Week of 10/30 Deliverables

Red Lemurs

Deliverables

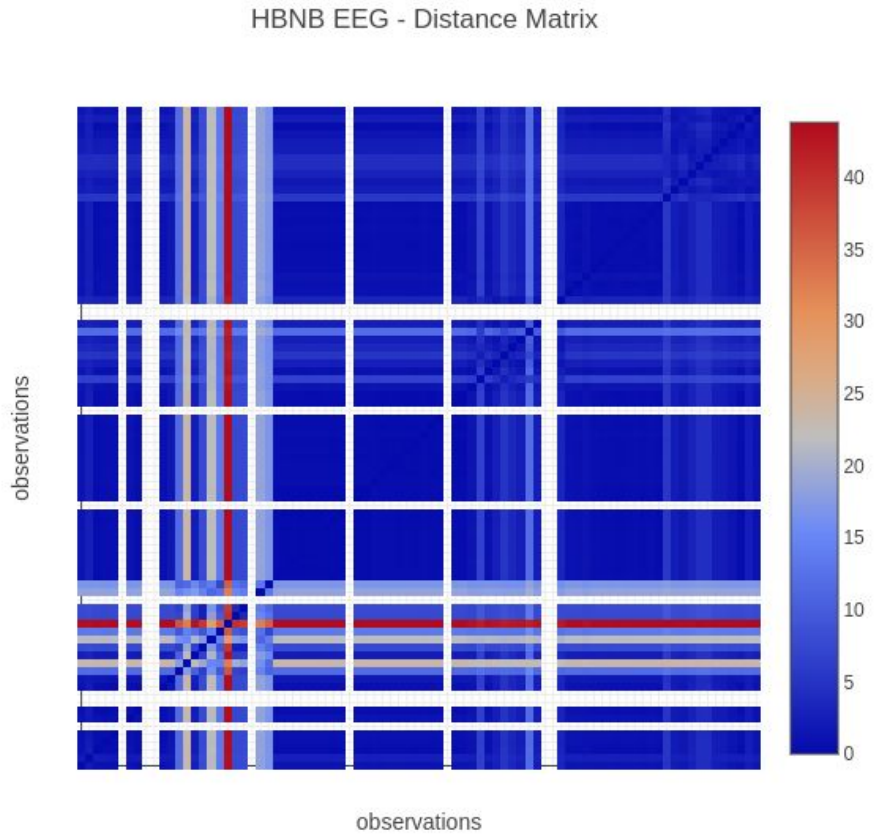
- Lemur library alpha
  - notebook
- Run Eric's pipeline on fMRI data
  - Notebook, Literature Scoping
- Fitting AR(1)
  - https://github.com/NeuroDataDesign/lemur-f17s18/blob/master/docs/vidurkailash/ndd-lemurs-10-29.pdf

Distance Between EEG Scans notebook

Pairwise Distance Heatmap

Given n observations $X = \{x_1, x_2, \ldots, x_n\}$ where each x_i is a $d \times T$ EEG scan, given tl distance function $f : X \times X \to \mathbb{R}, f(x_i, x_j) = \|(x_i x_i^T) - (x_j x_j^T)\|_F$, we define a distance $D \in \mathbb{R}^{n \times n}, D_{ij} = f(x_i, x_j)$.

```
from lemur.distance.functions import FroMetric, ErosMetric
dataset.setDistanceMetric(FroMetric)
dmp = lpl.DistanceMatrixPlotter(dataset)
dmp.plot()
```



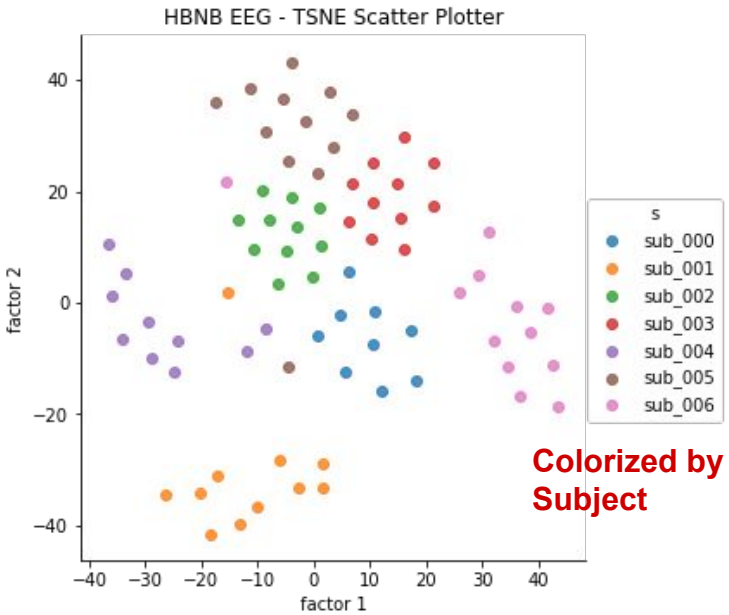
(labels are viewed by hovering over matrix cells)

