



SKILLPILLS

Skill Pill: MATLAB

Jeremie Gillet (thanking Albert Benseny Cases)
Plotting and scope



2D plots

3D plots

More useful stuff

Vector plots

Logical array

Some available Apps

The background of the slide is filled with a dense, scattered pattern of red and white capsules, resembling a 2D plot of data points.

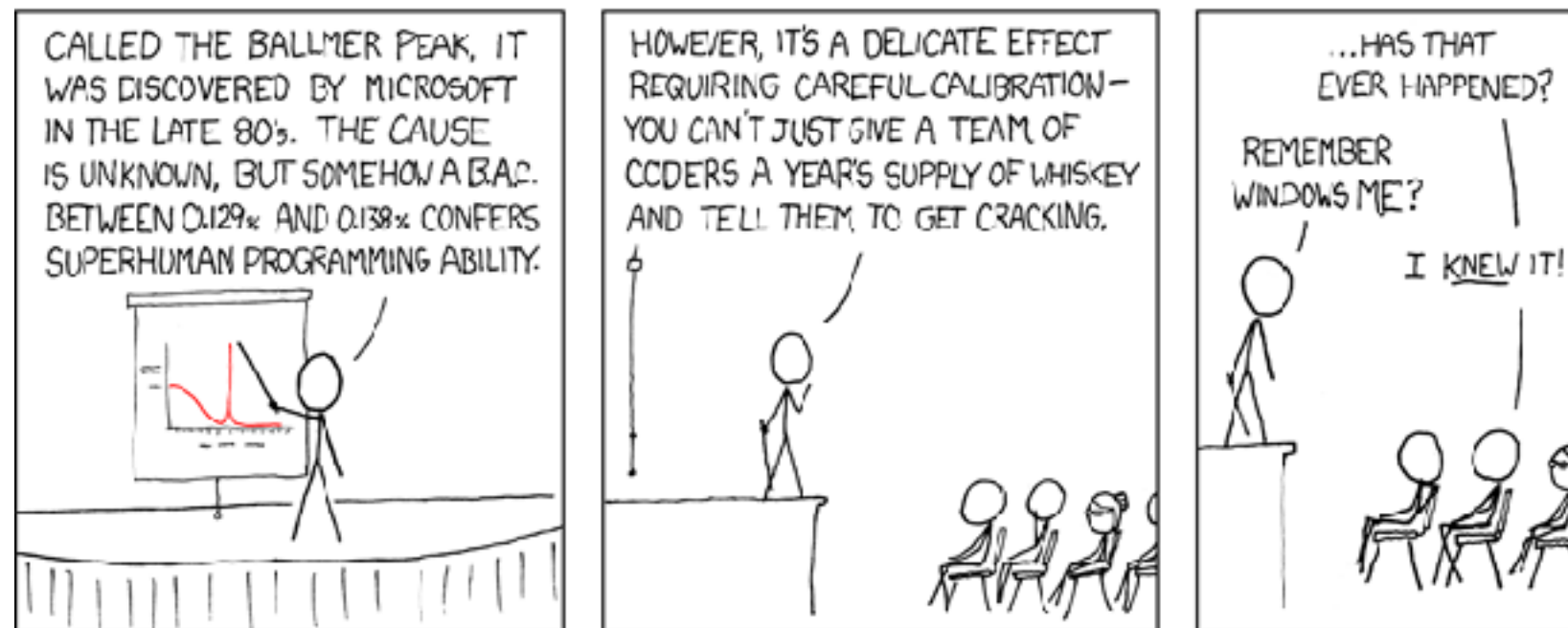
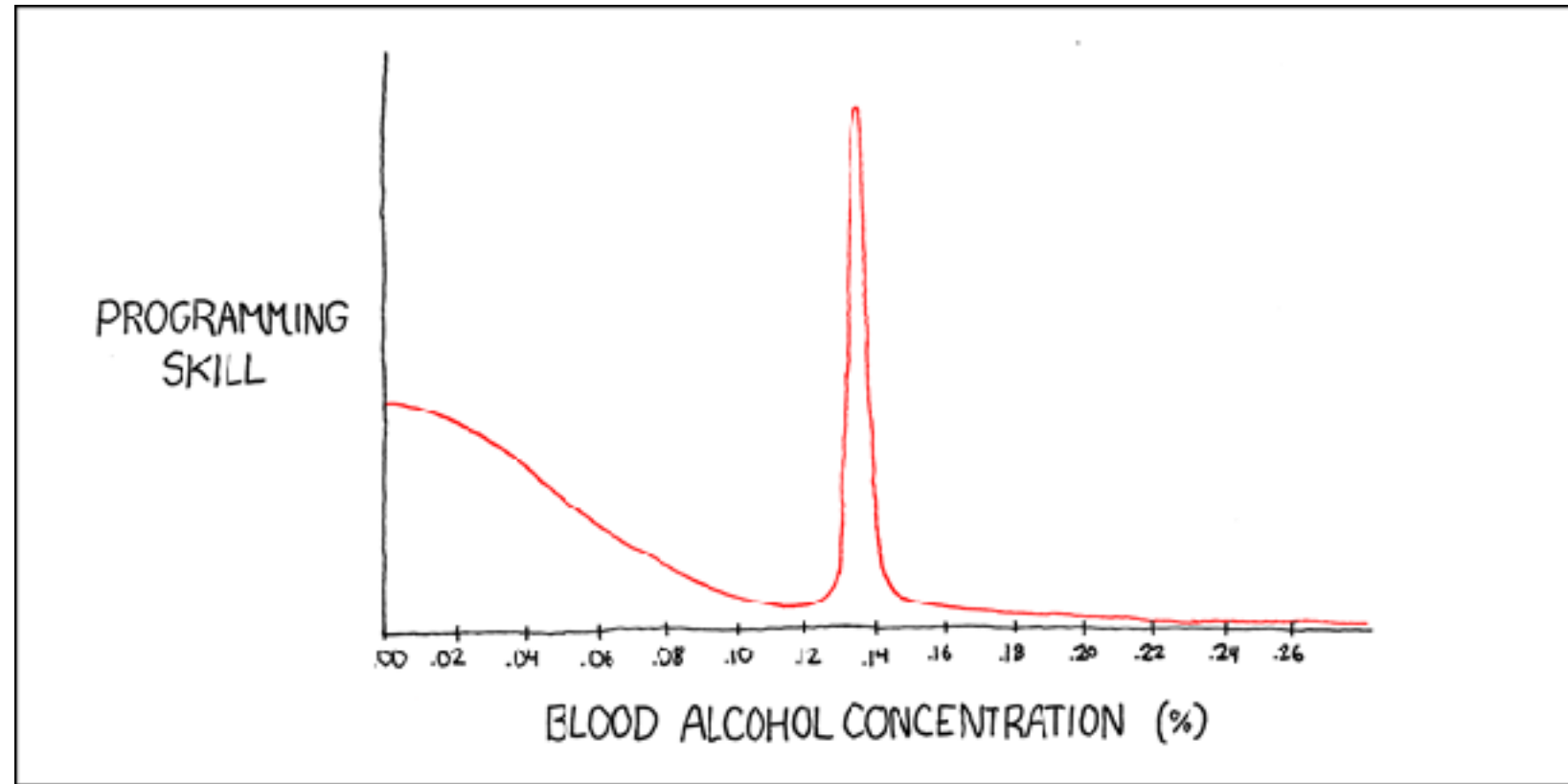
2D plots!

