Universidade de São Paulo
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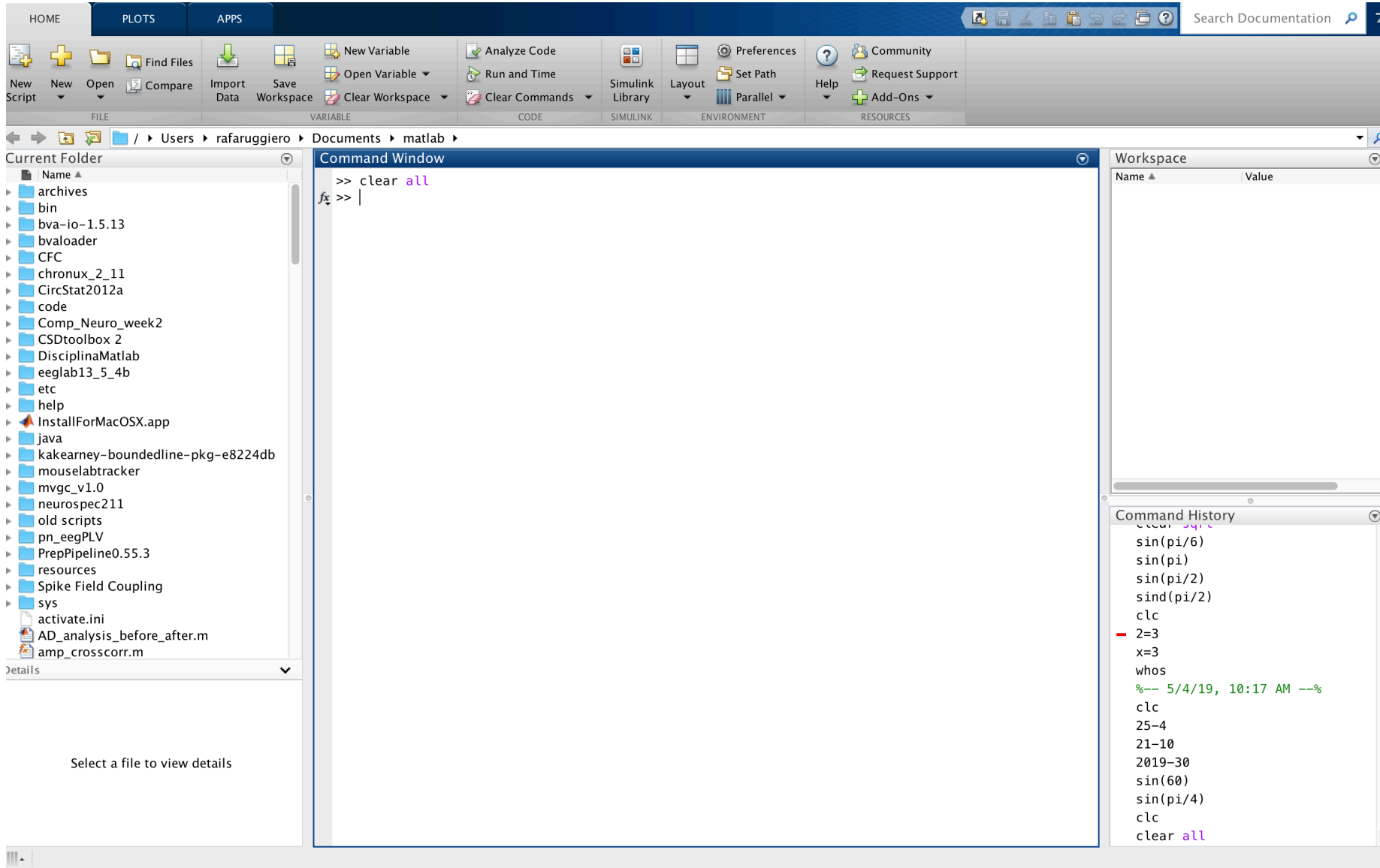# Fundamentos de programação computacional para as neurociências

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Aula 1: Introdução ao Matlab

What is Matlab

- Software environment

- Program language

- Data analysis

- Plot data

- High level language

- Built in functions

Matlab environment

Matlab environment

Table 1-1: MATLAB Windows

Window	Purpose
Command Window	Main window, enters variables, runs programs.
Figure Window	Contains output from graphic commands.
Editor Window	Creates and debugs script and function files.
Help Window	Provides help information.
Launch Pad Window	Provides access to tools, demos, and documentation.
Command History Window	Logs commands entered in the Command Window.
Workspace Window	Provides information about the variables that are used.
Current Directory Window	Shows the files in the current directory.

Gilat, 2008.