Visualizing the Pairwise Distances in 2D

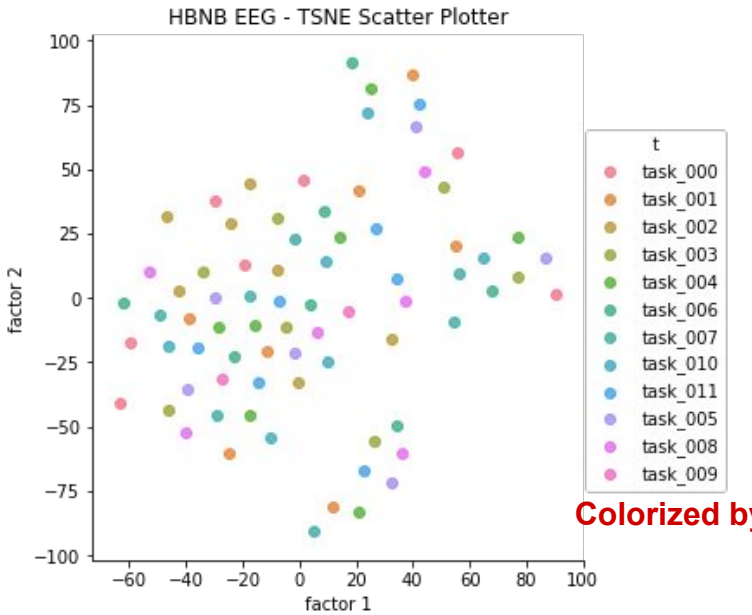
notebook

2 Dimensional TSNE Scatter

Given the (n x n) distance matrix, perform TSNE and plot first colorized by subject, then colorized by task.



Colorized by Subject



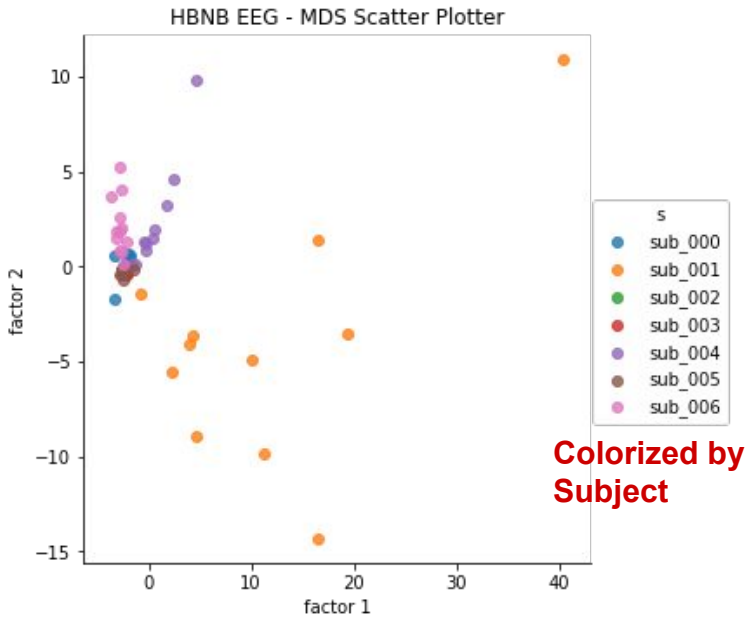
Colorized by Task

Visualizing the Pairwise Distances in 2D

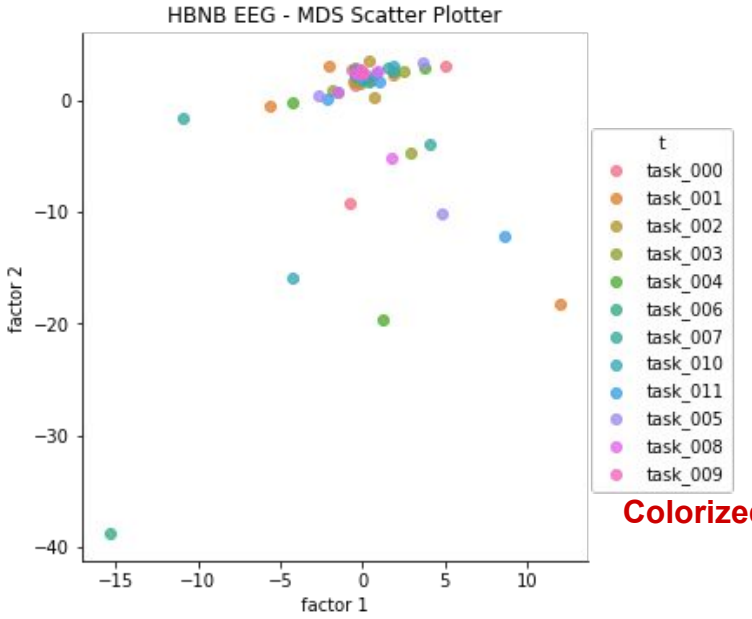
notebook

2 Dimensional MDS Scatter

Given the (n x n) distance matrix, perform MDS and plot first colorized by subject, then colorized by task.



