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اصفهان



دانشگاه علوم پزشکی
قزوین

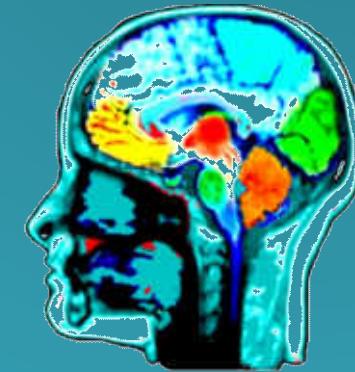


گروه تصویر پردازی و
آنالیز تصاویر مغزی
بیمارستان آمام خمینی
تهران



Workshop on Imaging and analysis of fMRI data

School of Advanced Technologies in Medicine
13th Esfand 1399 - 12th Khordad 1400
Isfahan, Iran



Software Introduction

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Amirkabir university of technology
hakim@aut.ac.ir

Content

Workshop-General Picture

AnyDesk

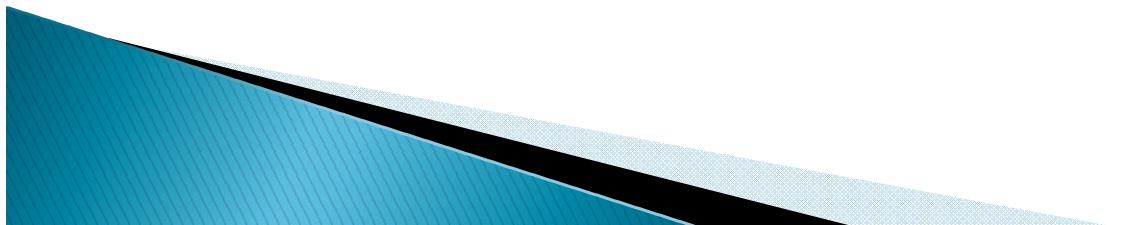
MATLAB

SPM

DPARSF

MRIcro

Dcm2nii



Workshop-General Picture



AnyDesk



The image shows the AnyDesk website's landing page for Windows. The background is orange with a globe graphic. At the top left is the AnyDesk logo (diamond icon and text). At the top right are navigation links: Solutions, Pricing, Downloads, and Resources. The main heading is "Get AnyDesk for Windows" in large white font. Below it is the subtext "No email, registration or installation required!". A green button labeled "Download Now" with a dropdown arrow is centered. Below the button, the file size "v6.2.2 (3.7 MB)" is shown. At the bottom, there is a row of icons for various operating systems: Windows, macOS, Android, iOS, Linux, FreeBSD, Raspberry Pi, and Chrome OS. A green button at the bottom left contains the URL "https://anydesk.com/en".

◆ AnyDesk

Solutions ▾ Pricing Downloads Resources ▾

Get AnyDesk for Windows

No email, registration or installation required!

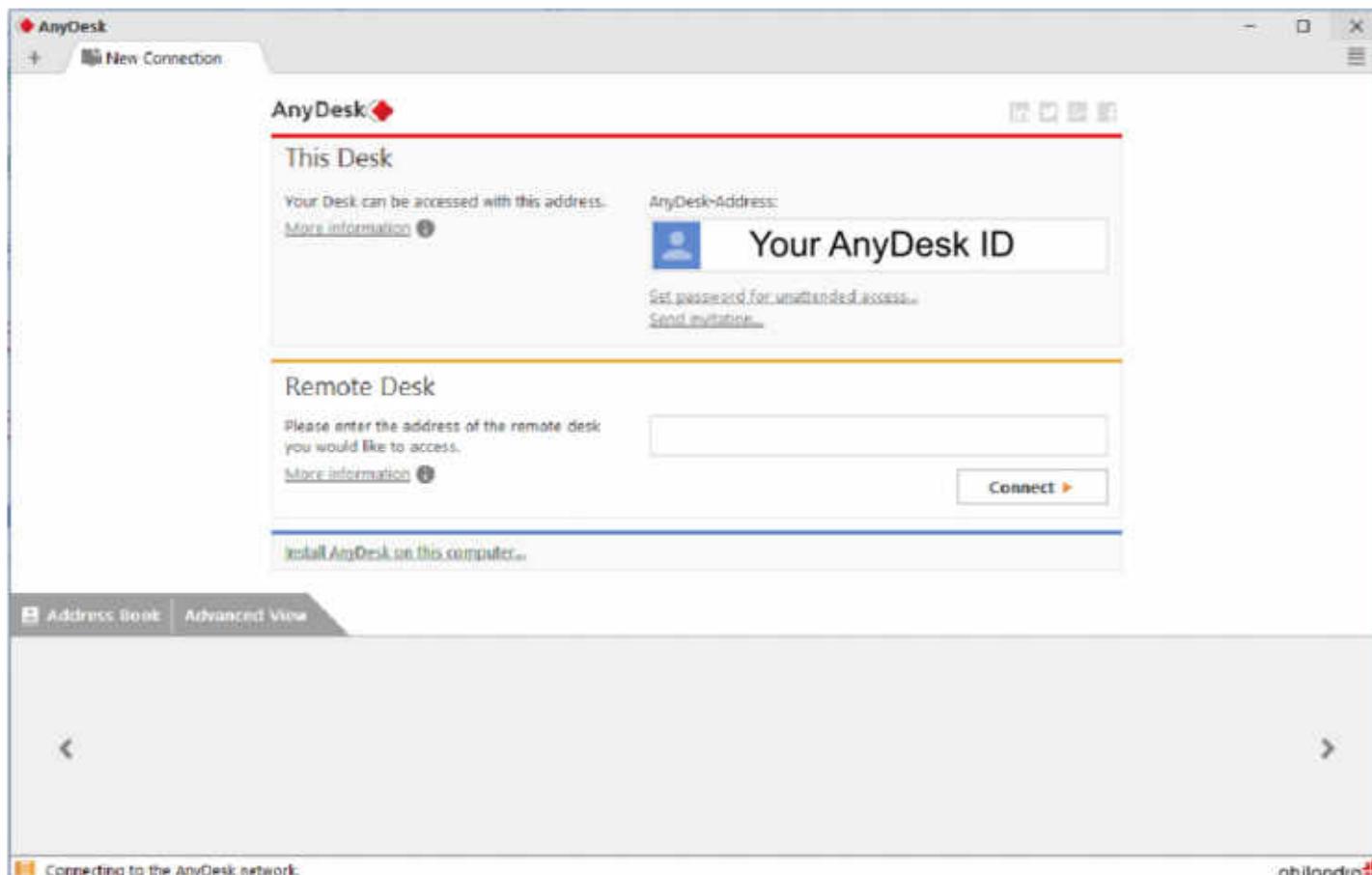
Download Now ▾

v6.2.2 (3.7 MB)

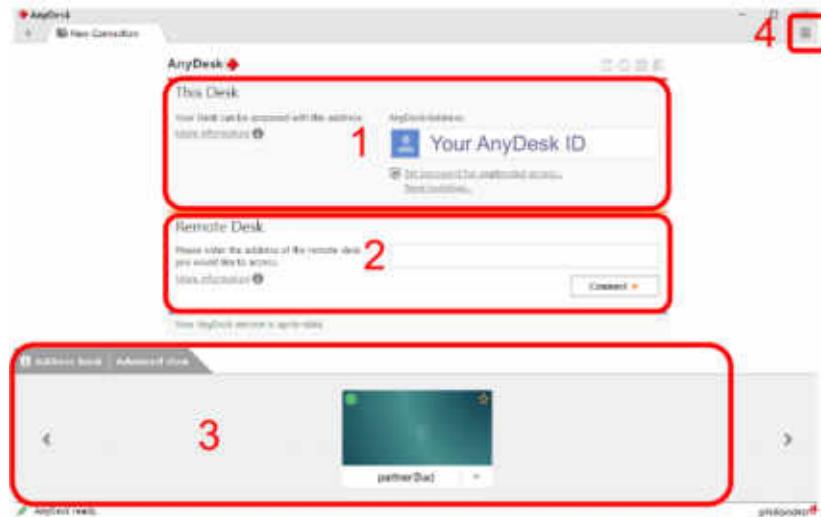
Windows macOS Android iOS Linux FreeBSD Raspberry Pi Chrome OS

