Systems Neuroscience

Matlab, 3^+ dimensional data

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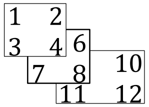
JMH 332

Matrices in *n* dimensions

```
x=[1 2 3; 4 5 6]
```

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$$

```
y(:,:,1)=[1 2; 3 4]
y(:,:,2)=[5 6; 7 8]
y(:,:,3)=[9 10; 11 12]
size(y)  -> [2 2 3]
```



Typical brain data : location of neuron (x,y,z) + time

Heat-maps

imagesc(Data) – view 2D matrix of scaled data as image

- Red is highest value, blue is lowest value

Visualize a 2D slice of brain data (size(brainData) -> 128x128x88)

```
slice=squeeze(brainData(:,:,20))  -> slice 20 of brain
imagesc(slice)
```

Scaling vs. not-scaling

`imagesc(Data)` – view 2D matrix of scaled data as image

- Red (or yellow) is highest value, blue is lowest value

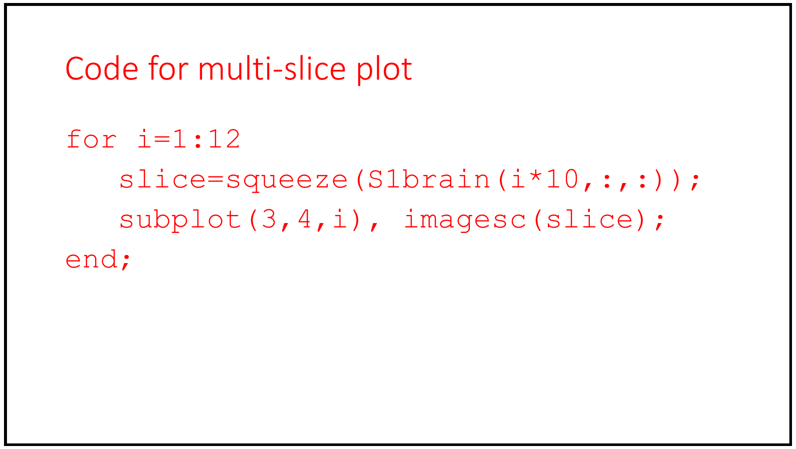
`image(Data)` – view 2D matrix of data as image

- Red (or yellow) is 64 or higher, blue is 0 or lower

```
slice=squeeze(brainData(:,:,10));
figure; imagesc(slice);
```

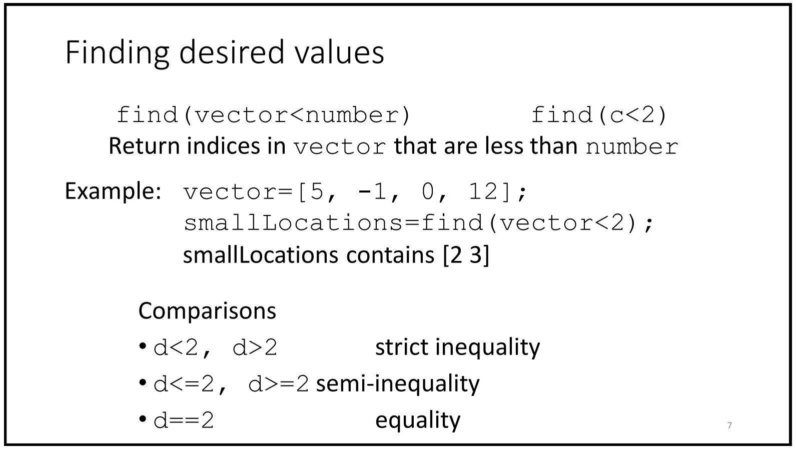
vs

```
figure; image(slice)
```



Code for multi-slice plot

```
for i=1:12
   slice=squeeze(S1brain(i*10,:,:));
   subplot(3,4,i), imagesc(slice);
end;
```



Finding desired values

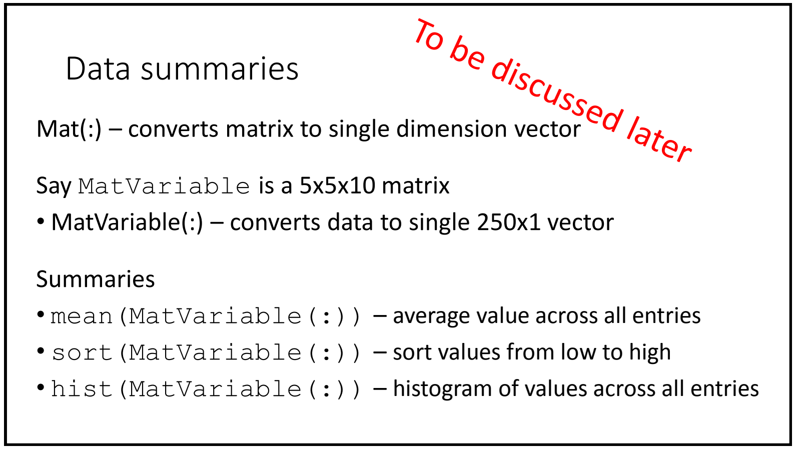
`find(vector<number)`   `find(c<2)`

Return indices in `vector` that are less than `number`

Example: `vector=[5, -1, 0, 12];`
`smallLocations=find(vector<2);`
smallLocations contains [2 3]

Comparisons

- `d<2, d>2` strict inequality
- `d<=2, d>=2` semi-inequality
- `d==2` equality



Data summaries

To be discussed later

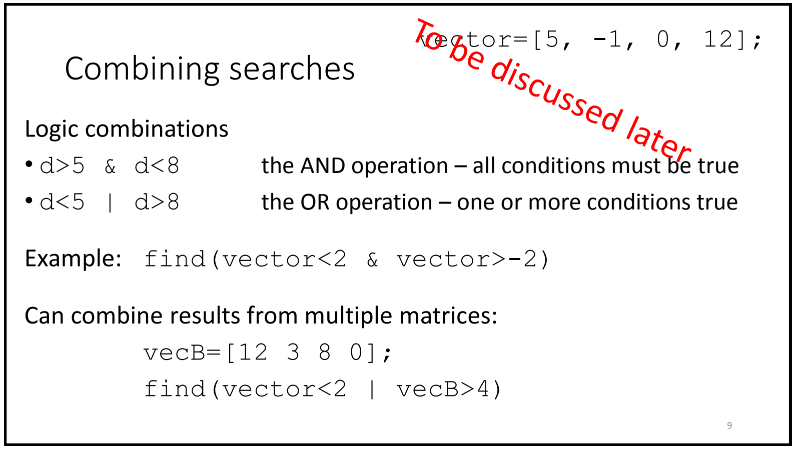
Mat(:) – converts matrix to single dimension vector

Say `MatVariable` is a 5x5x10 matrix

- MatVariable(:) – converts data to single 250x1 vector

Summaries

- `mean(MatVariable(:))` – average value across all entries
- `sort(MatVariable(:))` – sort values from low to high
- `hist(MatVariable(:))` – histogram of values across all entries



Combining searches

`vector=[5, -1, 0, 12];`

To be discussed later

Logic combinations

- `d>5 & d<8` the AND operation – all conditions must be true
- `d<5 | d>8` the OR operation – one or more conditions true

Example: `find(vector<2 & vector>-2)`

Can combine results from multiple matrices:

```
vecB=[12 3 8 0];
find(vector<2 | vecB>4)
```