TO DO LISTS

TODO JR

- Viola's PC plot -> trace of the first PC before hit and miss
- Show the distributions of PC loadings before hit and before miss
- Cross-correlation: take the absolute value of each element of cov matrix
- Discard licks 250ms
- Log the covariates that are better fit by the logs
- Merge multiple sessions
- Make the IO plot to Saxey's recommendation

TODO ML

- Email Johannas about the oasis nan
- Do fun stuff with the PCs

Glossary

Neural activity matrix

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

Synonyms:

- pairwise covariance

Principal directions

- *symbol*: V
- *size matrix*: (n_{comps} x $n_{neurons}$)

- *defined by*: eigendecomposition $C = VLV^T$, where L is the (diagonal) matrix with eigenvalues

Synonyms:

- Loading matrix
- principal axes
- Eigenvectors
- right singular vectors

Eigenvalues of Covariance matrix

- *symbol*: L
- *size*: (n_{comps}, n_{comps}) = ($n_{neurons}$, $n_{neurons}$) (equal in case of full eigendecomposition)
- *defined by*: eigendecomposition $ = 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