

CRCNS.org hc-5 data description
Version 0.6 (Jan 15, 2015)

Summary

The CRCNS.org hc-5 data set contains recordings made using a silicon probe from three areas from a single rat that was performing different behavioral tasks. The three regions recorded from are: left and right hippocampal CA1 and right entorhinal cortex (EC). The tasks are a left/right alternate selection task, wheel running, and platform exploration. The data includes:

- Waveforms of putative spikes extracted from original raw broadband signal
- LFPs (local field potentials)
- Results of spike sorting
- Information about the animal behavior during the experiment

Some of these data were included in the following publications:

[Internally generated cell assembly sequences in the rat hippocampus.](#) Pastalkova E, Itskov V, Amarasingham A, Buzsáki G. Science. 2008 Sep 5;321(5894):1322-7

[Theta oscillations provide temporal windows for local circuit computation in the entorhinal-hippocampal loop.](#) Mizuseki K, Sirota A, Pastalkova E, Buzsáki G. Neuron. 2009 Oct 29;64(2):267-80.

[Theta sequences are essential for internally generated hippocampal firing fields.](#) Wang Y, Romani S, Lustig B, Leonardo A, Pastalkova E. Nat Neurosci. 2014 Dec 22. [Epub ahead of print]

Data from 13 sessions is included. Data from each session is stored in tar.gz file. The sessions are described in Table 1.

Data file	Size	Description
i01_maze05.005.tar.gz	5.9 GB	L/R alternation task, 18 min, 15sec wheel runs, several errors
i01_maze06.002.tar.gz	5.4 GB	L/R alternation task, 18 min, 15-17sec wheel runs, good behavior and performance
i01_maze06.005.tar.gz	5.9 GB	L/R alternation task, 20 min, 20sec wheel runs, several errors
i01_maze08.001.tar.gz	2.5 GB	L/R alternation task, 35 min, 15sec wheel runs, several errors
i01_maze08.003.tar.gz	8.8 GB	Home cage: good spontaneous wheel running, some cage exploration, 34min
i01_maze08.004.tar.gz	6.8 GB	L/R alternation task, 24 min, 15sec wheel runs, several errors
i01_maze08.006.tar.gz	17.4 GB	Large 2D platform exploration, 60min
i01_maze09.002.tar.gz	11.0 GB	Large 2D platform exploration, 38min
i01_maze13.002.tar.gz	15.4 GB	Large 2D platform exploration, 50min
i01_maze13.003.tar.gz	16.3 GB	L/R alternation task, 53 min, 20sec wheel runs, several errors
i01_maze15.001.tar.gz	3.9 GB	Large 2D platform exploration, 60min
i01_maze15.002.tar.gz	6.4 GB	L/R alternation task, 23 min, 20sec wheel runs, several errors
i01_maze16.002.tar.gz	15.9 GB	Large 2D platform exploration, 59min

Table 1: Description of sessions included in the data set.

Data format

The neural data was recorded on 125 channels. Three additional channels were used to record experimental events. Data recorded on each channel was:

- Right EC: channels 1-32
- Right hippocampus (CA1): channels 33-64
- Left hippocampus (CA1): channels 65-128 (except for channels 105-107)
- Wheel TTL pulse: channels 105+106
- SYNC pulse: channel 107

Each recording contains all data as described in the hc3 data set documentation, as well as one highly processed matlab structure (*_BehavElectrData.mat). This matlab structure contains all position, spike, LFP-derived and behavioral data so one only needs to load this structure and find the fields they are looking for. This should make it very easy to work with the raw data. The names of the fields should be self-explanatory. The sampling rate is 1250Hz unless specified differently. Below is one example from a 2D recording:

```
a=load([shortFileName '_BehavElectrDataLFP.mat'])
```

```
a =
```

```
Clu: [1x1 struct] % all info about clusters
```

```
Laps: [1x1 struct] % all info about laps in the maze (N/A for 2D
```

recording or a home cage)
Spike: [1x1 struct] % all info about spikes
Track: [1x1 struct] % all info about tracking
xml: [1x1 struct] % all parameters

Clu length fields ~ N of clusters (N=153)

Clu.shank: [1x153 double] % ID # of a shank;
Clu.localClu: [1x153 double] % ID # of a cluster within a given shank
Clu.totClu: [1x153 double] % overall ID # of a cluster (1-153)
Clu.isIntern: [1x153 double] % boolean value:based on FR and wave shape
Clu.SpKWidthC: [1x153 double]
Clu.RefracViolPercent: [1x153 double]
Clu.FirRateHz: [1x153 double]
Clu.isolDist: [1x153 double] % Mahalanobis distance from noise
Clu.SpatLocalChan: [1x153 double] % ID of ch with AP max amplitude
Clu.SpatLocalRelAmpl: [1x153 double] % AP max amplitude
Clu.RightMax: [1x153 double] % max of the right APshoulder
Clu.LeftMax: [1x153 double] % max of the left APshoulder
Clu.centerMax: [1x153 double]
Clu.SpKWidthR: [1x153 double]
Clu.SpKWidthL: [1x153 double]
Clu.confidIsIntern: [1x153 double]
Clu.ccgVal: [153x201 double] % Auto-correlogram Y values
Clu.ccgT: [153x201 double] % Auto-correlogram dT values