<https://anydesk.com/en>

AnyDesk window



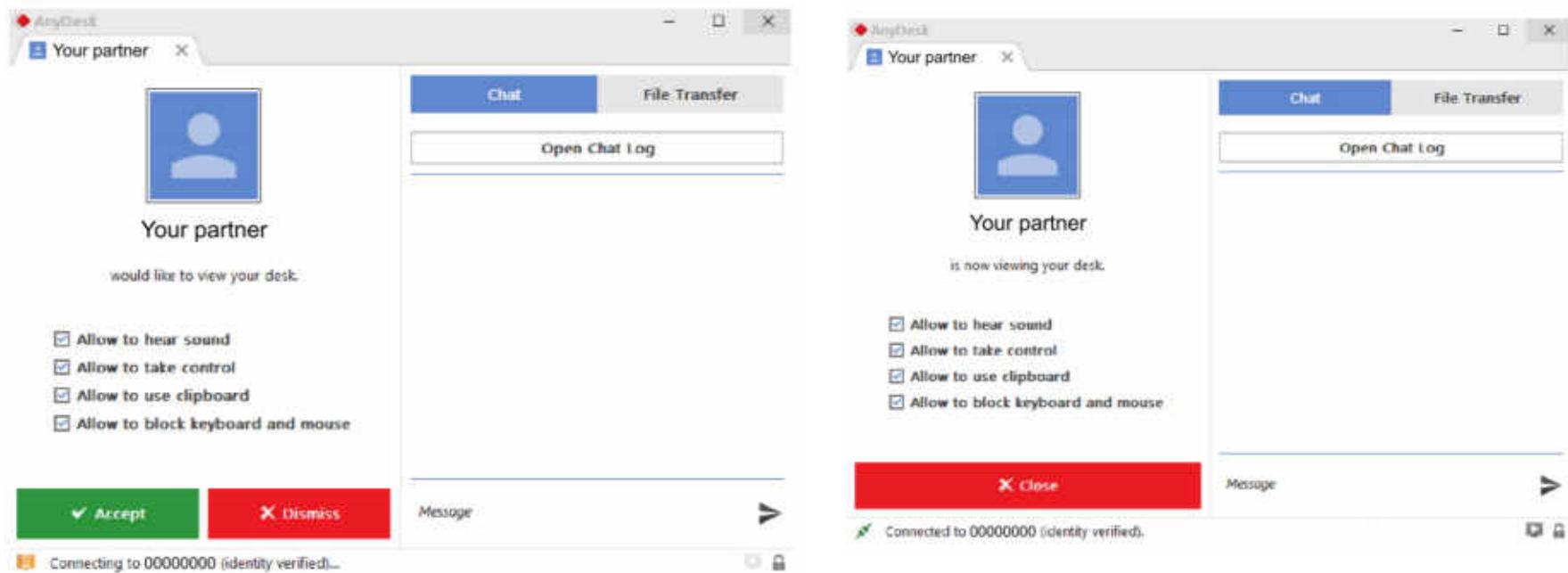
AnyDesk window



1	This Desk: This is where you will see your AnyDesk address that you use to connect to other computers. Under the menu option "Settings", you can choose to display your AnyDesk address as an alias or a number [23].
2	Remote Desk: This is where you establish a connection to another computer. Simply enter the AnyDesk address of the remote computer into the field and click on "Connect".
3	Quick dial: The quick dial allows you to quickly access your previous connections. Simply click on a connection to enter the information directly ² into the field and establish a connection [8].
4	Menu bar: You will only be able to access the "General" menu here at first, including the settings [18]. During an active session, additional menus will become available.

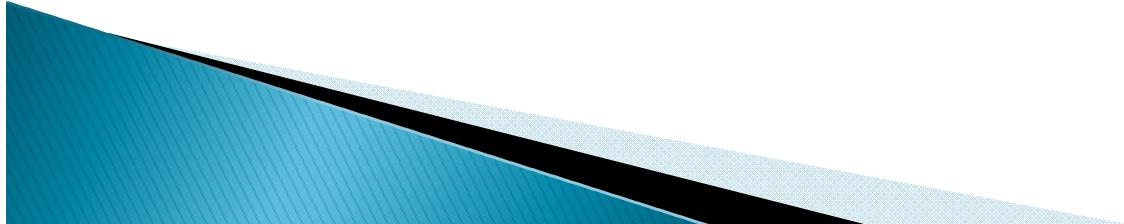
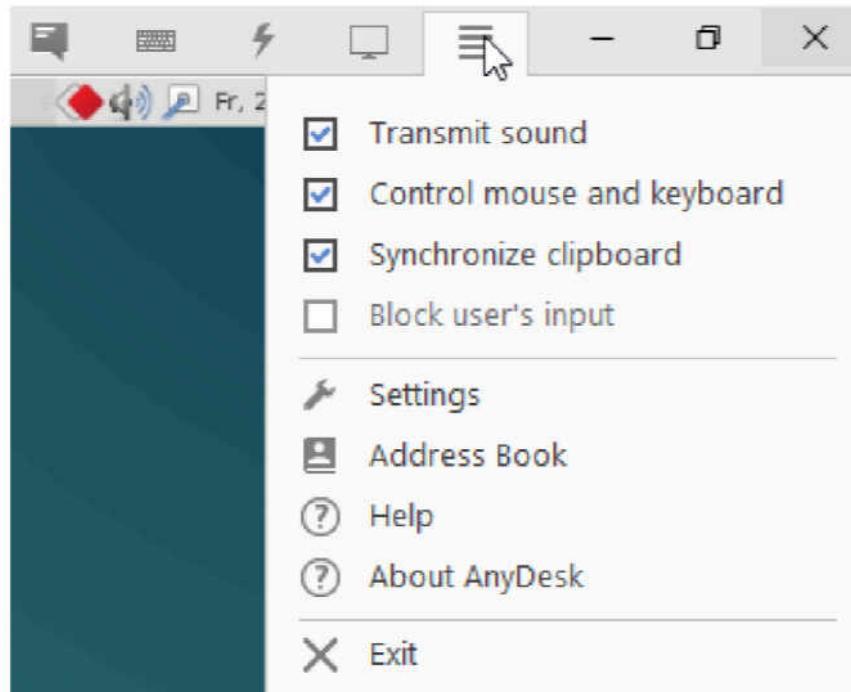
AnyDesk