Colorized by Subject



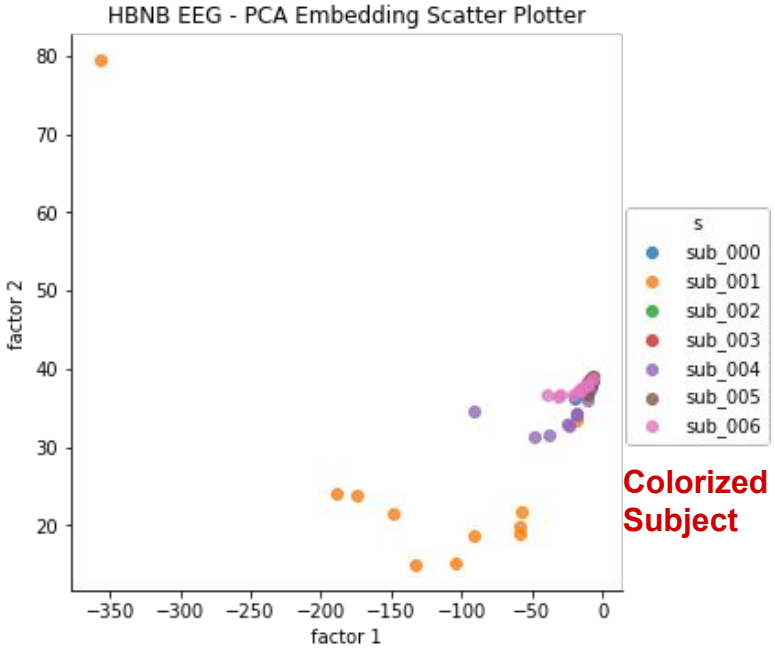
Colorized by Task

Visualizing the Pairwise Distances in 2D

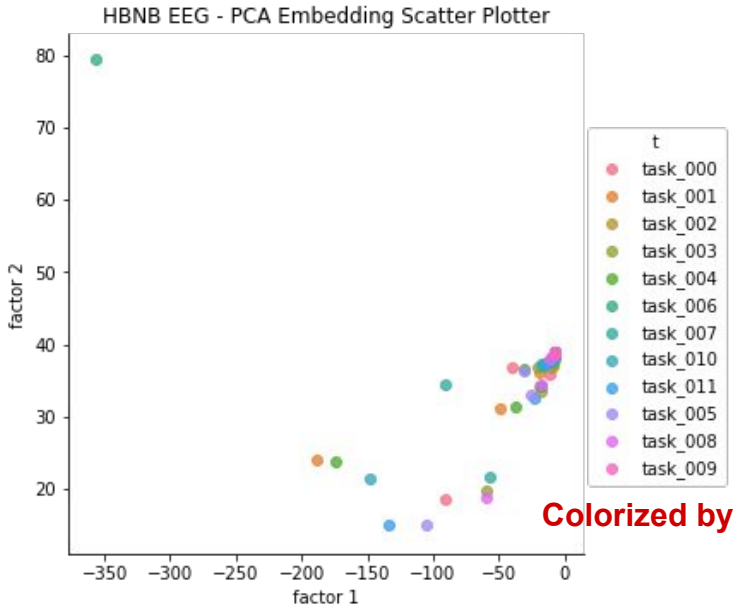
notebook

2 Dimensional PCA Scatter

Given the (n x n) distance matrix, we consider each column to be an observation for each of the n data points. We perform PCA on the (n x n) distance matrix, and project the (n x n) matrix onto the first two principal components. This gives a 2d representation for each of the n points based on its dissimilarity to other points.



