ECoG from mice motor cortex

Data:

Recordings from motor cortex neurons from adult mice, available CRCNS (https://crcns.org/data-sets/motor-cortex/alm-1). Mice were trained to lick one of two directions (left / right) after auditory cues were given. Surgery was performed on mice to install probes on mice motor cortex to record extracellular spikes. This dataset is expected to be better than EEG data from human since probes are implanted on mice brain.

Preprocessing:

Original data was sampled at 19531.25 Hz. This is too large (6 GB per session, each session with 400 trials), and so down-sampling was performed to reduce the sampling rate to 195 Hz. 2 subject, 6 session in total were used. Data was standardized using StandardScaler from sklearn. Due to some classifier using covariance matrix, flat channels would cause covariance matrix to be non-positive definite. Therefore, flat channels were removed from epochs.

Classifiers:

There are four classification methods used:

Method 1: PCA + logistic regression (PCA across trials)

Method 2: PCA + logistic regression (PCA across channels for each trial)

Method 3: Common spatial pattern + Linear discriminant analysis

Method 4: Tangent space classifier (projecting covariance matrix to Riemannian space)

Results:

Each session was recorded on different days, each session has approximately 450 epochs.

Two classes (left/right) chance level = 50%

Mouse no. 1

	Session 1	Session 2	Session 3
Method 1	50.3%	51.7%	51.16%
Method 2	76.1%	64.37%	58.9%
Method 3	91.35%	81.7%	66.88%
Method 4	89.39%	78.125%	68.2%

Mouse no. 2

	Session 1	Session 2	Session 3
Method 1	53.4%	53.9%	47.4%
Method 2	56.8%	60.9%	60.0%
Method 3	66.8%	72.1%	69.4%
Method 4	67.4%	76.1%	73.7%

Results from aggregated data set:

To investigate if data from the same subject but recorded on different days can be mixed, data sets were aggregated

Mouse No.1

	Session 1 + Session 2 + Session 3
Method 1	51.1%
Method 2	66.2 %
Method 4	73.68%

Mouse No.2

	Session 1 + Session 2 + Session 3
Method 1	52.6%
Method 2	56.6%
Method 4	72.3%

Link to github:

https://github.com/XikunYuan/Senior-thesis/blob/master/mice%20ECoG%20.ipynb