Allowing access to your own desk



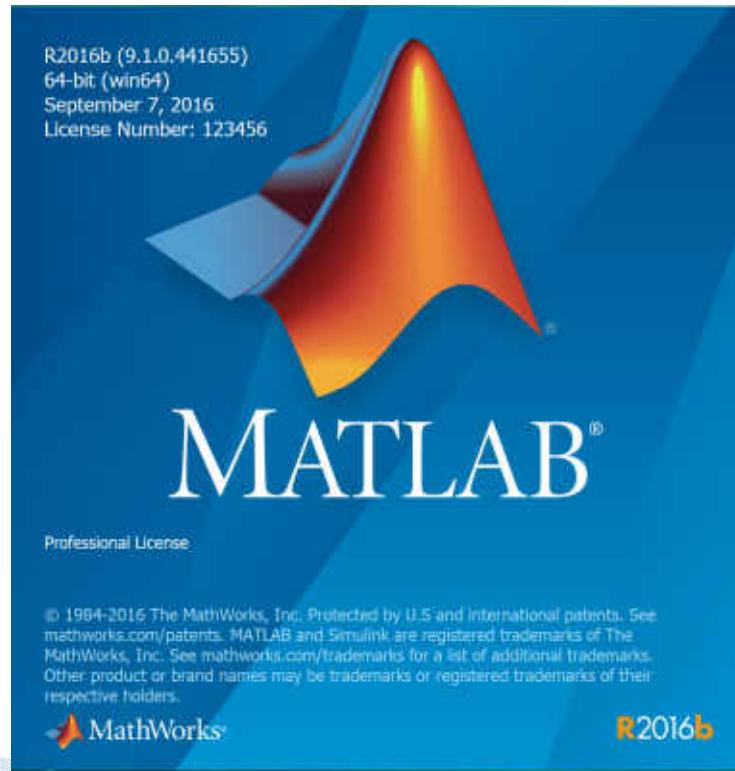
AnyDesk-Menu

"General" menu

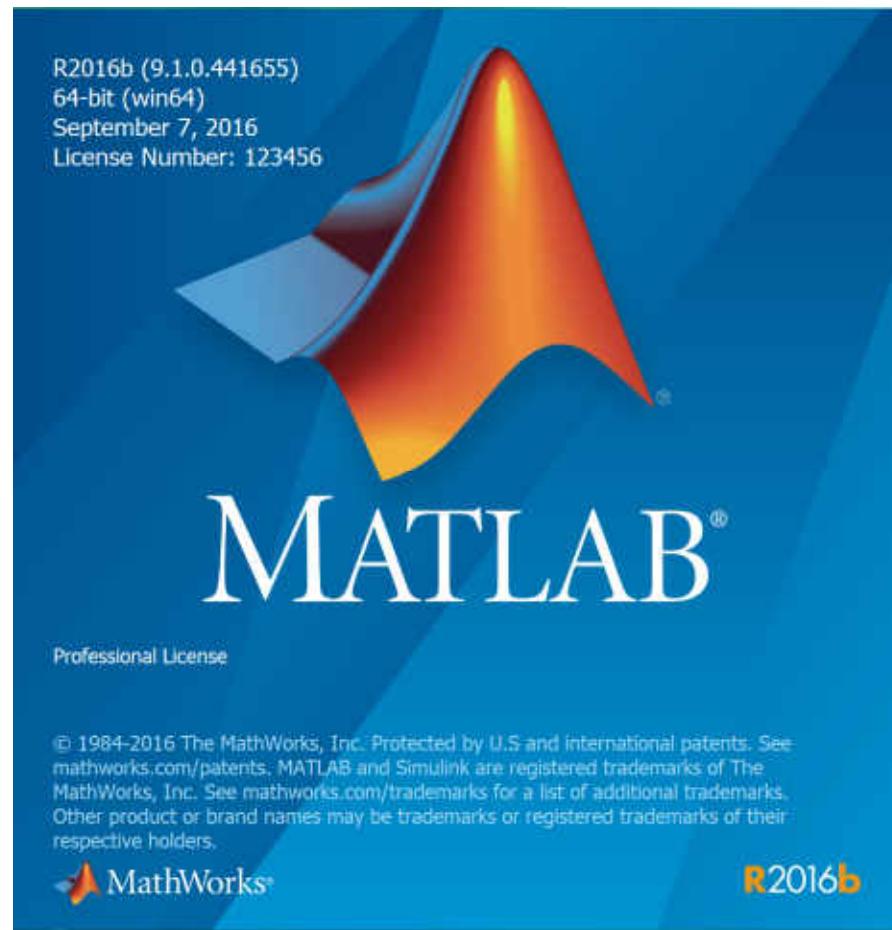


MATLAB

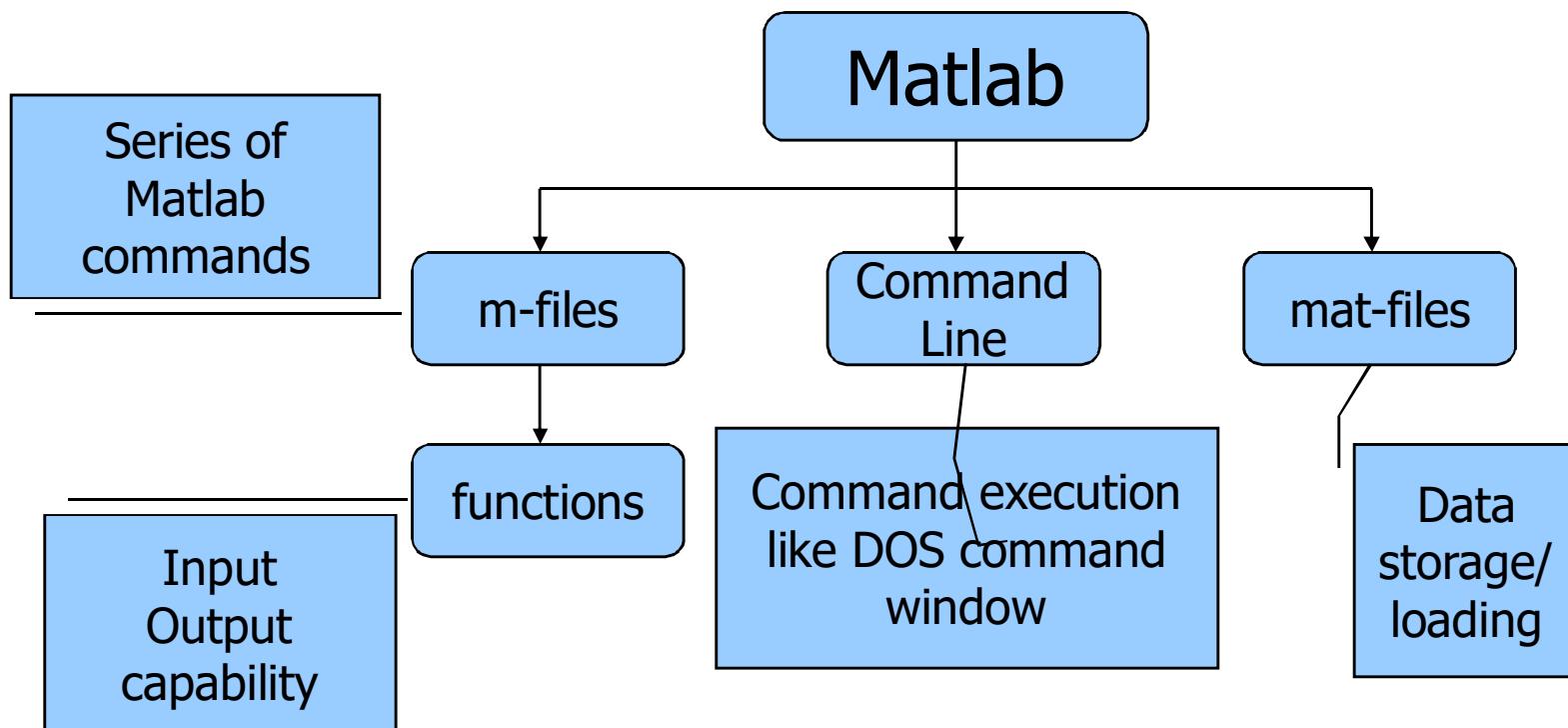
- ▶ Matlab = Matrix Laboratory
- ▶ Easy to learn
- ▶ Robust