Laps length fields ~ N maze/wheel runs

Laps.lapID: [0x1 double] % ID of a maze run (N/A for 2D recording)
Laps.isStimulation: [0x1 double] % Ind given at 1250Hz
Laps.startLfpInd: [0x1 double]
Laps.endLfpInd: [0x1 double]
Laps.startT: [0x1 double]
Laps.endT: [0x1 double]
Laps.dirChoice: [0x1 double] % Left/right
Laps.whlDirChoice: [0x1 double] % CW/CCW
Laps.corrChoice: [0x1 double]
Laps.behavType: [0x1 double]
Laps.NLapCW: [2635000x1 double] % wheel run ID
Laps.WhlDistCW: [2635000x1 double] % wheel distance
Laps.WhlLapsDistCW: [2635000x1 double]
Laps.WhlSpeedCW: [2635000x1 double]
Laps.WhlLfpIndStartCW: []
Laps.WhlLfpIndEndCW: []
Laps.WhlStopsIndCW: []
Laps.NLapCCW: [2635000x1 double]
Laps.WhlDistCCW: [2635000x1 double]
Laps.WhlLapsDistCCW: [2635000x1 double]
Laps.WhlSpeedCCW: [2635000x1 double]
Laps.WhlLfpIndStartCCW: []
Laps.WhlLfpIndEndCCW: []
Laps.WhlStopsIndCCW: []

Spike length fields ~ N of spikes detected in the entire recording

Spike.res: [539323x1 double] % time stamp of each spike
Spike.res20kHz: [539323x1 double] % time stamps at 20kHz sampl. rate
Spike.clu: [539323x1 double] % ID of a cluster spike belongs to
Spike.shank: [539323x1 double] % ID of a shank spike belongs to
Spike.totclu: [539323x1 double] % cluter ID
Spike.IDBurst: [539323x1 double]

```

Spike.burstLength: [539323x1 double]
Spike.orderInBurst: [539323x1 double]
Spike.thPhaseHilb: [539323x1 double] % Hilbert Tran. derived theta phase
Spike.thPhaseInterp: [539323x1 double] % Linear Interpol. der. theta ph.
Spike.xMM: [539323x1 double] % animal position at the spike time
Spike.yMM: [539323x1 double]
Spike.xPix: [539323x1 double]
Spike.yPix: [539323x1 double]
Spike.linXMM: [539323x1 double] % linearized distance
Spike.linYMM: [539323x1 double]
Spike.linDistMM: [539323x1 double]
Spike.headDirDeg: [539323x1 double]
Spike.speed_MMsec: [539323x1 double]
Spike.accel_MMsecSq: [539323x1 double]
Spike.whlSpeed: [539323x1 double]
Spike.whlDist: [539323x1 double]
Spike.whlDir: [539323x1 double]
Spike.NLapCW: [539323x1 double]
Spike.NLapCCW: [539323x1 double]
Spike.behavLap: []
Spike.mazeSection: [539323x1 double] % maze section ID

```

Track length fields ~ N of samples in the entire recording (1250Hz sampling rate)

```

Track.selectLED: 1 % tracking analysis based on one LED
Track.xPix: [2635000x1 double] % animal's position
Track.yPix: [2635000x1 double]
Track.xMM: [2635000x1 double]
Track.yMM: [2635000x1 double]
Track.mazeSect: [2635000x1 double] % maze section ID
Track.startLfpInd: [2635000x1 double]
Track.lapID: [2635000x1 double]
Track.whlDirChoice: [2635000x1 double]
Track.corrChoice: [2635000x1 double]
Track.dirChoice: [2635000x1 double]
Track.behavType: [2635000x1 double]
Track.speed_MMsec: [2635000x1 double]
Track.accel_MMsecSq: [2635000x1 double]
Track.headDirDeg: [2635000x1 double]
Track.realDistMM: [2635000x1 double]
Track.linXMM: [2635000x1 double]
Track.linYMM: [2635000x1 double]
Track.linXPix: [2635000x1 double]
Track.linYPix: [2635000x1 double]
Track.linDistMM: [2635000x1 double]
Track.thetaPhHilb: [2635000x1 double]
Track.thetaPhLinInterp: [2635000x1 double]
Track.eeg: [2635000x1 double] % one channel of 1250Hz LFP
Track.eegRaw: [42160000x1 double] % one channel of 20kHz LFP
Track.thetaPeak_tAmpl: [18299x2 double] % indices of LFP theta peaks
Track.thetaTrough_tAmpl: [18299x2 double]
Track.thetaPtoTzeros_tAmpl: [18299x2 double]
Track.thetaTtoPzeros_tAmpl: [18298x2 double]

```

parameter file

```

xml.FileName: 'A992-20140828-1346-06'
xml.Date: '2014-08-19'

```

```
xml.nBits: 16          % AD card resolution
xml.nChannels: 129
xml.SampleRate: 20000
xml.SampleTime: 50
xml.VoltageRange: 20
xml.Amplification: 400
xml.Offset: 0
xml.lfpSampleRate: 1250
xml.AnatGrps: [1x16 struct] % N of shanks
xml.SpKGrps: [1x16 struct]
xml.nElecGps: 16        % On of groups used for spike sorting
xml.ElecGp: {1x16 cell}
xml.pca_before: 8       % N data points after the AP peak used for PCA
xml.pca_after: 11       % N data points after the AP peak used for PCA
```