Matlab, part 3: Vector analysis

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Matrix math

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

Matrices and weighted sums

\[
\begin{bmatrix}
1 & 4 & 1 & 0 \\
\end{bmatrix}
\begin{bmatrix}
[1] \\
[0] \\
[1] \\
[-1] \\
\end{bmatrix}
\]

\[
1 [0] + 4 [1] + 1 [0] + 0 [0] = [4] \\
0 [1] + 1 [0] + 1 [1] + 0 [0] = [0] \\
[-1] [1] + 0 [0] + 1 [0] + 0 [1] = [4] \\
\]

Left Matrix columns times Right matrix numbers

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

Matrix math

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

\[
b = \begin{bmatrix}
4 \\
5 \\
\end{bmatrix};
\]

What is \( A*b \)?

Transpose: \([4; 5] == [4 5]'\)

\( a'\) flips rows and columns
Scatter-plots
Visualizing how two variables vary together

<table>
<thead>
<tr>
<th>Reaction time</th>
<th>Cortical response</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>10</td>
</tr>
<tr>
<td>45</td>
<td>25</td>
</tr>
<tr>
<td>150</td>
<td>6</td>
</tr>
<tr>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>125</td>
<td>14</td>
</tr>
<tr>
<td>33</td>
<td>12</td>
</tr>
<tr>
<td>200</td>
<td>3</td>
</tr>
</tbody>
</table>

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

Comparing vectors
Can compare 2 vectors
• by multiplying \( a \times b' \)
  – high product = high similarity
• by correlating \( \text{corr}(a,b) \)
  – between -1 and 1
  – high |correlation| = high connection between vectors

LOC localizer: experimental design
Each second:
• new object OR
• new noise OR
• “blank screen” (fixation)

Visual comparison
timesObjs2, at each second:
• 0 for no-object
• 1 for yes-object
Voxel response
neuroData2(24, 26, 4, :)
at each second neural response to stimuli
Numeric comparison

Single voxel response:
voxRespl=squeeze(neuroData2(24,26,4,:));

Compare with object appearance times:
corr(voxRespl, timesObjs2');

Consider correlations at multiple locations (axial slice):
for x=1:32,
   for y=1:32
      voxResp=squeeze(neuroData2(x,y,5));
      corrMat(x,y)=corr(voxResp,timesObjs2');
   end
end