Colorized by Subject

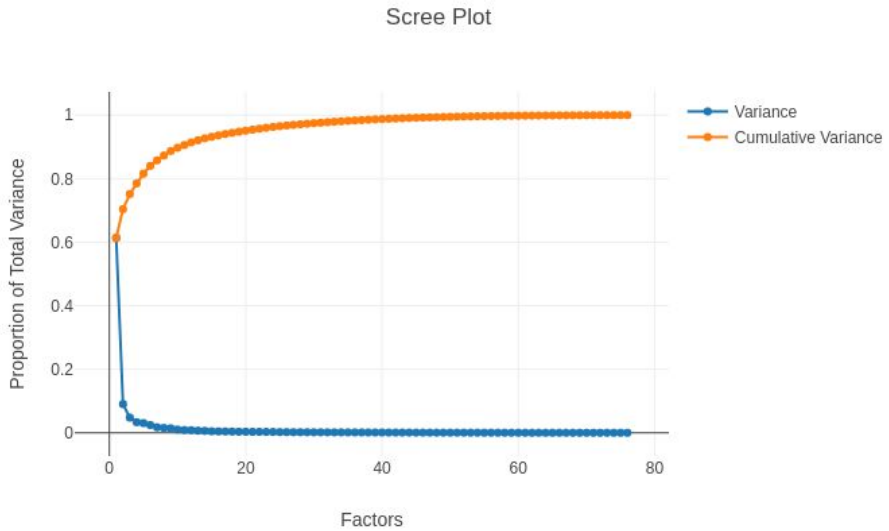


Colorized by Task

Visualizing Spectral Info of the Pairwise Distance Graph [notebook]

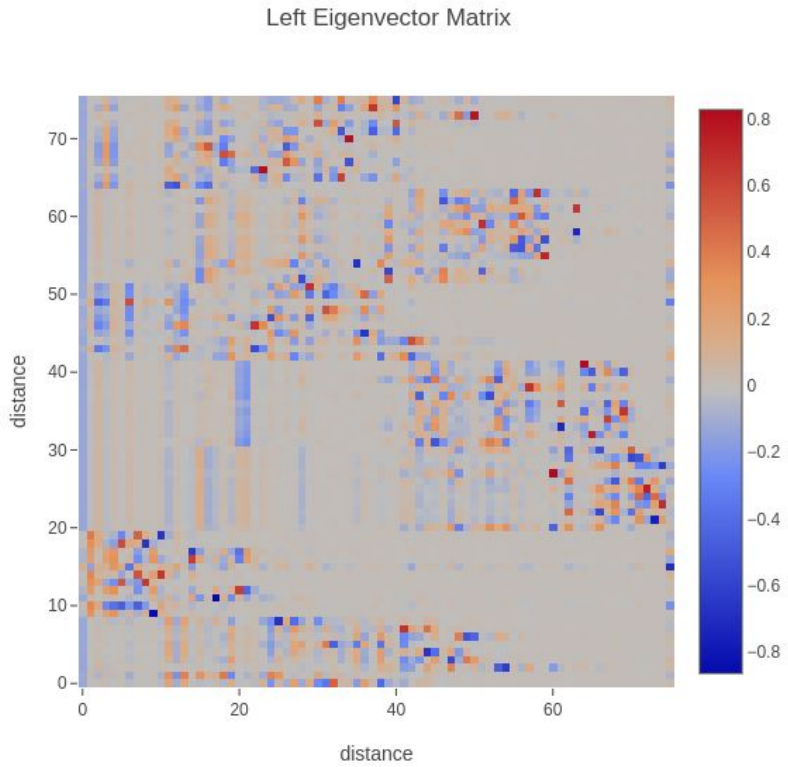
Scree Plot

A scree plot of the spectrum of the singular value decomposition of the (n x n) distance matrix.



Raw Heatmap of the Left Eigenvectors of the Distance Matrix

We perform PCA on the (n x n) distance matrix, then plot the U matrix (the left singular vectors).

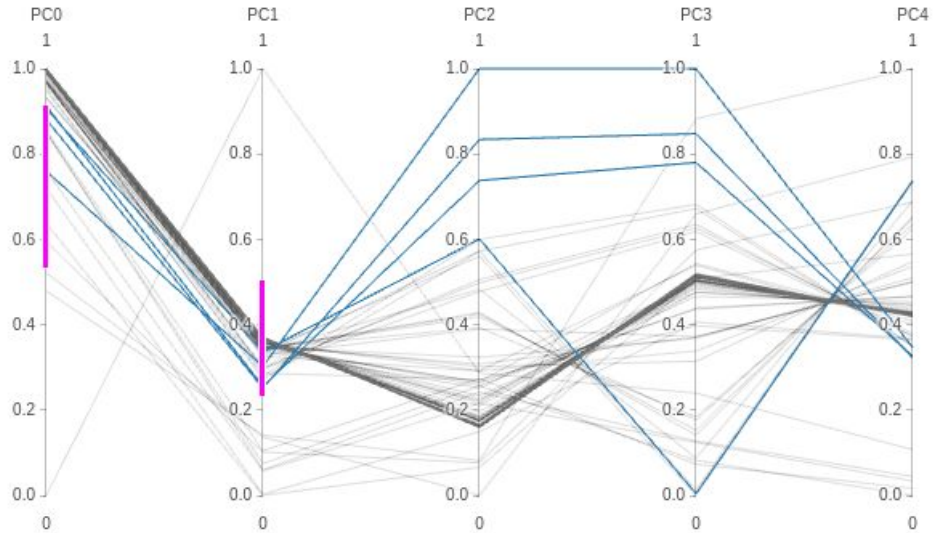


Other Misc. Plots notebook

Parallel Coordinate Plot

Parallel Coordinate plot where coordinate i is the projection of the (n x n) distance matrix onto its i'th singular vector.