MATLAB-setup

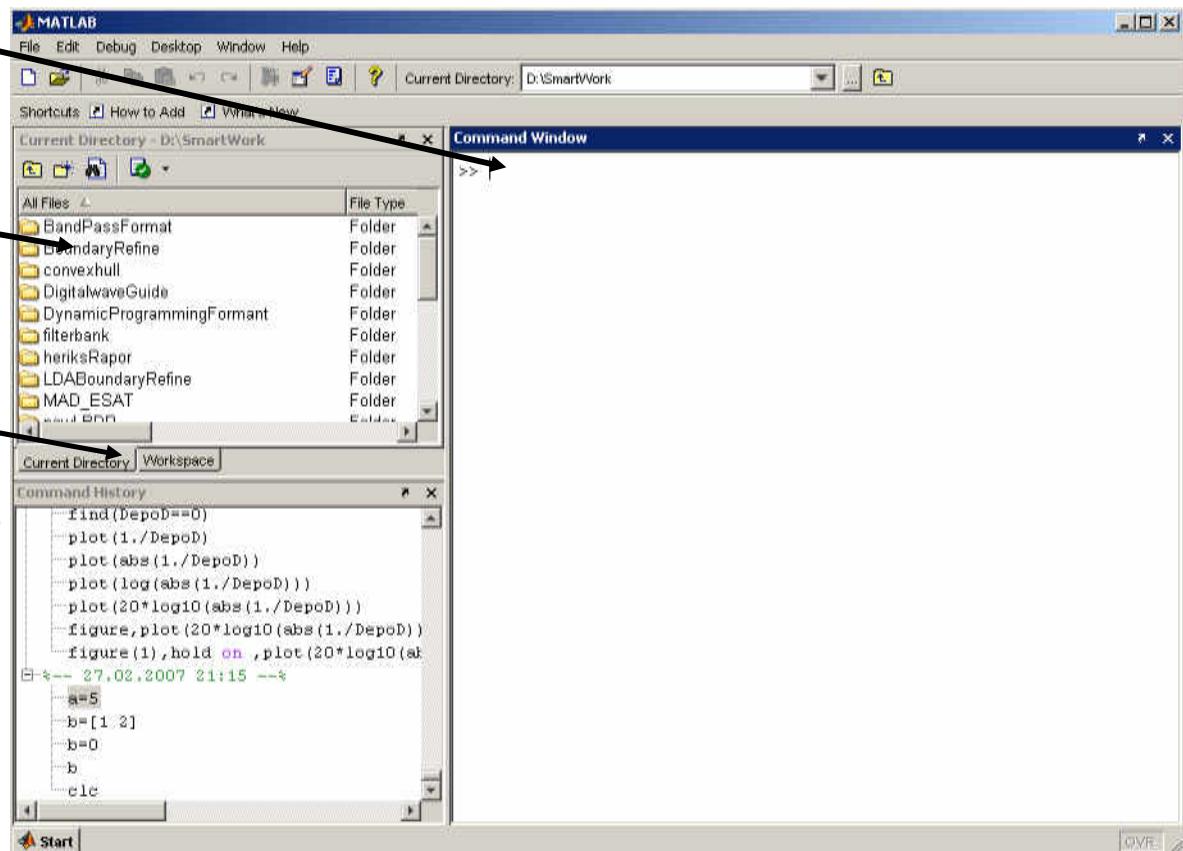


MATLAB-General Picture



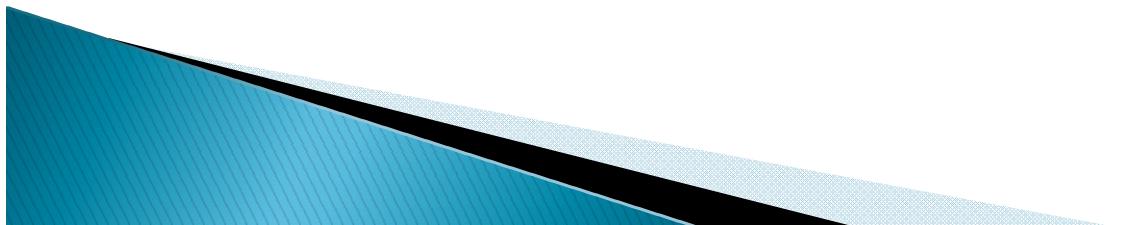
MATLAB-General Picture

- ▶ **Command Window**
 - type commands
- ▶ **Current Directory**
 - View folders and m-files
- ▶ **Workspace**
 - View program variables
 - Double click on a variable to see it in the Array Editor
- ▶ **Command History**
 - view past commands
 - save a whole session using diary



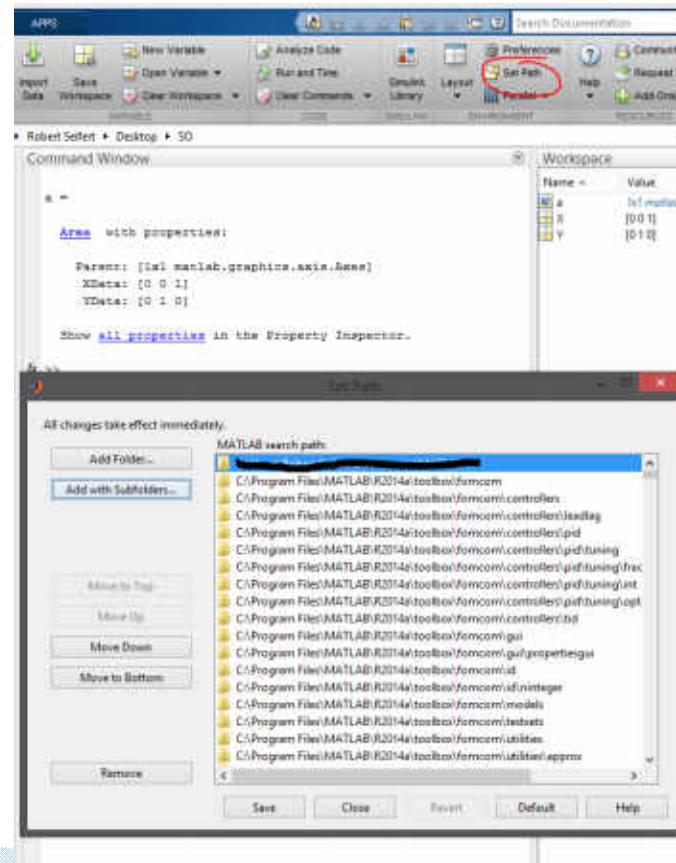
Exercise

- ▶ Get Matlab version
 - Run “version()” expression in command line
- ▶ Set current directory to desktop folder



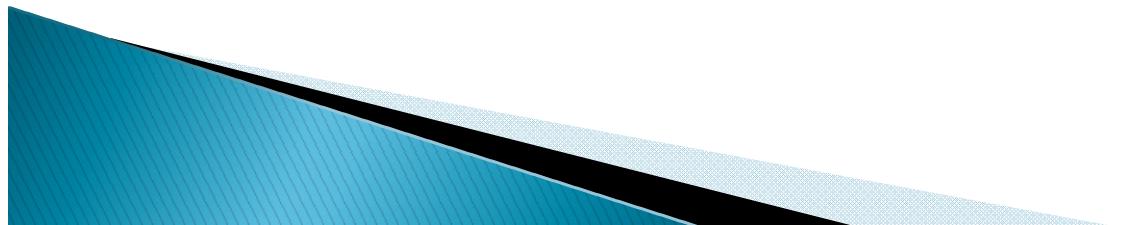
Matlab-use other tools

- ## ▶ matlab search path



Exercise

- ▶ Add path SPM toolbox to matlab path



SPM–Dataset

University College London

Statistical Parametric Mapping(test hypotheses about functional imaging data)

fMRI, PET, SPECT, EEG and MEG.