Line plots

- `plot(y)` will plot `y`.
- `plot(x, y)` will plot `y` vs `x`.
- `axis([xmin xmax ymin ymax])`
- We can the format of the lines/dots...
- `xlabel` to add a label to `x` axis.
- `ylabel` to add a label to `y` axis.
- `title` to set a title.

Reproduce Ballmer peak's plot

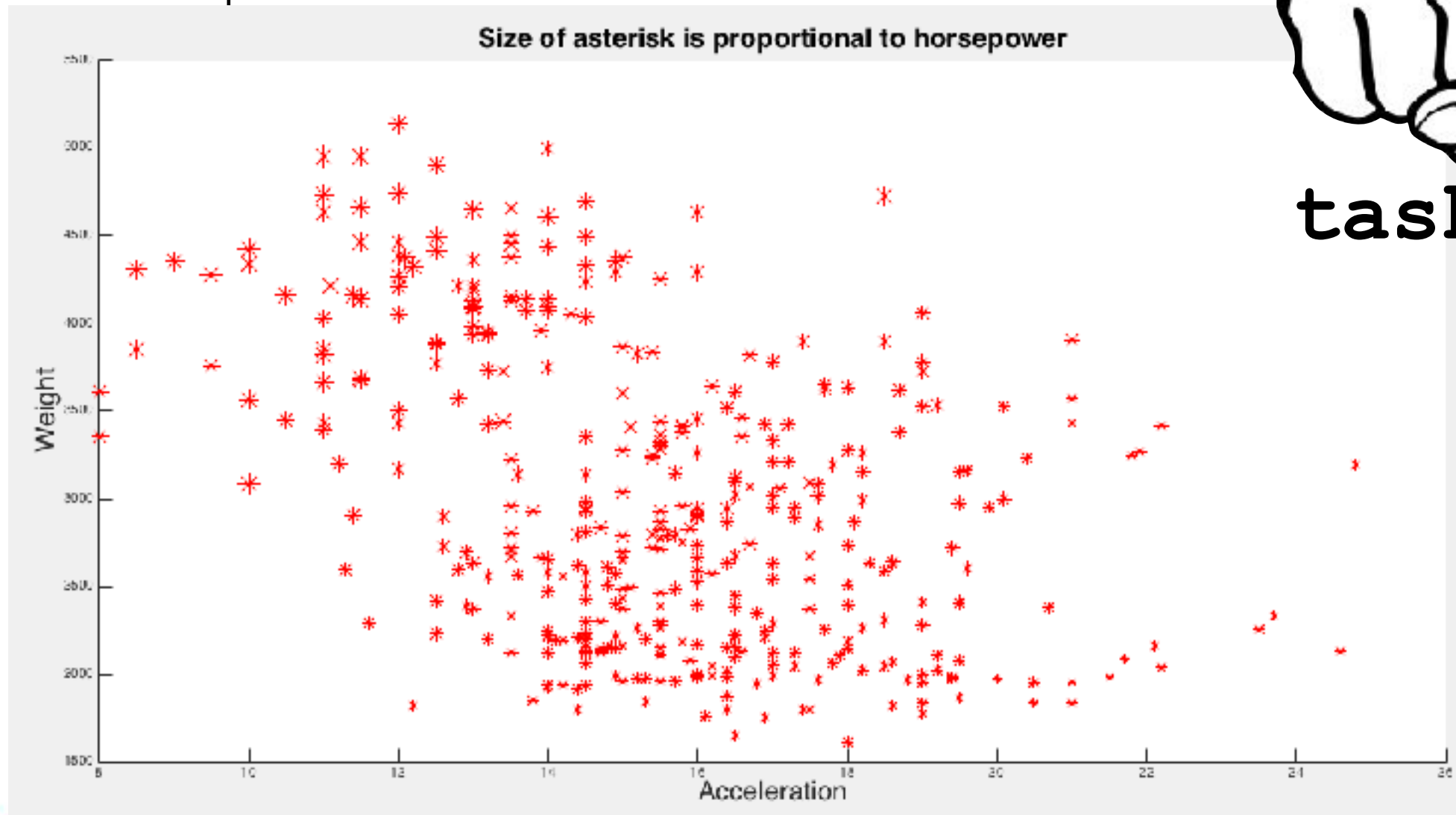
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data is in ballmer.mat

My first scatter plot

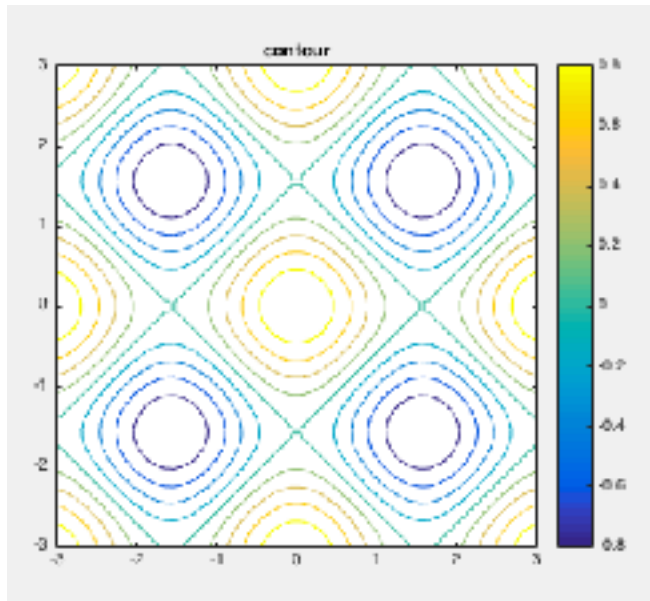
- `scatter` is used for scatter/bubble plots.
`load carbig.mat`
`help scatter`



