Matlab, part 4: Projection/Correlation Analyses

Matrix math

\[
\begin{bmatrix}
  v_1 & v_2 & v_3 \\
  x & y & z
\end{bmatrix}
\]

\[= xv_1 + yv_2 + zv_3\]

Assuming right matrix is a single column
In general, # of left matrix columns must equal # of right matrix rows

Matrices in Matlab

\[
A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} ;
\]
\[
b = \begin{bmatrix} 4 \\ 5 \end{bmatrix} ;
\]

What is \(A*b\)?

Transpose: \([4; 5] == [4 5]'\),
\[a'\] flips rows and columns

LOC localizer: experimental design

Each second:
- new object OR
- new noise OR
- “blank screen” (fixation)

Localize part of brain selective for object pictures
Our data: “block design”
Rapid sequence of objects
Pause
Rapid sequence of noise

2s
2s
2s
2s
2s
30s
Building the voxel response

Voxel response to stimuli at each second

neuroData

timesObjs, at each second:

• 0 for no-object,
  1 for yes-object
• Drift and offset

Comparing vectors

Can compare 2 vectors

• by correlating \( \text{corr}(a, b) \)
  – between -1 and 1
  – high |correlation| = high connection between vectors
• by multiplying \( a \times b' \)
  – high product = high similarity

Scatter-plots

Visualizing how two variables vary together

plot(var1, var2, '.')
scatter(var1, var2)

Building the voxel response

General Linear Model

Design matrix \( M \)

• On/off information \( O \)
• Constant offset \( C \)
• Linear drift \( L \)

Measured voxel output \( v = [v_{t=1}, v_{t=2}, \ldots, v_{t=93}]^T \)

\[
M = \begin{bmatrix}
O & C & L
\end{bmatrix}
\begin{bmatrix}
\beta_o \\
\beta_c \\
\beta_L
\end{bmatrix} = v \\
B = M^{-1}v
\]
Convolution in Matlab

Think of a 1-D input and 1-D pattern

Check if 1-D pattern matches (multiply and add) at different windows of the input