Requirements

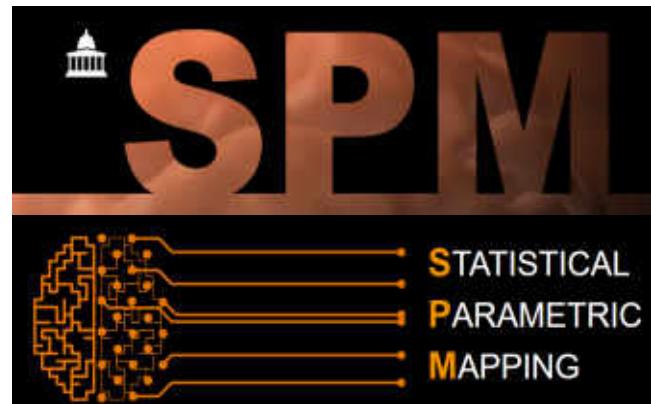
- MATLAB
- Support platforms(windows,Linux,MacOS)

Standalone version

From 1998(SPM99)–2020(SPM12)

<https://www.fil.ion.ucl.ac.uk/spm/>

Copy left!



Version	Release Date	Imaging	SPM8	SPM12	SPM15	SPM18	SPM12
3.0	R2000a - 2000						
3.1	R2018a - 2018						
3.2	R2019a - 2019						
3.3	R2019b - 2019						
3.4	R2019b - 2019						
3.5	R2017a - 2017						
3.6	R2017a - 2017						
3.7	R2018b - 2018						
3.8	R2019a - 2019						
3.9	R2019b - 2019						
4.0	R2019b - 2019						
4.1	R2019b - 2019						
4.2	R2019b - 2019						
4.3	R2019b - 2019						
4.4	R2019b - 2019						
4.5	R2019b - 2019						
4.6	R2019b - 2019						
4.7	R2019b - 2019						
4.8	R2019b - 2019						
4.9	R2019b - 2019						
5.0	R2019b - 2019						
5.1	R2019b - 2019						
5.2	R2019b - 2019						
5.3	R2019b - 2019						
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5.5	R2019b - 2019						
5.6	R2019b - 2019						
5.7	R2019b - 2019						
5.8	R2019b - 2019						
5.9	R2019b - 2019						
6.0	R2019b - 2019						
7.0	R2019b - 2019						
7.1	R2019b - 2019						
7.2	R2019b - 2019						
7.3	R2019b - 2019						
7.4	R2019b - 2019						
7.5	R2019b - 2019						
7.6	R2019b - 2019						
7.7	R2019b - 2019						
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7.96	R2019b - 2019						
7.97	R2019b - 2019						
7.98	R2019b - 2019						
7.99	R2019b - 2019						
7.100	R2019b - 2019						



SPM- Courses



Home Software Documentation Courses Email list Data sets Extensions

SPM Courses

London, May & October 2021

The FIL SPM course on using Statistical Parametric Mapping for neuroimaging is held each May and October as part of the Institute of Neurology's short course programme.

Since 2010, we provide two separate SPM courses reflecting the different imaging modalities. There is a three-day course on *SPM for EEG/MEG* followed by the long-established three-day course on *SPM for fMRI/VBM/PET*. Both courses are suitable for beginners and more advanced users. We advise students to gain at least some minimal familiarity with the methodology, for example, from reading introductory articles available from the SPM web page or by following data analysis examples in the SPM manual.

The next SPM course in London will take place in **May 2021** but the exact dates have not been finalised yet.

Externally organised SPM courses

Other SPM courses are organised around the world at different times of year and in different languages. If you do organise one, please [let us know](#) so that it can be listed here.

Training programs at the Martinos Center, Boston, Massachusetts, USA:
<http://www.martinos.org/training/courses>

TReNDS Center, Georgia State University, Atlanta, USA:

SPM–Dataset

The screenshot shows the homepage of the SPM-Dataset website. At the top left is the SPM logo, which includes a stylized brain icon and the text "STATISTICAL PARAMETRIC MAPPING". To the right is a large orange banner with the letters "SPM" in white. Below the banner is a navigation menu with links: Home, Software, Documentation, Courses, Email list, Data sets, and Extensions. The main content area features a section titled "Data sets and tutorials" with a sub-section "Introduction". A sidebar on the left contains links for Home, Software, Documentation, Courses, Email list, and Data sets. Under "Data sets", there are links for Introduction, fMRI: epoch, fMRI: event-related, fMRI: multi-subject, fMRI: DCM, and EEG: MMN.

SPM

Home Software Documentation Courses Email list Data sets Extensions

Data sets and tutorials

Introduction

The following data sets are being made available for training and personal education and evaluation purposes. Those wishing to use these data for other purposes, including illustrations or evaluations of methods, should contact the Methods group at the Wellcome Centre for Human Neuroimaging.

A set of instructions showing how SPM can be used to analyse each data set are also provided. These tutorials show how one can use SPM to implement analyses of PET data, epoch or event-related fMRI data, and data from a group of subjects using Random effects analyses ([RFX](#)). They also cover more advanced topics such as Psychophysiological Interactions ([PPIs](#)) and Dynamic Causal Modelling ([DCM](#)).

fMRI: epoch

The instructions accompanying these data sets show you how to implement a block-design fMRI analysis in SPM. They are both single-subject or 'first-level' analyses.

- Auditory - single subject
- Attention to Visual Motion - single subject

The instructions accompanying the Attention to Visual Motion data also show you how to use SPM to implement, for example, Psychophysiological Interactions ([PPIs](#)) and Dynamic Causal Modelling ([DCM](#)).

fMRI: event-related

SPM- Extensions

Quick Links

Toolboxes:

[AAL](#) | [AAL2](#) | [AAL3](#) | [ACID](#) | [AICHA](#) | [ALI](#) | [ALVIN](#) | [AMAT](#) | [AnalyzeMovie](#) | [Anatomy](#) | [AQuA](#) | [ArtRepair](#) | [aslM](#) | [ASLtbx](#) | [at4fmri](#) | [aws4SPM](#) | [BAAD](#) | [BFAST3D](#) | [BrainNetViewer](#) | [Brainnetome](#) | [BRANT](#) | [BredeQuery](#) | [Bruker2nifti](#) | [bspmview](#) | [CAT](#) | [CCAfMRI](#) | [CLASS](#) | [Clinical](#) | [Complexity](#) | [conn](#) | [ConnExT](#) | [CPCA](#) | [DAiSS](#) | [DICOMCD_Import](#) | [Diffusion_II](#) | [DPABI](#) | [DPARSF](#) | [DRIFTER](#) | [EEGAnalyzer](#) | [EMS](#) | [ExtractVals](#) | [FASL](#) | [FAST](#) | [fECM](#) | [FDR](#) | [FieldMap](#) | [fieldmap_undistort](#) | [FieldTrip](#) | [fMRIPower](#) | [fOSA](#) | [gPPI](#) | [GraphVar](#) | [GridCAT](#) | [Grocer](#) | [HV](#) | [hMRI](#) | [IBASPM](#) | [iBrainAT](#) | [iBrainLT](#) | [IBZM_tool](#) | [ICN_Atlas](#) | [ImaGIN](#) | [INRIAlign](#) | [ISAS](#) | [lead-dbs](#) | [lesion_gnb](#) | [LI](#) | [LogTransform](#) | [MACS](#) | [Mantis](#) | [MARINA](#) | [MARS](#) | [MarsBar](#) | [MASCOI](#) | [mfBox](#) | [Masking](#) | [Masks](#) | [MEAW](#) | [MIP-C](#) | [MM](#) | [MP2RAGE](#) | [multifocal](#) | [MRTOOL](#) | [MRM](#) | [NIRS-SPM](#) | [NPBayes](#) | [NS](#) | [OCT](#) | [PETPVE12](#) | [pTFCE](#) | [Ortho](#) | [ppi_batch_hipp](#) | [PSPM](#) | [QModeling](#) | [REST](#) | [rfxplot](#) | [RobustWLS](#) | [rsHRF](#) | [SAFe](#) | [SAMIT](#) | [SCRalyze](#) | [SDM](#) | [SGTT](#) | [SimpleROIBuilder](#) | [SnPM](#) | [SpikeDet](#) | [spm_wavelet](#) | [SPMd](#) | [SPMMouse](#) | [SSM](#) | [STEM](#) | [SUIT](#) | [SurfRend](#) | [SwE](#) | [TDT](#) | [PhysIO](#) | [TOM](#) | [TFCE](#) | [UF2C](#) | [Unwarp2](#) | [VarTbx](#) | [VDB](#) | [Volumes](#) | [WBM](#) | [WSPM](#) | [WFU_PickAtlas](#) | [xjView](#) | [XMLTools](#) | [ASLtbx](#) | [BENtbx](#) | [SVRLSMtbx](#) | [GIFT](#)

Utilities:

[AveLI](#) | [BrainMagix](#) | [Bruker2Analyze](#) | [CBMG-Tools](#) | [Design_Magic](#) | [dicom2nifti](#) | [DynPET](#) | [Easy_ROI](#) | [Easy_Volumes](#) | [FDRill](#) | [Fluctuation](#) | [fToolbelt](#) | [FAD](#) | [GA](#) | [GE2SPM](#) | [JG](#) | [L2S](#) | [log_roi_batch](#) | [LMGS](#) | [MatlabTFCE](#) | [Motion](#) | [mri_toolbox](#) | [MSU](#) | [Orth1](#) | [PCT](#) | [pvconv](#) | [r2agui](#) | [SEM](#) | [slice_overlay](#) | [TSDiffAna](#) | [TSU](#) | [iTT](#) | [VBMtools](#) | [VIS](#) | [visionToSPM](#) | [VoiTool](#)

Batch Utilities:

SPM– Methods



Preprocessing

- Slice Timing
- Realignment
- Unwarp
- Coregistration
- Normalisation
- Segmentation
- Spatial smoothing

Modelling

- Haemodynamic Response Function
- Basis functions
- General Linear Model
- Correlation and Regression
- Linear Hierarchical Models
- Covariance
- Autocorrelation
- Non-sphericity
- Session concatenation
- Group analysis

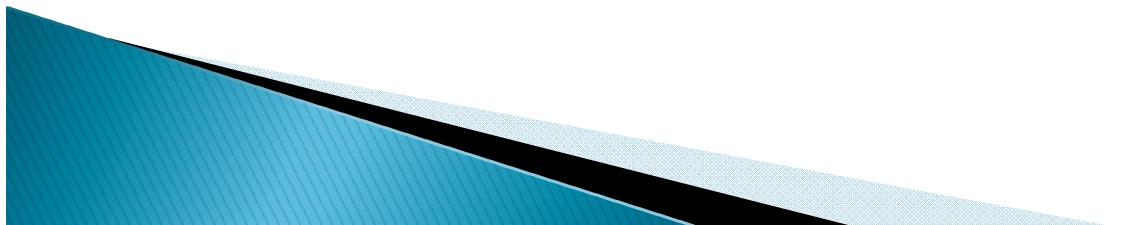
Statistical Inference

- F and T tests
- Contrasts
- Inference
- Conjunction
- Power Analysis
- About Correlation
- Bayesian Inference
- Results Table
- Information to include in papers ↗
- Calculating Percentage signal change
- Comparing a single patient versus a group of controls
- Timeseries extraction

SPM-Tools

Other tools

- [Cogent](#) a MATLAB-based stimulus presentation software
- [MRIcron](#) and [MRIcroGL](#) medical images viewers
- [MarsBaR](#) region of interest toolbox for SPM
- [SnPM](#) Statistical nonParametric Mapping
- [Anatomy](#) SPM Anatomy toolbox
- [AAL](#) Anatomical Automatic Labeling
- [WFU_PickAtlas](#) a region of interest toolbox for SPM based on the [Talairach Daemon Database](#)
- [Physiological noise correction](#)
- [Diffusion tools](#)



SPM



<https://www.fil.ion.ucl.ac.uk/spm/software/download/>

- ▶ website

Download SPM

Please complete the following form to download a copy of the SPM software.

The requested SPM version is the only mandatory entry.

If you need further assistance with the installation of SPM, send an email to the [SPM manager](#) after having read the [installation documentation](#).

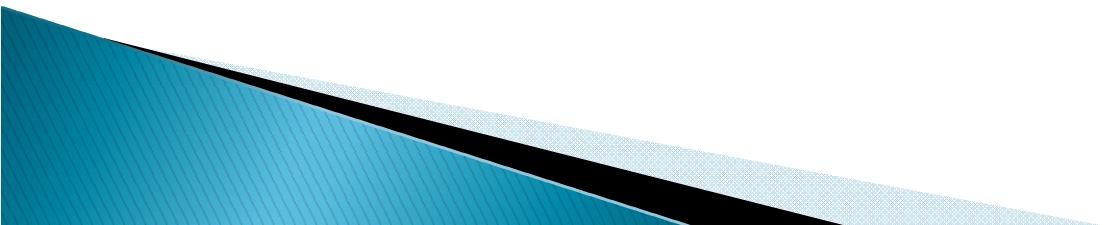
1 SPM Version

Select SPM version required:

Select

2 Additional Info

It is helpful for us in developing and positioning SPM to know more about how you plan to use our software. All entries are optional.



Exercise

▶ Run SPM in matlab

SPM12 [edit]

Installation [edit]

- Download [spm12.zip](#).
- Unzip spm12.zip in a folder of your choice, such as C:\Users\login\Documents\MATLAB\spm12).
- Start MATLAB and add SPM into your path, either using *File > Set Path > Add Folder...* or typing

```
>> addpath C:\Users\Login\Documents\MATLAB\spm12
```

in MATLAB's workspace.