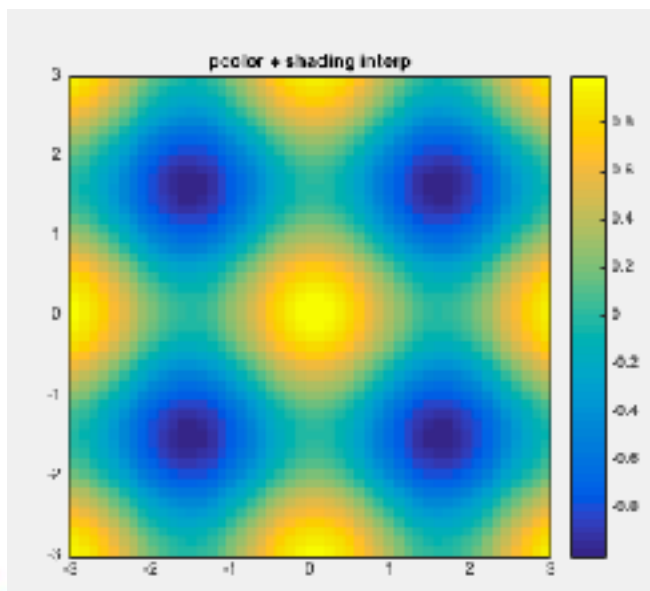
The background of the slide is filled with a dense, scattered pattern of red and white capsules, resembling a 3D plot of data points.

3D plots!!

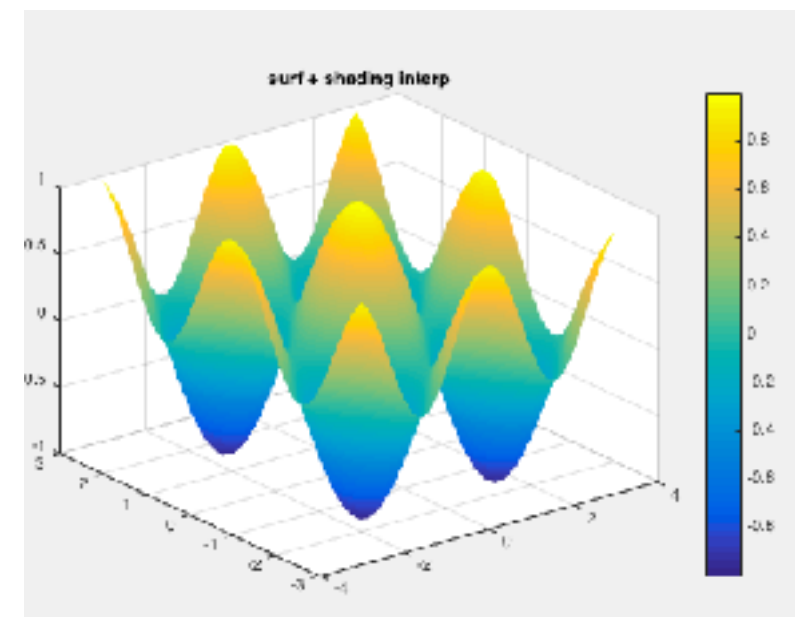
- Contour plots



- Pseudocolor plot



- Surface plots



- To make 3D plots we need a meshgrid, a cartesian grid created from vectors:
 $[x \ y] = \text{meshgrid}(x_v, y_v)$
- We use x and y to create functions to plot

```
>> x_line = 1:5
```

```
x_line =
```

```
     1     2     3     4     5
```

```
>> y_line = -2:2
```

```
y_line =
```

```
    -2    -1     0     1     2
```

```
>> [x y] = meshgrid(x_line, y_line)
```

```
x =
```

```
     1     2     3     4     5
     1     2     3     4     5
     1     2     3     4     5
     1     2     3     4     5
     1     2     3     4     5
```

```
y =
```

```
    -2    -2    -2    -2    -2
    -1    -1    -1    -1    -1
     0     0     0     0     0
     1     1     1     1     1
     2     2     2     2     2
```

```
>> z = x .* y
```

```
z =
```

```
    -2    -4    -6    -8   -10
    -1    -2    -3    -4    -5
     0     0     0     0     0
     1     2     3     4     5
     2     4     6     8    10
```