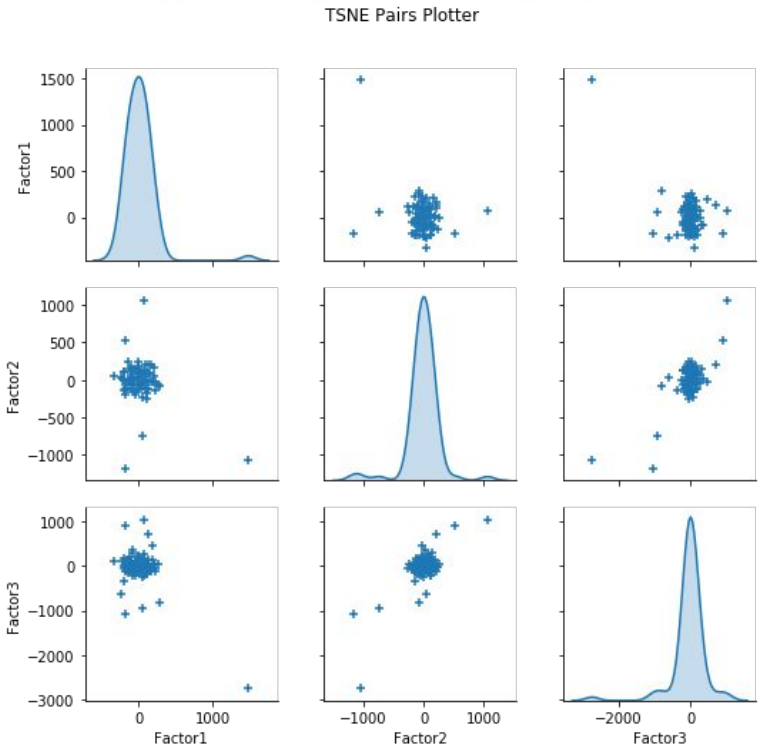
You can filter which lines are colored blue.



Other Misc. Plots [notebook]

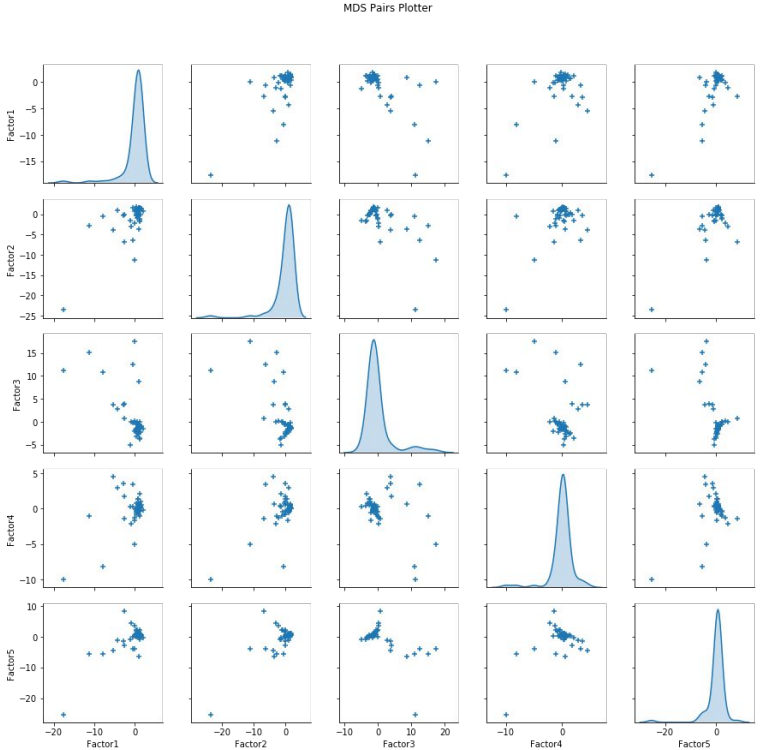
Pairs Plot of 3 T SNE dimensions

(T SNE with the precomputed metric set as the (n x n) distance matrix)