- Launch SPM by typing

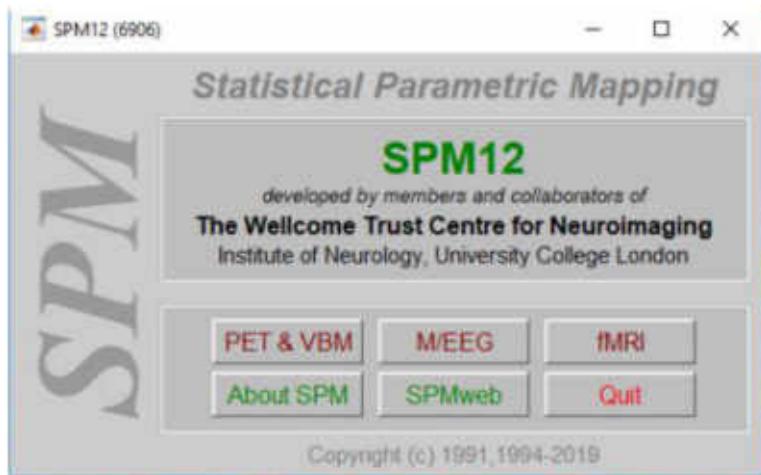
```
>> spm
```

You might have to install the VC++ 2005 and 2008 Redistributable Packages (*vcredist_x86.exe*) from Microsoft:

- <http://support.microsoft.com/kb/2019667>

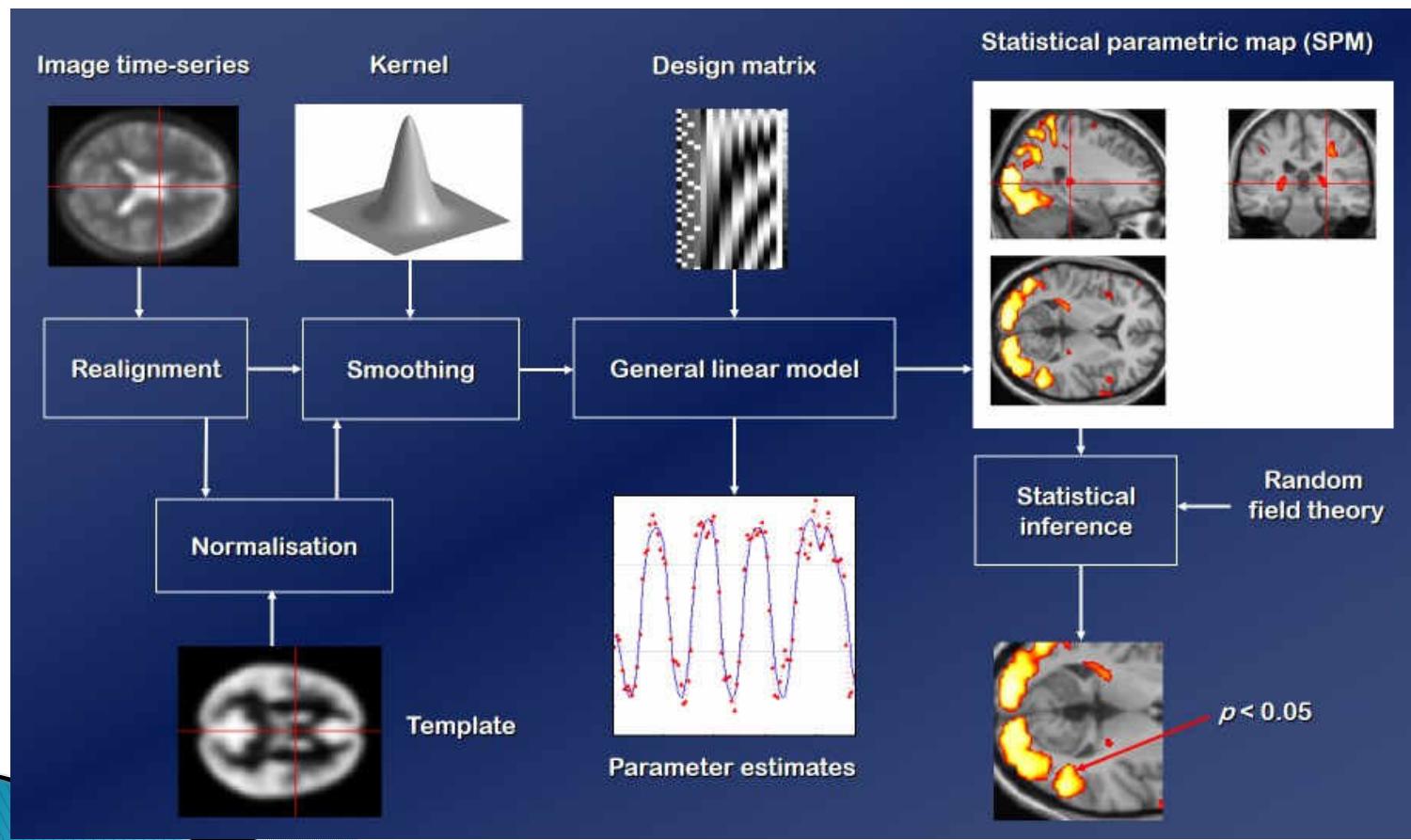
SPM

▶ Window



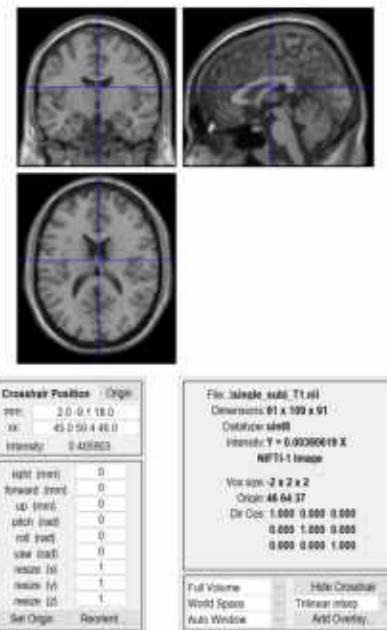
SPM-Task fMRI

▶ Window

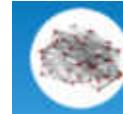


Exercise

- ▶ Display MRI data in SPM
- ▶ Click Display
- ▶ go to spm folder
- ▶ Open the “\spm12\canonical\ single_subj_T1.nii”



DPARSF



The R-fMRI Network

a network for supporting resting-state fMRI related studies.

<http://rfmri.org/DPARSF>

2010–2020

Data Processing Assistant for Resting-State fMRI (DPARSF)

- Preprocessing data (slice timing, realign, normalize, smooth)
- Connectivity analysis(FC, ReHo, ALFF and fALFF)
- Post processing

Requirements

- MATLAB
- SPM

frontiers in
SYSTEMS NEUROSCIENCE

METHODS ARTICLE
published: 14 May 2010
doi: 10.3389/fnsys.2010.00013

DPARSF: a MATLAB toolbox for “pipeline” data analysis of resting-state fMRI

Yan Chao-Gan* and Zang Yu-Feng*

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Edited by:
Luciana Q. Uddin, Stanford University, USA

Reviewed by:
Martin Walter, Otto-von-Guericke-Universität Magdeburg, Germany
Sakarath Rival, Stanford University, USA

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e-mail: zangy@bnu.edu.cn

Resting-state functional magnetic resonance imaging (fMRI) has attracted more and more attention because of its effectiveness, simplicity and non-invasiveness in exploration of the intrinsic functional architecture of the human brain. However, user-friendly toolbox for “pipeline” data analysis of resting-state fMRI is still lacking. Based on some functions in Statistical Parametric Mapping (SPM) and Resting-State fMRI Data Analysis Toolkit (REST), we have developed a MATLAB toolbox called Data Processing Assistant for Resting-State fMRI (DPARSF) for “pipeline” data analysis of resting-state fMRI. After the user arranges the Digital Imaging and Communications in Medicine (DICOM) files and click a few buttons to set parameters, DPARSF will then give all the preprocessed (slice timing, realign, normalize, smooth) data and results for functional connectivity, regional homogeneity, amplitude of low-frequency fluctuation (ALFF), and fractional ALFF. DPARSF can also create a report for excluding subjects with excessive head motion and generate a set of pictures for easily checking the effect of normalization. In addition, users can also use DPARSF to extract time courses from regions of interest.