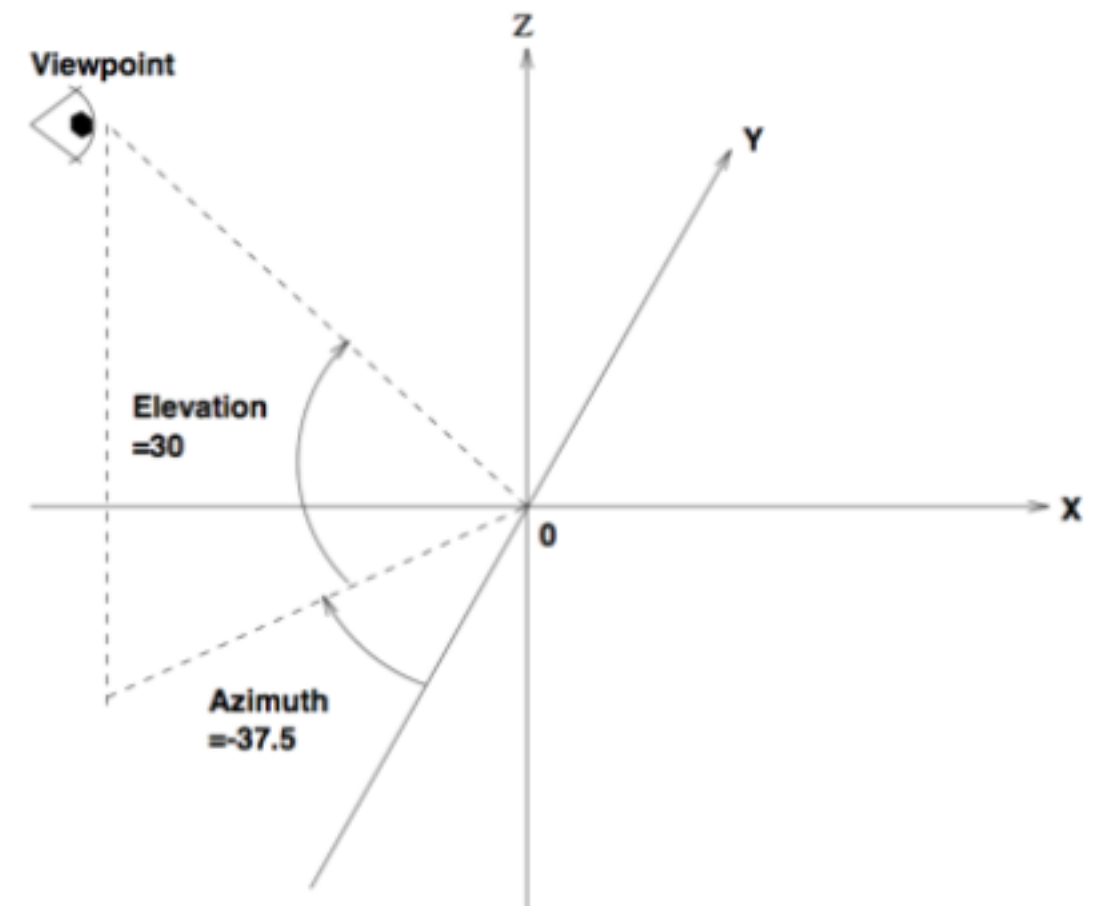
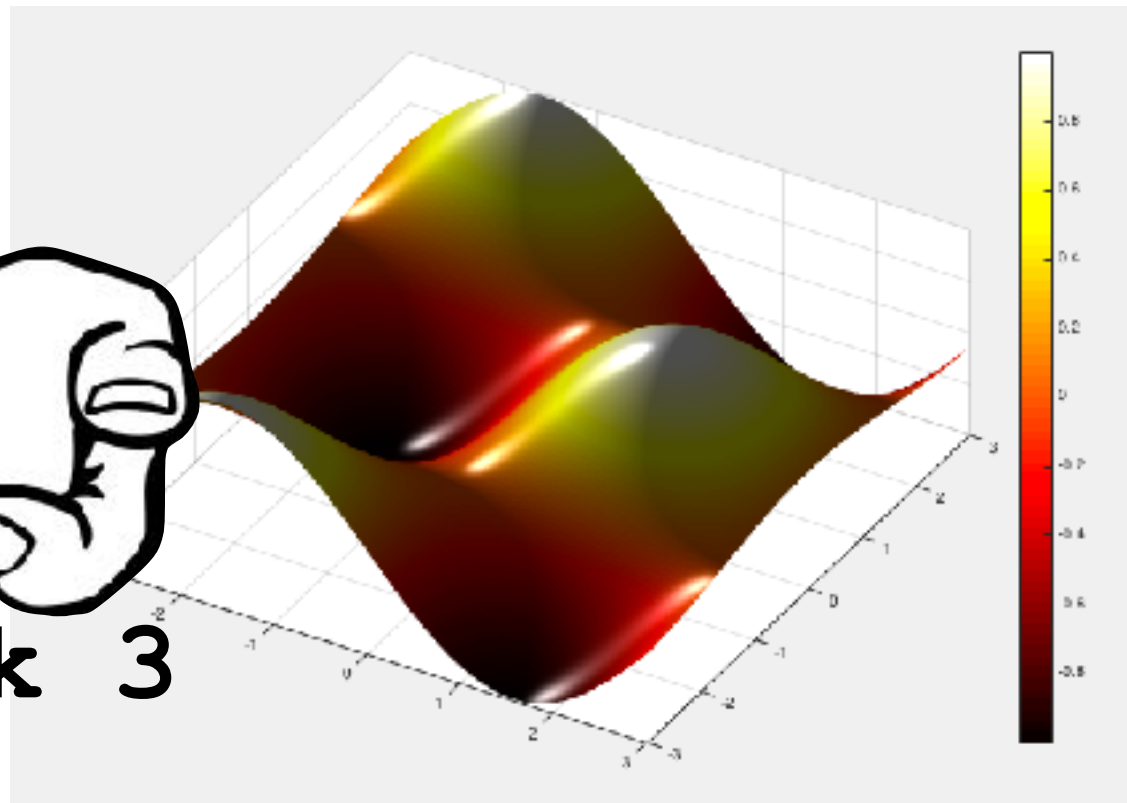


- **Contour of $z(x,y)$:** `contour(x, y, z)`
- `colorbar` **to show colorbar**
- **change colors!** `colormap [jet, hot, cool, spring, winter, gray, bone, copper, pink, lines]` **or** `colormapeditor`
- `caxis([cmin cmax])`: **colorbar range**

- Pseudocolor plot of $z(x,y)$ works the same
`pcolor(x, y, z)`
- We can remove the lines by using
`shading flat`
`shading interp` (also smoothes)

Surface plots

- They work the same: `surf(x, y, z)`
- Plot $z = \sin(x)\cos(y)$ in $[-3 \ 3] \times [-3 \ 3]$
- **Get help!** You can use `lightangle`, `shading`, `lighting`, `view(az, el)`

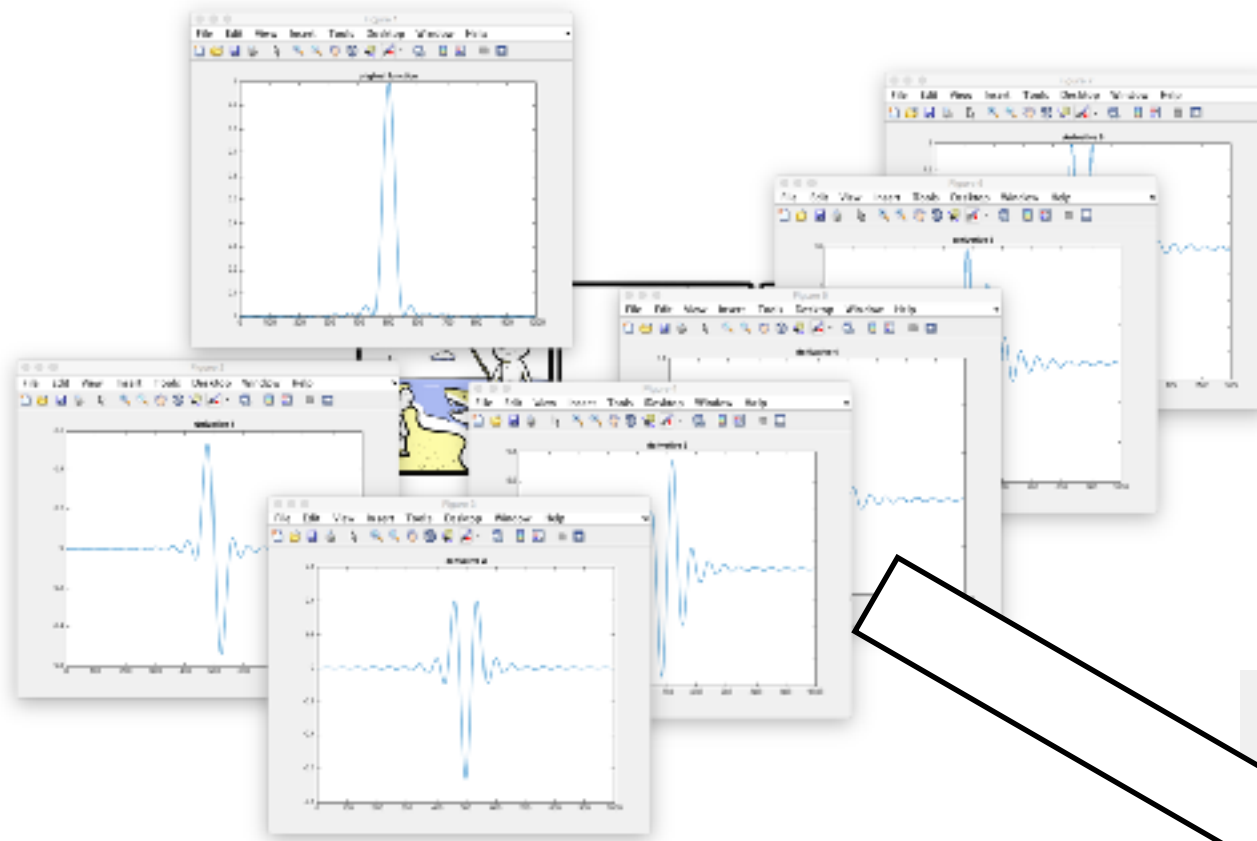


The background of the slide is a dense, repeating pattern of red and white capsules, scattered across the entire surface. The capsules are oriented in various directions, creating a textured, medical-themed backdrop.

