CISC 3250
Systems Neuroscience

Matlab, part 4:
Vector analysis

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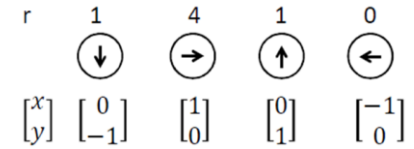
JMH 332

Matrices and weighted sums



$$1\begin{bmatrix}0\\-1\end{bmatrix}+4\begin{bmatrix}1\\0\end{bmatrix}+1\begin{bmatrix}0\\1\end{bmatrix}+0\begin{bmatrix}-1\\0\end{bmatrix}=\begin{bmatrix}4\\0\end{bmatrix}$$

$$\begin{bmatrix}0&1&0&-1\\-1&0&1&0\end{bmatrix}\begin{bmatrix}1\\4\\1\\0\end{bmatrix}=\begin{bmatrix}4\\0\end{bmatrix}$$

Left Matrix columns times
Right matrix numbers

$$\begin{bmatrix}|&|&|\\v_1&v_2&v_3\\|&|&|\end{bmatrix}\begin{bmatrix}x\\y\\z\end{bmatrix}=xv_1+yv_2+zv_3$$

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Matrix math

$$\begin{bmatrix}|&|&|\\v_1&v_2&v_3\\|&|&|\end{bmatrix}\begin{bmatrix}x\\y\\z\end{bmatrix}=xv_1+yv_2+zv_3$$

Assuming right matrix is a single column

In general, # of left matrix columns must equal
# of right matrix rows

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Matrix math

```
A= [1 2; 3 4];
b= [4; 5];
```

What is `A*b`? **[19 ; 28]**

Transpose: `[4; 5]` == `[4 5]'`

`a'` flips rows and columns

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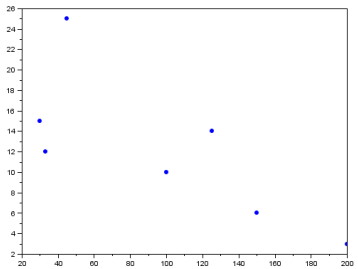
Scatter-plots

Visualizing how two variables vary together

Reaction time	Cortical response
100	10
45	25
150	6
30	15
125	14
33	12
200	3



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

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Comparing vectors

Can compare 2 vectors

- by multiplying `a*b'`
  - high product = high similarity
- by correlating `corr(a,b)`
  - between -1 and 1
  - high |correlation| = high connection between vectors

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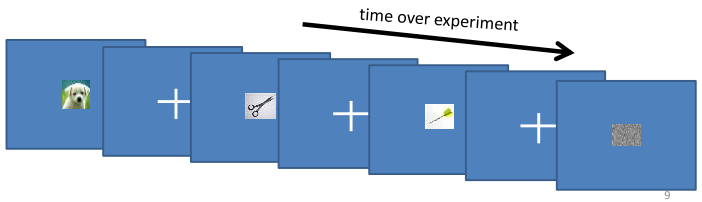
LOC localizer: experimental design

Each second:

- new object OR
- new noise OR
- "blank screen" (fixation)



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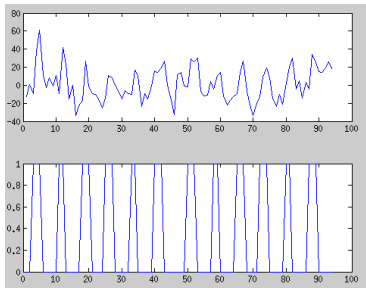
Visual comparison

`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



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Numeric comparison

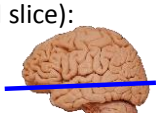
Single voxel response:

```
voxResp1=squeeze(neuroData2(24,26,4,:));
```

Compare with object appearance times:

```
corr(voxResp1, 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
```

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