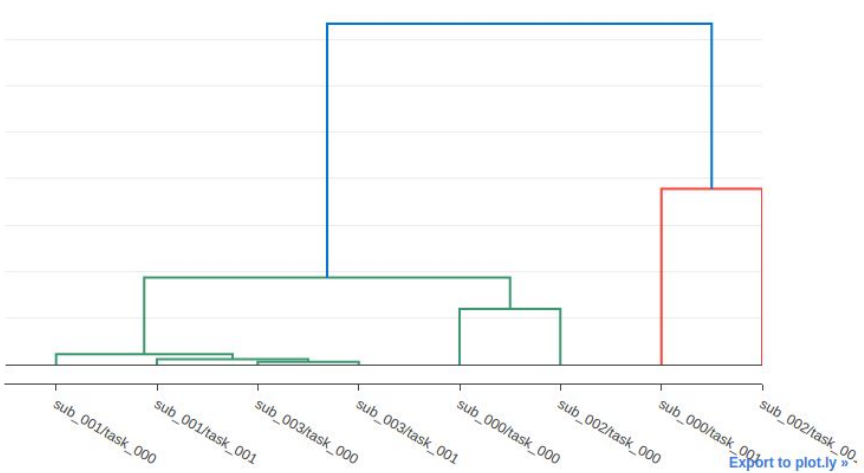
Pairs Plot of 5 MDS dimensions

(MDS with the precomputed metric set as the (n x n) distance matrix)

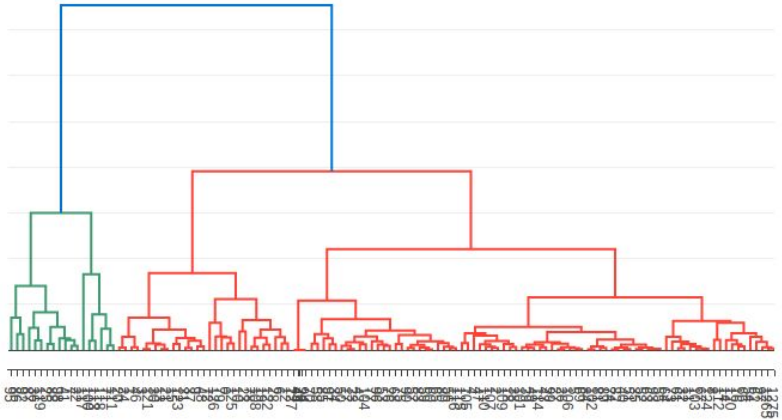


Other Misc. Plots notebook

4 Subjects 2 Paradigms



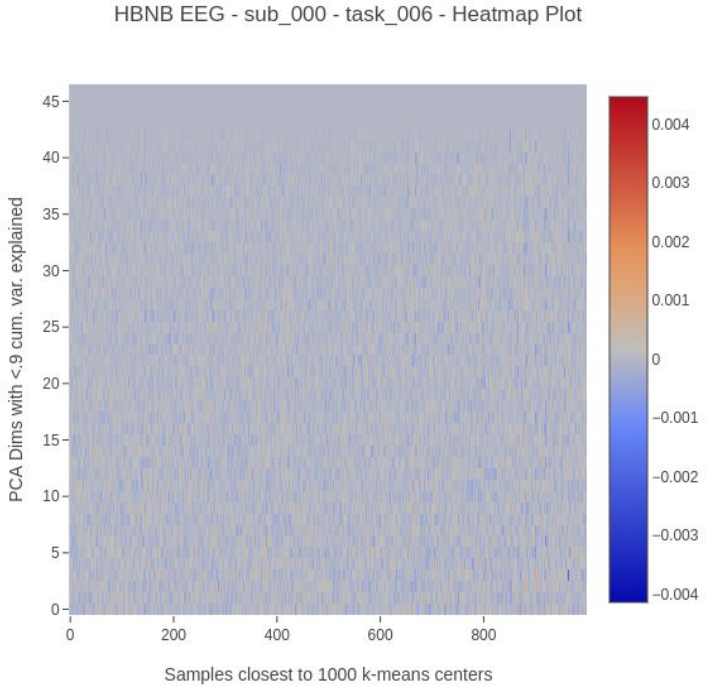
Subject NDARAA075AMK



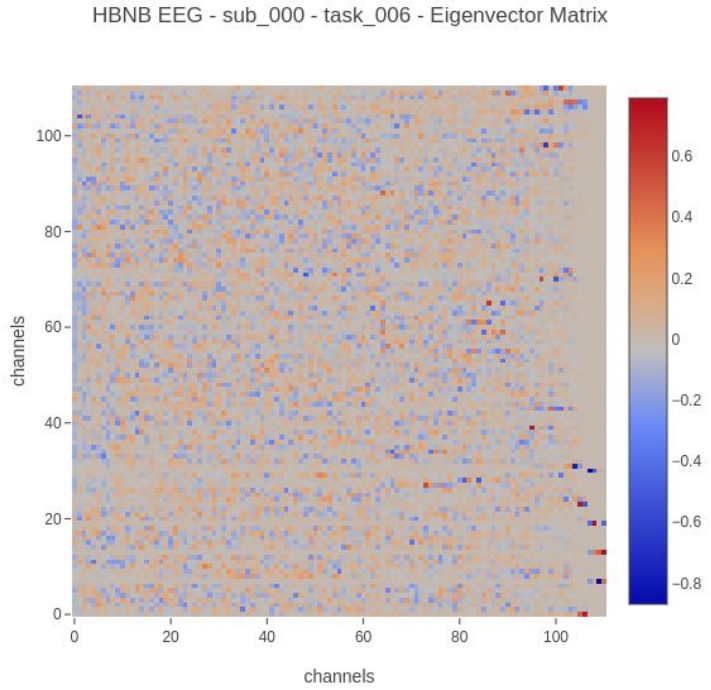
Plotting Single Trials of EEG Data [notebook]

Raw Heatmap

If there are more than 100 dimensions, then we first project the data onto the top k PCs, where k is the number of the PC which makes the cumulative varianced explained go over 0.9.