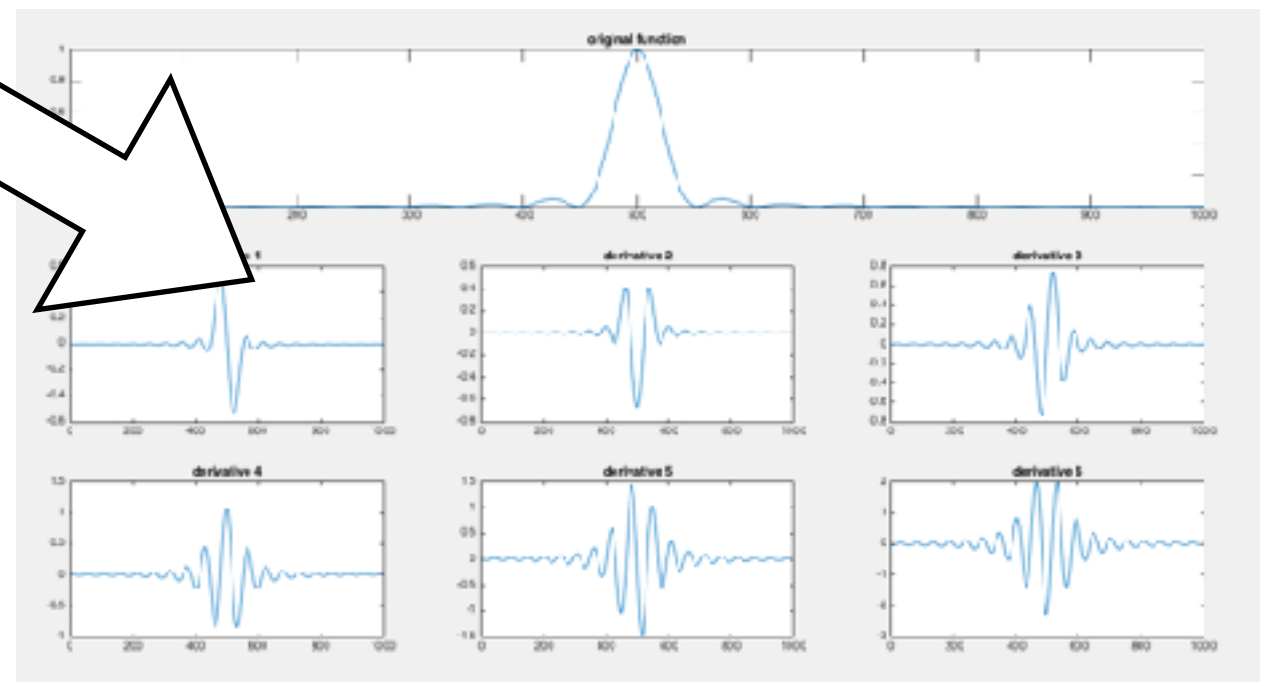
Other useful stuff...

- `figure` makes a new figure.
`figure(n)` goes to/creates a window for figure `n`.
- `clf` clears the contents of the current figure.
`clf(n)` clears figure `n`.
- To put multiple plots in the same figure we can use `subplot(nr, nc, i)`.

Practice your subplotting!



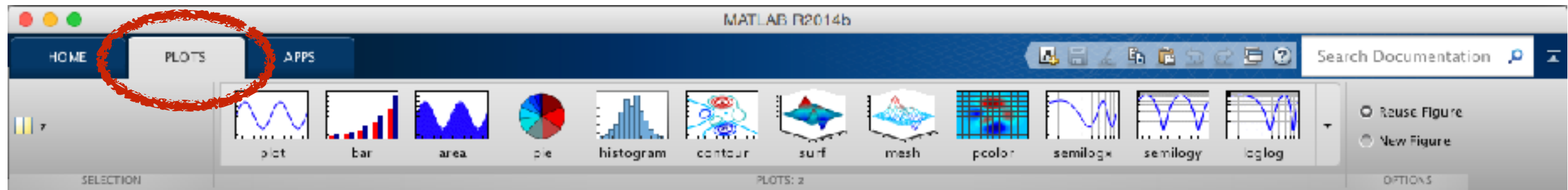
task 4



bonus points for using a for loop!

- **Export figure to eps**
`hgexport(fig_n 'name.eps')`
- **Export to png**
`print -dpng 'filename.png'`
- **print has lots of options!**
`help print`

