name (second column of the above table). Three types of files are stored. For every session there is a file with suffix ".tar.gz" that contains all files associated with the session except for any large (> 500MB) raw data or large movie file. If present, the large data file associated with the session is stored in a separate file with suffix ".dat.gz". Some sessions include the movie of animal behavior (suffix ".mpg.gz"). For example, for session "EE0622/EE.049", the files are:
    EE.049.tar.gz - Contains all files associated with session except raw data and movie
    EE.049.dat.gz - Raw data
    EE.049.mpg.gz - Movie of animal behavior

Session EE0708/EE.188 includes a matlab file (**EE188_example.mat**) which summarizes the neuronal information in session EE.188 (which is used in Fig 2A and Fig 3D in the Fujisawa et al, 2008 paper). The file contains the following matlab variables [1]-[8];

[1] spiket   : time stamps of all spikes of all cells.
                (Sampling rate is 20 khz, that is, 1 sec is represented as 20,000 in the 'spiket')
[2] spikeind : cell # to which the spike belongs

'spiket' and 'spikeind' are the vectors of the same length.
For example, if you want the spike times of cell #156, the following will work;
    spiketimes156 = spiket(find(spikeind==156));

<Behavior information>
[3] spikeX   : rat position at which the spike occurred
          position is normalized (0=start,1=end, -1=out of the field)
[4] spikeRtr : trial # in which the spike occurred (Right trials)
[5] spikeLtr : trial # in which the spike occurred (Left trials)
[6] spiketAl : spike time stamps (20khz) aligned with the start times of trials

    [1]-[6] are the vectors of the same length.

<Cell information>
[7] CellsInfo :(matrix): some properties of each neuron
          column 1 : cell #
          column 2 : shank where the cell was recorded
          column 3 : pyramidal (=1), interneuron (=2), or unknown (=3)

[8] pairs_all: cell pairs which have monosynaptic connections (inferred by CCG)
          column 1 : presynaptic cell #
          column 2 : postsynaptic cell #

Similar files for other sessions may be added to the data set in the future.

Citing the data set
Any publications made with the data set should cite the Fujisawa et al., 2008 publication and also cite the data set using the following:

Fujisawa S, Amarasingham A, Harrison MT, Peyrache, A., Buzsáki G. (2015).
Simultaneous electrophysiological recordings of ensembles of isolated neurons in rat medial prefrontal cortex and intermediate CA1 area of the hippocampus during a working memory task.
CRCNS.org. http://dx.doi.org/10.6080/K01V5BWK