Intro to Matlab

Jia Wu

2019-03-01

What is MATLAB

- MATrix LABoratory
  - Matrix has two dimensions, rows and columns. But Matlab can do so much more.
  - High-level, compare to low level languages like C, C++ etc.
- A very popular environment for scientific research
  - (so is Python and R!)
- Has many useful toolboxes built by Mathworks
  - statistics, signal processing, image processing etc.
- Has many third party libraries
  - Psychtoolbox, EEGLAB, Artiifact, our own heart rate processing library, and 99% of the code used in this lab for signal processing
- Easy to modify, maintain and share.
  - Mostly everything is just text files.
- Many useful tutorials online that are freely available
  - Teaching Psychology and Neuroscience with MATLAB https://www.mathworks.com/academia/courseware/teaching-psychology-and-neuroscience-with-matlab.html
  - http://dinshi.com/introduction-to-matlab-psychology/

To start

- The layout
  - Command window, very important before you know how to do scripting
  - Workspace, instant view of all the current variables created
  - Editor, where to edit scripts
  - Current folder, where MATLAB looks for functions and files.
- Mainly two ways of writing and running code
  - Use the command window, which we will practice for now
    - Type after the >> sign in the command window
  - Use scripting, in which case you can use the previous code over and over and easy to modify.

Good at arithmetic

>>

>> 20+45

>> 1.23 * 456

>> 10^3 / 25

>> log10(10000)

Try vector and matrix

>> v1= 1:100;

1, 2, 3, 5, …..100

>> v2 = 0:2:100;

0, 2, 4, 6, 8, …….100

>>a = [1,2;3,4]

- defined variable “a”
- “a” is a two row matrix, row 1, [1,2], row 2, [3,4].
- Use ; to separate rows.

>> b = [7,8;9,10]

>> a + b

>> a.*b

>> use ; at the end of the line to avoid printing output

Common number manipulation

>> m1 = zeros(3,4)

- generating a 3 row by 4 column matrix of zero

>> m2 = ones(4,5)

>> m3 = rand(1,6)

>> m4 = m3 + 10

>> m5 = ceil(m4)

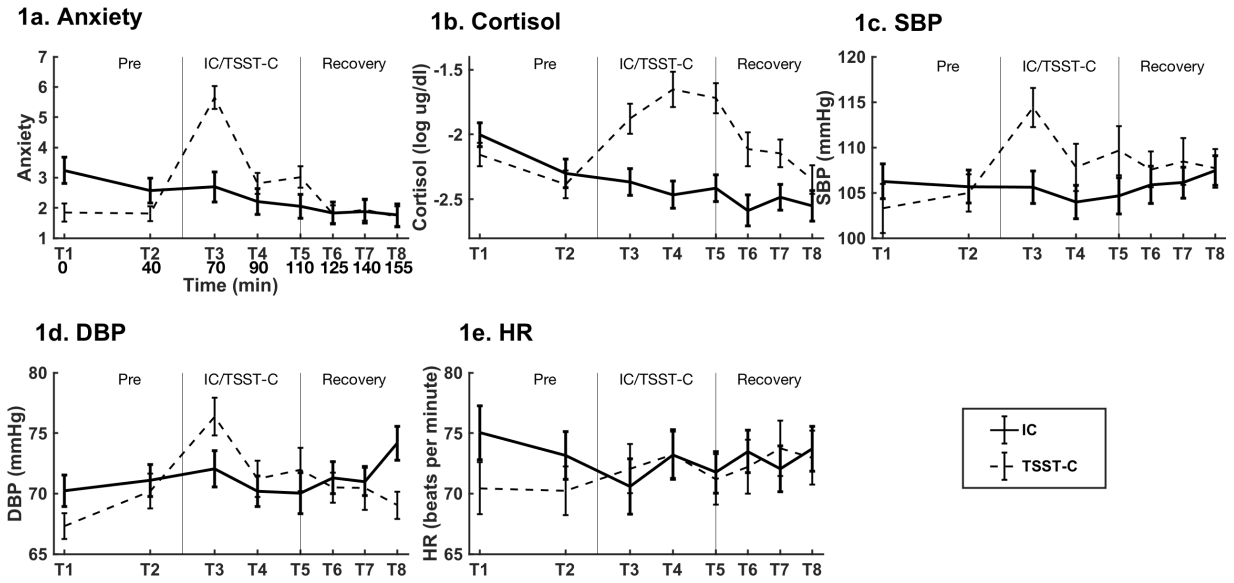
- alternative
- >>m5 = ceil(m3+10)
- %Nested, you can use % to comment on code
- floor, round,
- sum, mean,
- std, var,
- length, size

>> 5==2

- single equal sign is always for defining variable
- double equal sign is for comparing
- >, <

plot

```
>>data = 1:2:11;
>>plot(data);
>> title('abcde’);
>>hold on
>> plot([8:-1:3], ' r ‘);
>>xlabel('test’);
```



Able to access and change every single element in the figure

Practical I/O

>> a = inputdlg('what is your name’)

>> a = inputdlg({'what is your name','age’})

>> help inputdlg

- read what it does
- read the content at the bottom that functions do similar things
- try out dialog, listdlg, msgbox

HOMEWORK

Think of a small practical example you can use MATLAB to solve

EEGLAB

- Most commonly used third party MATLAB library for processing EEG data
- Many plugins that extend functionalities
- Preprocessing
  - Non-ICA
    - Filtering
    - Segmentation
    - Reject channel
    - Reject epochs
    - Baseline correction
    - Averaged reference
  - ICA
    - Filtering
    - Reject channel
    - ICA
    - Reject components
    - Re-interpolate channels
    - Baseline correction
    - Averaged reference
    - Segmentation
    - Reject epochs