

## TO DO LISTS

### TODO JR

- [ ] Discard licks 250ms
- [ ] Churchland 2010 natneuro (Do our results match?)
- [ ] Log the covariates that are better fit by the logs
- [ ] RERUN WITH NEW PCA Viola's PC plot -> trace of the first PC before hit and miss
- [ ] Factor analysis
- [ ] Merge multiple sessions for the logistic classifier
- [ ] Please plot hit trials traces split by num cells
- [ ] Fix the model and run on all the data
- [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

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### 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  $\Sigma = V L V^T$ , where  $V$  is the matrix of eigenvectors

**Synonyms:**

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

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**Principal Component (Dynamic Activity)**

- *symbol*:  $Z$
- *size matrix*:  $(n_{comps} \times n_{times})$
- *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>