Matlab environment

Search for help (don't get stuck):

https://www.mathworks.com/

https://stackoverflow.com/

https://www.google.com/

Get other people code:

https://github.com/

https://www.mathworks.com/
matlabcentral/fileexchange

http://code.google.com

Matlab environment

`ver`	Information about your license, computer, and MATLAB version, together in a convenient summary. If you consult with MathWorks support, you will need this information.
`date`	The current date (in a format you can specify).
`disp`	The value of an expression (numeric or string), displayed in the Command window.
`calendar`	The calendar for the current month.
`help`	Topics for which help can be provided within the command window. Adding a topic name after `help` (followed by a space) brings up help about that topic, provided it is known to MATLAB. You can find out what topics are known to MATLAB by first typing `help` alone. This brings up all the categories for which `help` is available.
`doc`	This is a shortcut to the Help window, where all the help that can be viewed in the Command window is available, plus more. The Help navigator can also be accessed via the Help tab at the top of the main MATLAB window.
`pwd`	Identifies the current directory, the one listed in the Current Folder window, and the default location for saving a script. (`pwd` stands for "print working directory".)
`ls`	Lists the contents of the current directory. Adding just part of a file name after `ls` (following a space) with an asterisk

Gilat, 2008.

Command window

- To type a command the cursor must be placed next to the command prompt (>>).

- Once a command is typed and the **Enter** key is pressed, the command is executed. However, only the last command is executed. Everything executed previously is unchanged.

- Several commands can be typed in the same line. This is done by typing a comma between the commands. When the **Enter** key is pressed the commands are executed in order from left to right.

- It is not possible to go back to a previous line in the Command Window, make a correction, and then re-execute the command.

- A previously typed command can be recalled to the command prompt with the up-arrow key (↑). When the command is displayed at the command prompt, it can be modified if needed and executed. The down-arrow key (↓) can be used to move down the previously typed commands.

- If a command is too long to fit in one line, it can be continued to the next line by typing three periods … (called an ellipsis) and pressing the **Enter** key. The continuation of the command is then typed in the new line. The command can continue line after line up to a total of 4096 characters.

Gilat, 2008.

Introduction to Matlab

The semicolon (;):

If a semicolon (;) is typed at the end of a command the output of the command is not displayed. Typing a semicolon is useful when the result is obvious or known, or when the output is very large.

Matlab as a calculator

Operation	Symbol	Example
Addition	+	$5 + 3$
Subtraction	−	$5 - 3$
Multiplication	*	$5 * 3$
Right division	/	$5 / 3$
Left division	\	$5 \backslash 3 = 3 / 5$
Exponentiation	^	$5 \wedge 3$ (means $5^3 = 125$)

Gilat, 2008.

Matlab as a calculator

>> 7+8/2
ans = 11

>> (7+8)/2
ans = 7.5000

Precedence	Mathematical Operation
First	Parentheses. For nested parentheses, the innermost are executed first.
Second	Exponentiation.
Third	Multiplication, division (equal precedence).
Fourth	Addition and subtraction.

Gilat, 2008.

Matlab functions

Function	Description	Example
sqrt(x)	Square root.	>> sqrt(81) ans = 9
nthroot(x,n)	Real nth root or a real number x. (If x is negative n must be an odd integer.)	>> nthroot(80,5) ans = 2.4022
exp(x)	Exponential (e^x).	>> exp(5) ans = 148.4132
abs(x)	Absolute value.	>> abs(-24) ans = 24
log(x)	Natural logarithm. Base e logarithm (ln).	>> log(1000) ans = 6.9078
log10(x)	Base 10 logarithm.	>> log10(1000) ans = 3.0000

Gilat, 2008.

Variables

Variable_name = A numerical value, or a computable expression

we can store and recall virtually an infinity of different values called *variables*.

>> a=2

>> nAlunos=20

>> x=2
>> y=4

>> x+y
>> x*y

Gilat, 2008.

Variables

1.6.2 Rules About Variable Names

A variable can be named according to the following rules:

- Must begin with a letter.

- Can be up to 63 (in MATLAB 7) characters long (31 characters in MATLAB 6.0).

- Can contain letters, digits, and the underscore character.

- Cannot contain punctuation characters (e.g. period, comma, semicolon).

- MATLAB is case sensitive; it distinguishes between uppercase and lowercase letters. For example, AA, Aa, aA, and aa are the names of four different variables.

- No spaces are allowed between characters (use the underscore where a space is desired).

- Avoid using the names of a built-in function for a variable (i.e. avoid using: cos, sin, exp, sqrt, etc.). Once a function name is used to define a variable, the function cannot be used.

Gilat, 2008.

Variables

- Don't use the same name as existing functions.

- Use capital letters carefully.

- Use meaningful variable names.

- Don't use variable names that are really long.

Gilat, 2008.

Variables

1.6.3 Predefined Variables and keywords

There are seventeen words, called keywords, that are reserved by MATLAB for various purposes, and cannot be used as variable names. These words are:

```
break     case    catch    continue    else    elseif    end
for     function    global    if    otherwise    persistent
return    switch    try    while
```

Gilat, 2008.