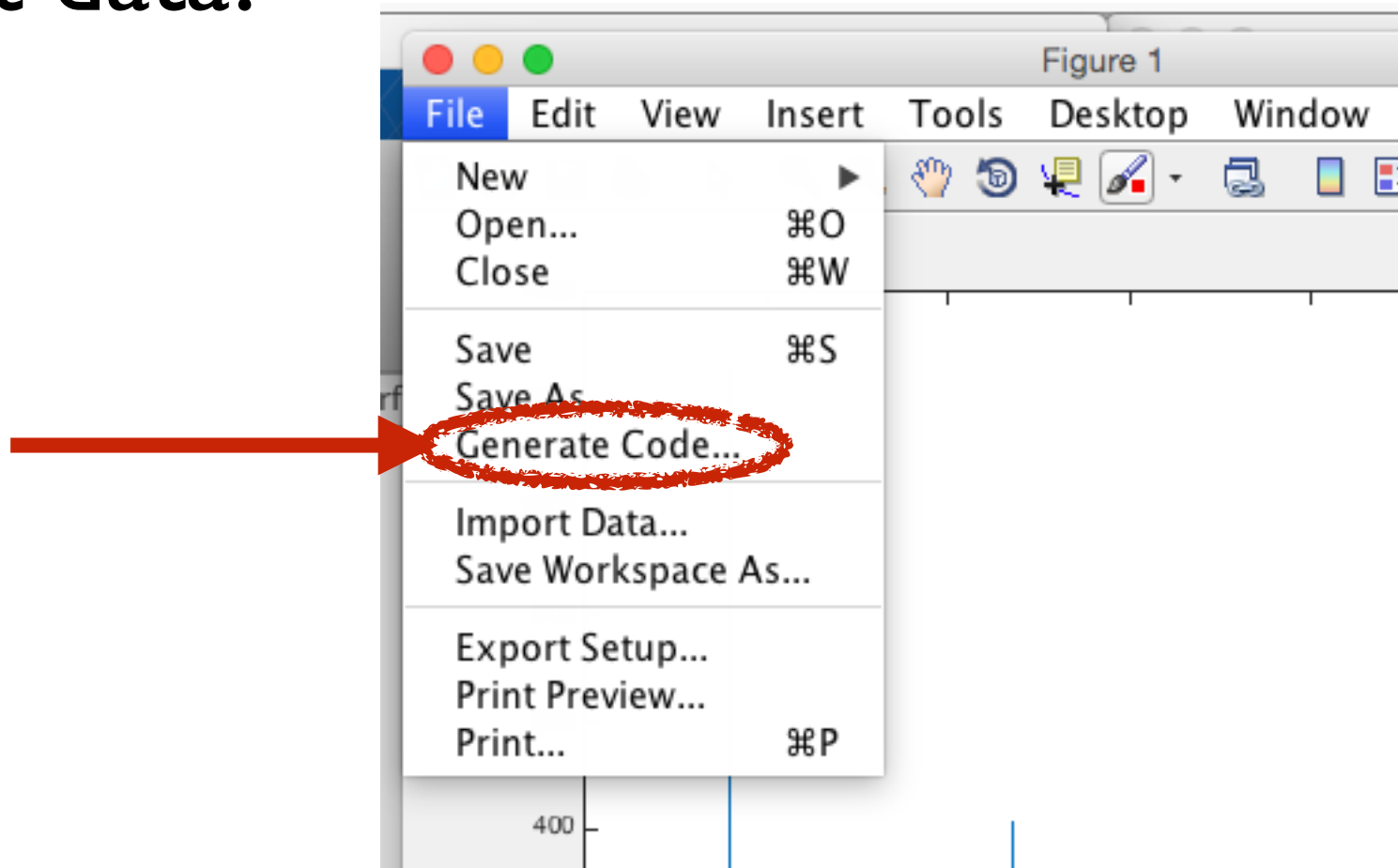
Don't know which plot to make?



- Select some data on the workspace.
- Click PLOTS.

Make a function for your plots! SKILLPILLS

- Once your plot is ready, you can create a function to generate the same plots with different data!



(from the figure menu options)

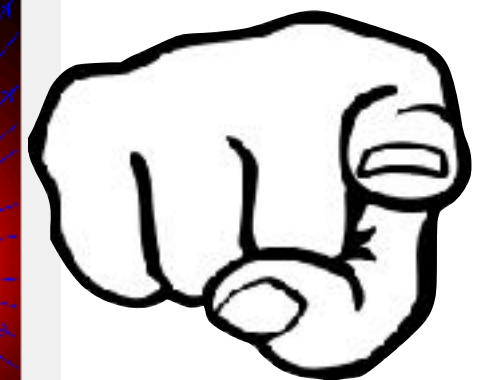
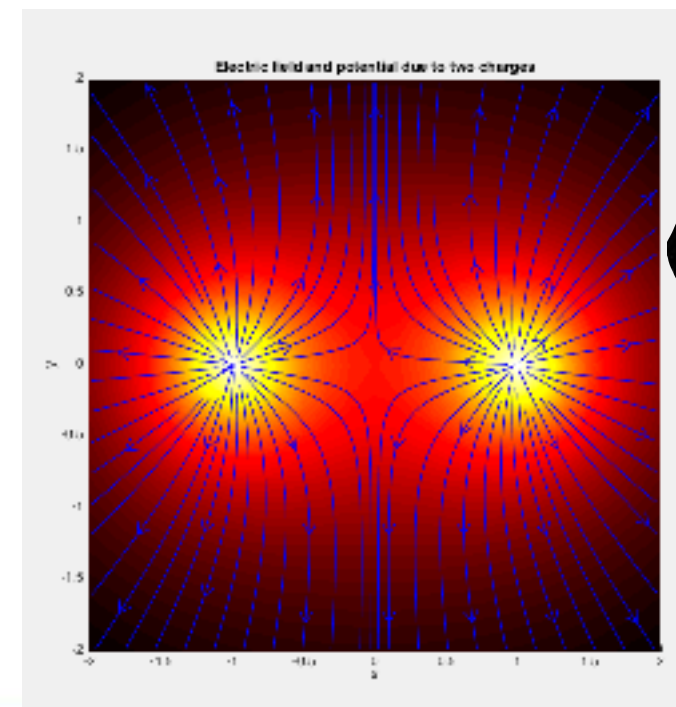
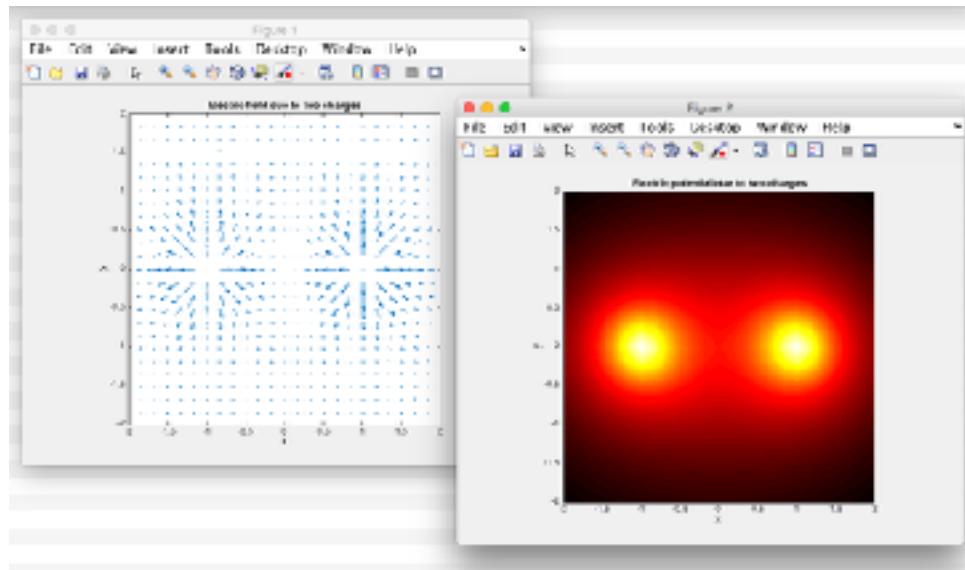
The background of the slide is filled with a dense, scattered pattern of red and white capsules, resembling a vector field or a random distribution of points.

