

TO DO LISTS

TODO JR

- [] Please plot hit trials traces split by num cells
- [] Fix the model and run on all the data
- [x] Discard licks 250ms
- [x] Churchland 2010 natneuro (Do our results match?)
- [x] Log the covariates that are better fit by the logs
- [x] RERUN WITH NEW PCA Viola's PC plot -> trace of the first PC before hit and miss
- [x] Factor analysis
- [x] Merge multiple sessions for the logistic classifier
- [x] Fix markdown checklist
- [x] Make the IO plot to Saxey's recommendation
- [x] Show the distributions of PC loadings before hit and before miss
- [x] Cross-correlation: take the absolute value of each element of cov matrix

TODO ML

- [] Email Johannas about the oasis nan
- [] Do fun stuff with the PCs
- [] Put the deconvolved spike data through the pipeline
- [] Photostim period length

Glossary

Neural activity matrix

- *symbol*: X
- *size* ($n_{neurons} \times n_{times}$)
- *defined by*: neural recordings

Synonyms:

- The activity of 1 neuron i is row i : $x_i(t)$
- Neural dynamics

Covariance matrix

- *symbol*: C
- *size*: $(n_{neurons} \times n_{neurons})$
- *defined by*: covariance of activity matrix X

Synonyms:

- pairwise covariance
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Principal directions

- *symbol*: V
- *size matrix*: $(n_{comps} \times n_{neurons})$
- *defined by*: eigendecomposition $C = VLV^T$, where L is the (diagonal) matrix with eigenvalues

Synonyms:

- Loading matrix
 - principal axes
 - Eigenvectors
 - right singular vectors
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Eigenvalues of Covariance matrix

- *symbol*: L
- *size*: $(n_{comps}, n_{comps}) = (n_{neurons}, n_{neurons})$ (equal in case of full eigendecomposition)
- *defined by*: eigendecomposition $C = V L V^T$, where V is the matrix of eigenvectors

Synonyms:

- eigenvalues λ_k are on the diagonal
- variance explained = eigenvalues / sum(eigenvalues) = $\frac{\lambda_k}{\sum_k \lambda_k}$

Principal Ccomponent (Dynamic Activity)

- *symbol*: Z
- *size matrix*: (n_comps x n_times)
- *defined by*: $Z = V \cdot X$ (Principal directions *dot* Neural activity)

Synonyms:

- The activity of one PC k is row k : $z_k(t)$
- Neural activity projected onto Principal axes
- Data projected on Principal axes
- Principal components
- PC scores
- Latent activity
- Latent components
- left singular vector *dot* (diagonal) singular value matrix

References:

- <https://stats.stackexchange.com/questions/134282/relationship-between-svd-and-pca-how-to-use-svd-to-perform-pca>
- <https://stats.stackexchange.com/questions/311908/what-is-pca-components-in-sk-learn>
- <https://jakevdp.github.io/PythonDataScienceHandbook/05.09-principal-component-analysis.html>