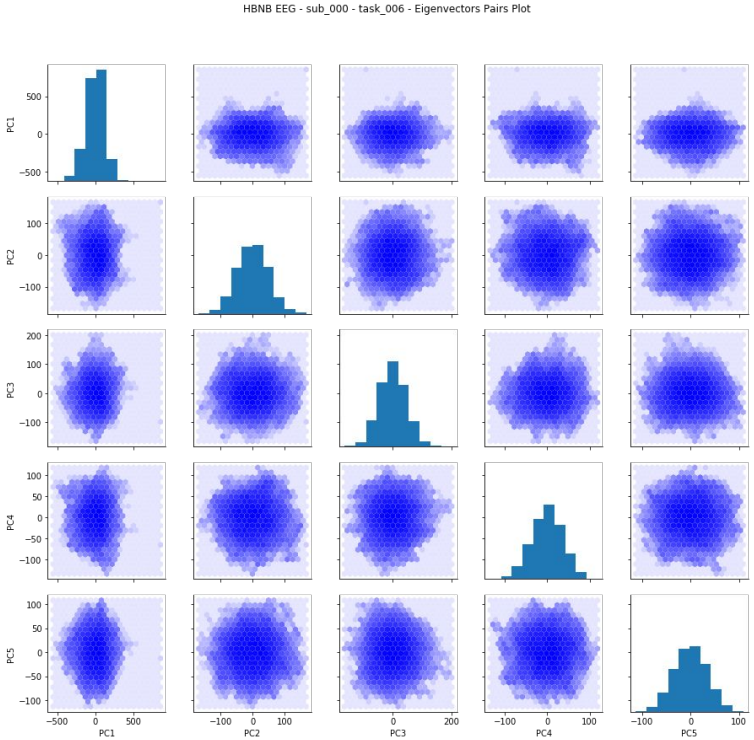
Raw Eigenvectors Heatmap



Plotting Single Trials of EEG Data [notebook]

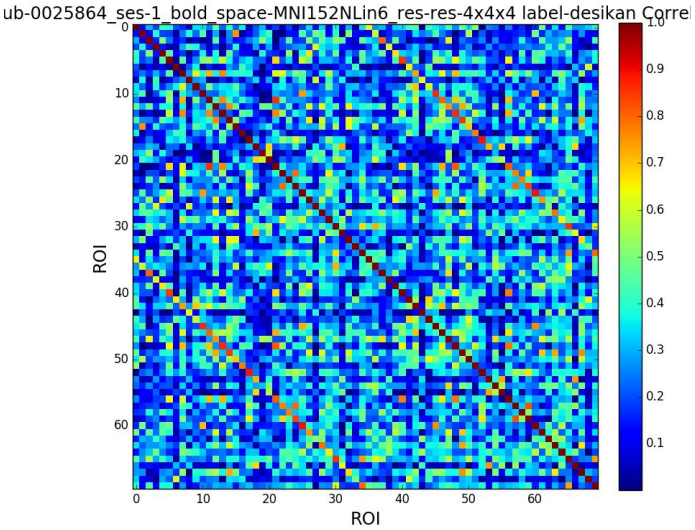
Eigenvectors Pairs Plot

Pairs plot of data points projected onto the first 5 PCs. If the number of points is > 1000, we use hex binned plots instead of raw scatter plots. Hex bins are log scale colorized.