Vector plots!!!

- `quiver(x, y, vx, vy)` shows vectors starting at (x, y) of lengths (vx, vy)
- `quiver(x, y, vx, vy, s)` can be used to scale the vector by a factor s .

Stream lines of vector field

- `streamslice(x, y, vx, vy)` draws streamlines with the vector field defined by the inputs.
- Create an awesome plot combining both the potential and electric field stream lines.



task 5

The background of the slide is a dense, repeating pattern of red and white capsules, scattered across the entire surface. The capsules are oriented in various directions, creating a textured, medical-themed backdrop.

Logical arrays

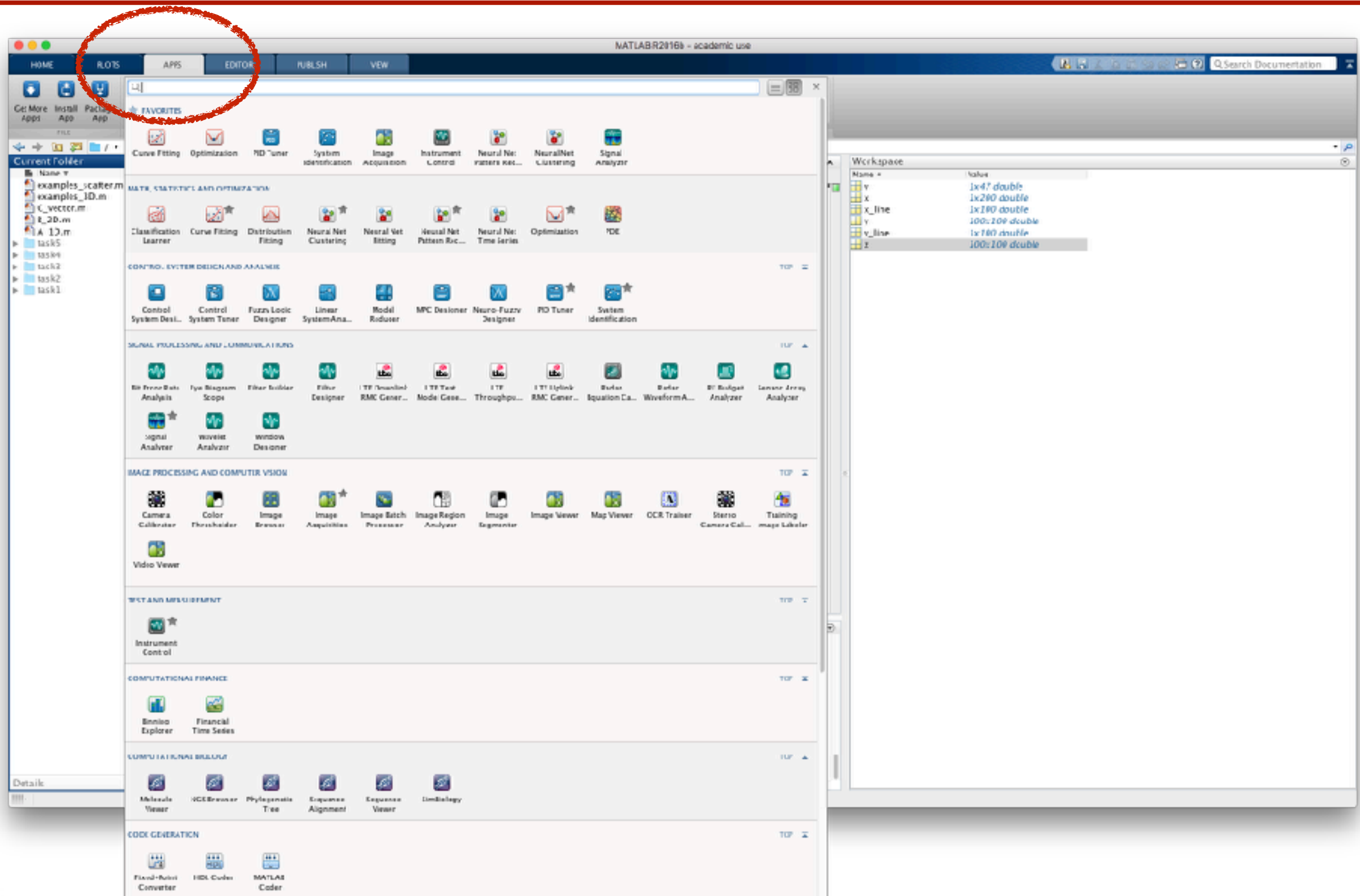
Logical arrays

- `>> mat = magic(5)`
- Let's figure out what these do:
 - `>> mat == 13`
 - `>> mBig = mat > 13`
 - `>> mat(mBig)`
 - `>> mat(mat>13)`
 - `>> mat(~mBig) = 0`
 - `>> r = rand(5) ; r(mBig) = 1`
 - `>> 0 + mBig`

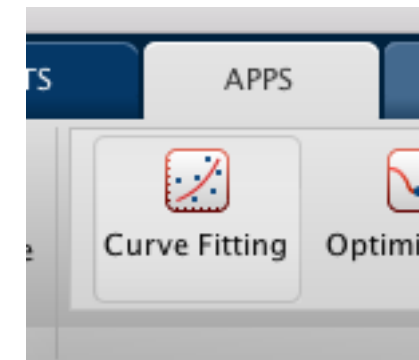
The background of the slide is a dense, repeating pattern of red and white capsules, scattered across the entire surface. The capsules are oriented in various directions, creating a textured, medical-themed backdrop.