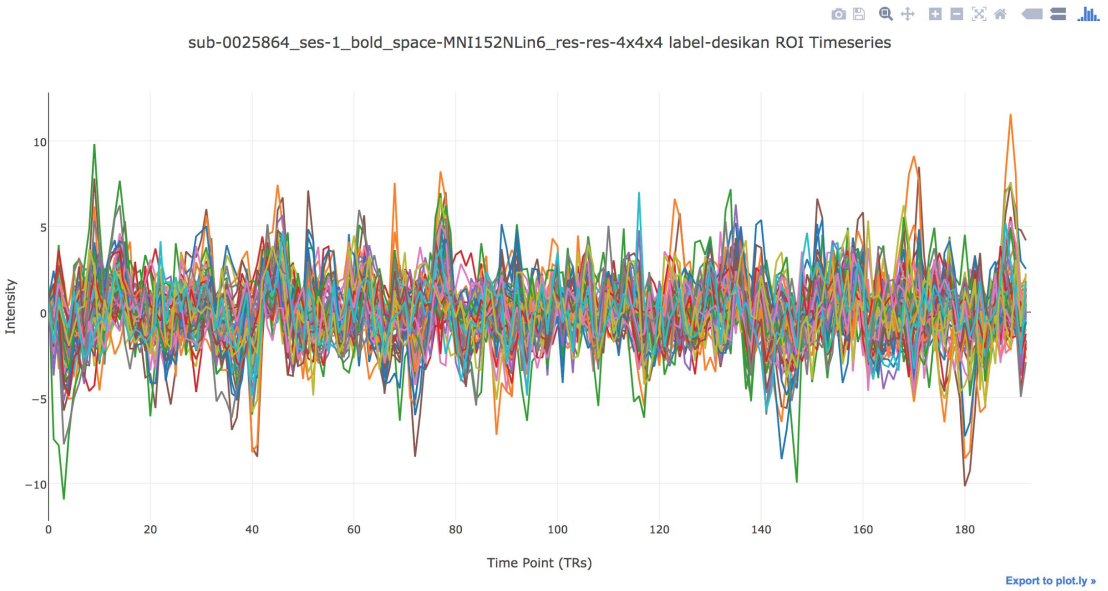


Run Eric's pipeline on fMRI data [Notebook]

Correlation Matrix

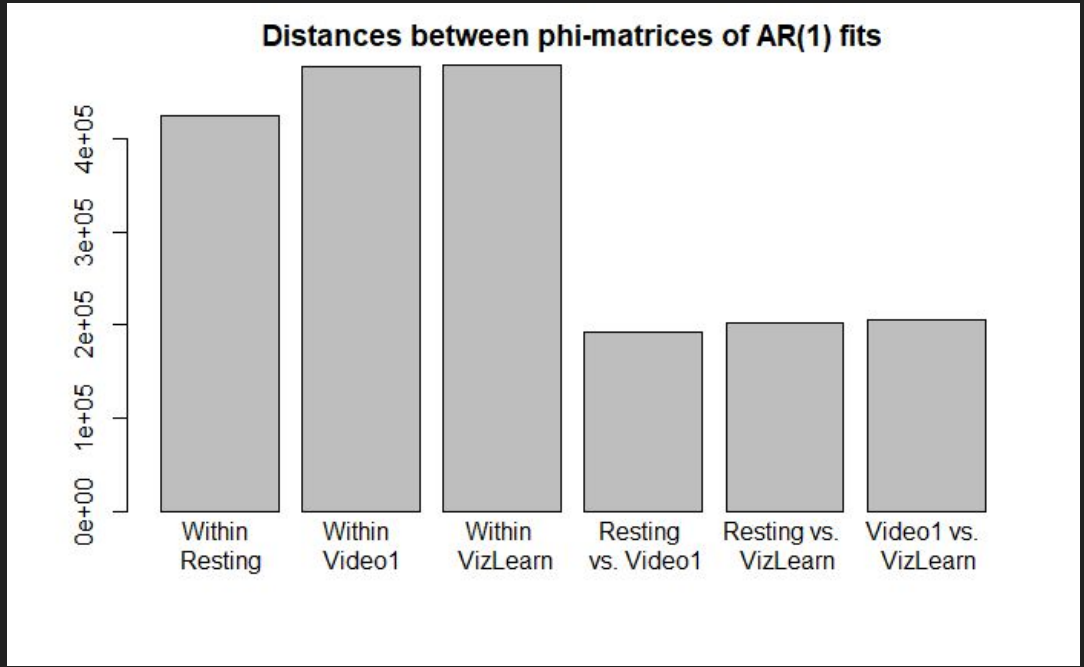


Time Series Plot



AR(1) Fitting

AR(1) fitting for 15 time series. Within each paradigm - calculate norm of pairwise distance matrices and then averaged them. Between each paradigm - average all matrices for each paradigm and then calculate pairwise distances. Distance is much higher for within than between.



Sprint 1 Progress

- Scope problems from literature
  - EEG Biomarkers
  - fMRI Biomarkers (connectivity)
  - Analysis of survey data (p-factor)
- Lemur Alpha Library
  - Need more modality specific plots for single data point to single plot (spatial + temporal)
    - Flattened EEG Heatmap
    - Graph of fMRI connectivity between ROIs
  - Iterate on aggregate plots, add Energy Distance and AR as a metric.
- Lemur Demo Notebook
  - Need to run on fMRI data also, run on larger datasets (15+ EEG subjects)
- Uniform plotting aesthetic & API
  - API examples in demo notebook, all plotly except 1-2 plots which will be switched over.