Quick look at Apps

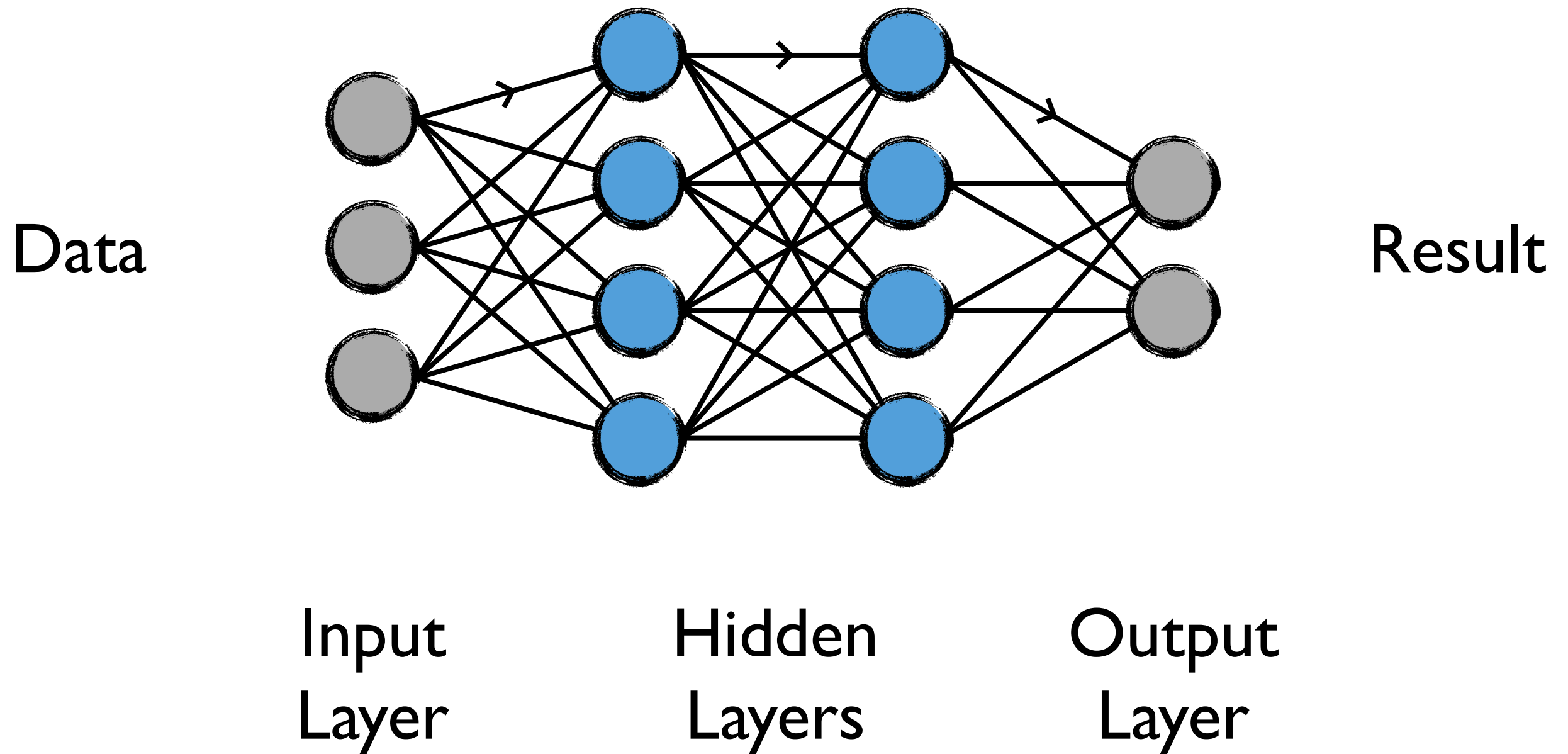
There are tons of apps

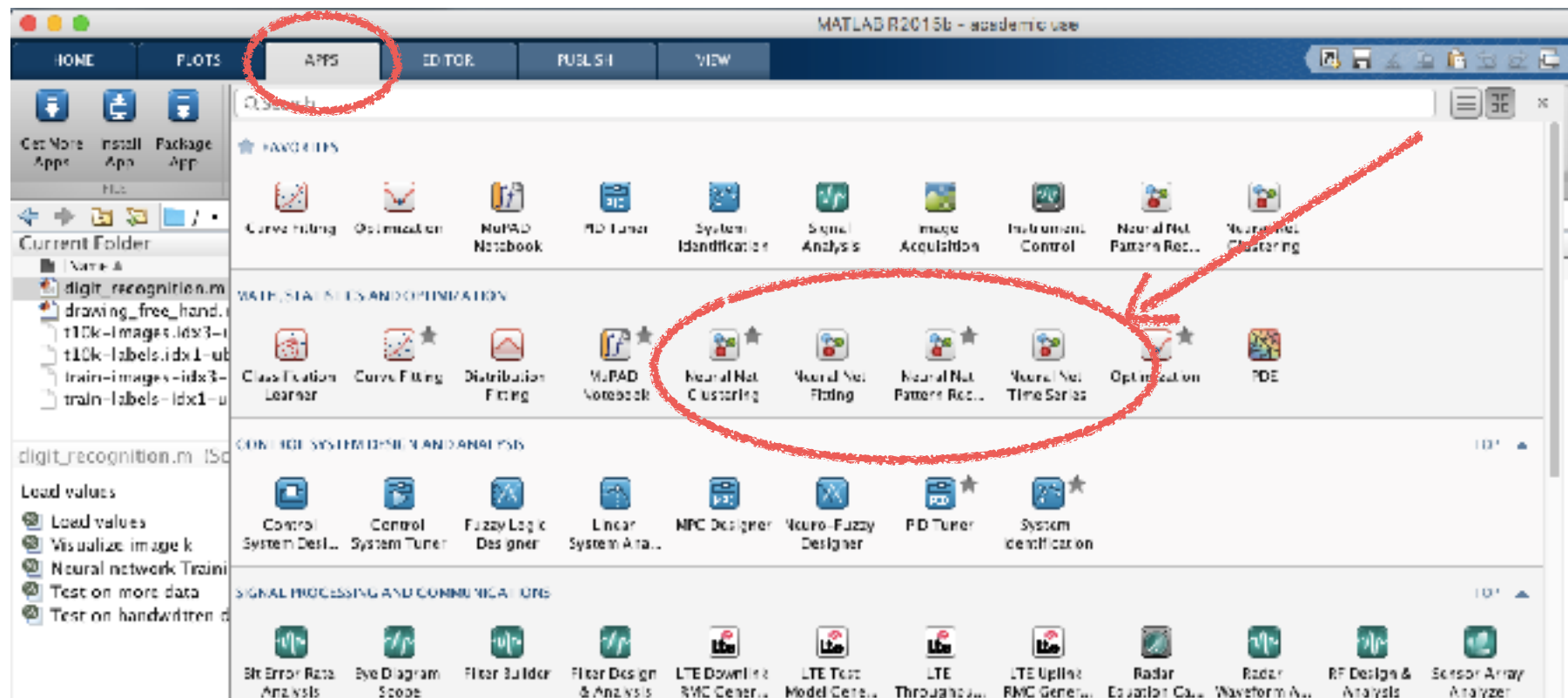


- Load your data (must be visible in the workspace)
- Click on the Curve Fitting app
- Choose all parameters
- Curve Fitting Tool window > File > Generate code



Neural Networks





- Several tools exist and are being developed
- Basic understanding of the tool is required
- Pushes the GUI, but stick with the code

Example: handwritten digits

- MNIST database
- 60,000 examples in training set
- 10,000 examples in test set
- $28 \times 28 = 784$ pixel images
- Our network: single hidden layer, 100 neurons



The background of the image is a dense, repeating pattern of small, stylized capsules. Each capsule is oriented horizontally and consists of two halves: one half is white with a thin red outline, and the other half is solid red. The capsules are scattered across the entire frame, creating a textured, medical-themed background.

**There are many
more...**