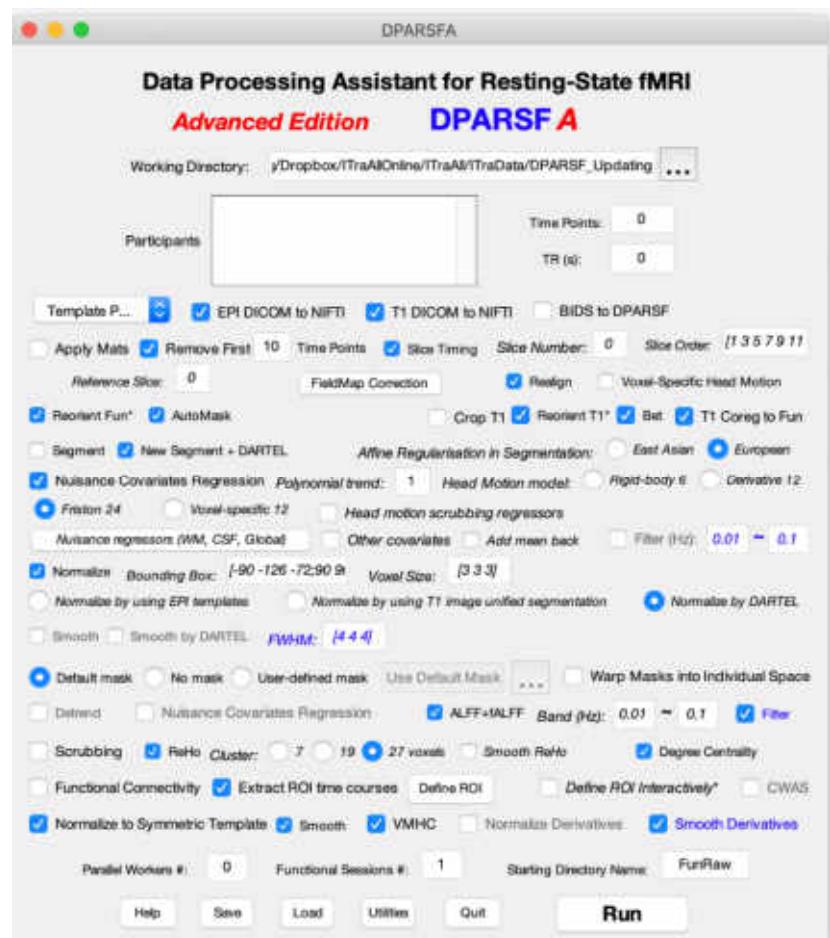
Keywords: data analysis, DPARSE REST, resting-state fMRI, SPM

DPARSF

- ▶ Download link

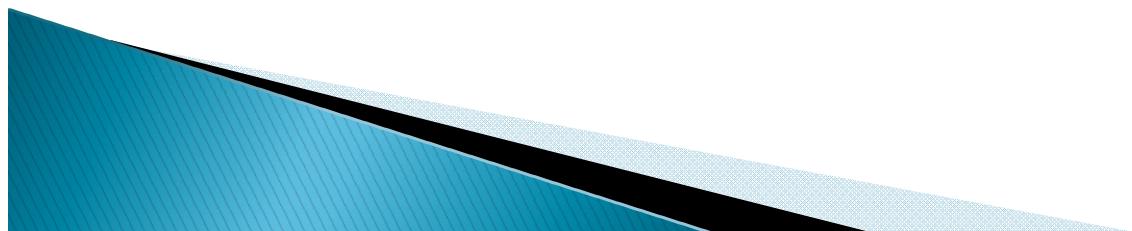
<http://rfmri.org/DPARSF>

- ▶ GUI



Exercise

- ▶ Run Dparsf





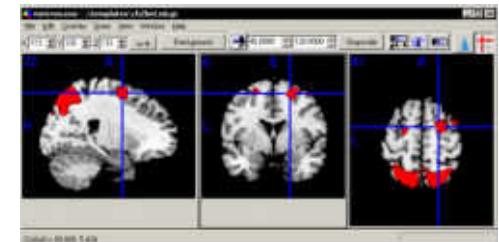
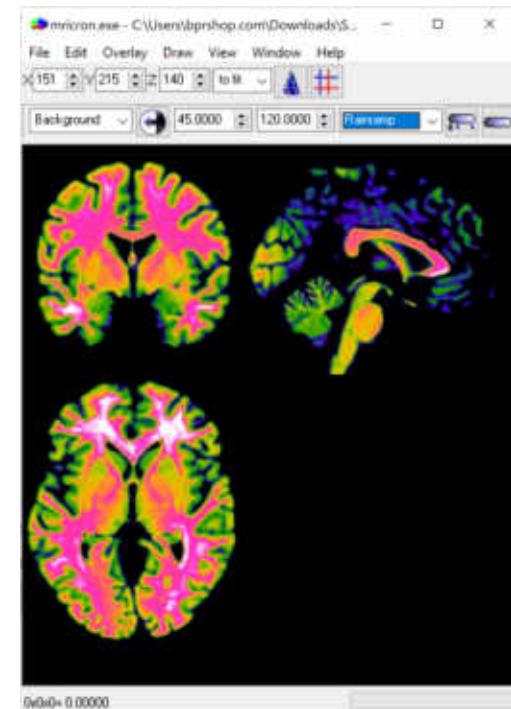
<https://people.cas.sc.edu/rorden/mricron/install.html>

load multiple layers of images

draw volumes of interest.

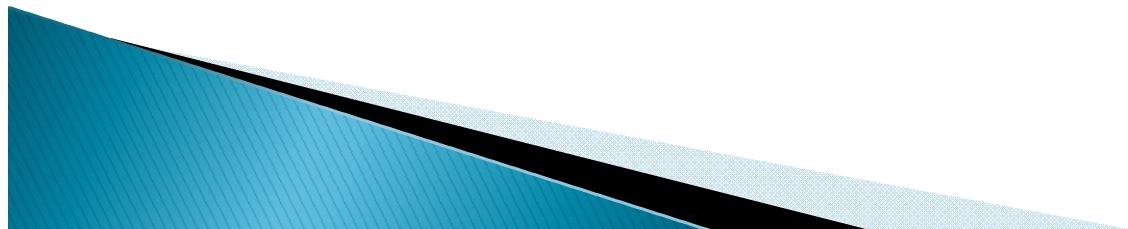
New MRICronGL

• <https://www.mccauslandcenter.sc.edu/mricrogl/home>



Exercise

- ▶ Show the MRI data





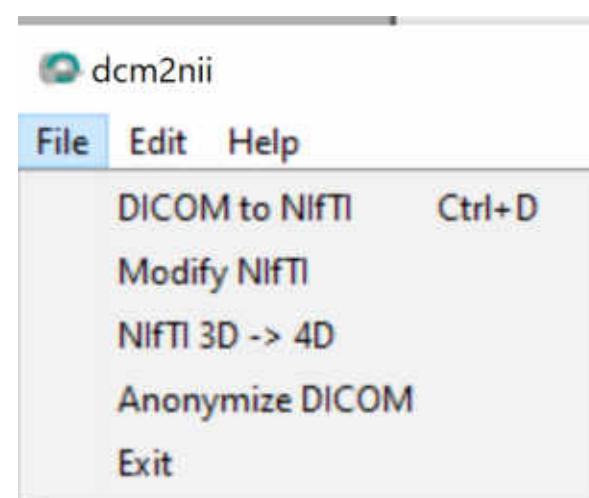
people.cas.sc.edu/rorden/mricron/dcm2nii.html

convert to the NIfTI format.

- NIfTI : Neuroimaging Informatics Technology Initiative
 - (a pair of files (hdr/img, compliant with most Analyze format viewers), or a single file (nii))

(Batch+gui)

Modify NIfTI

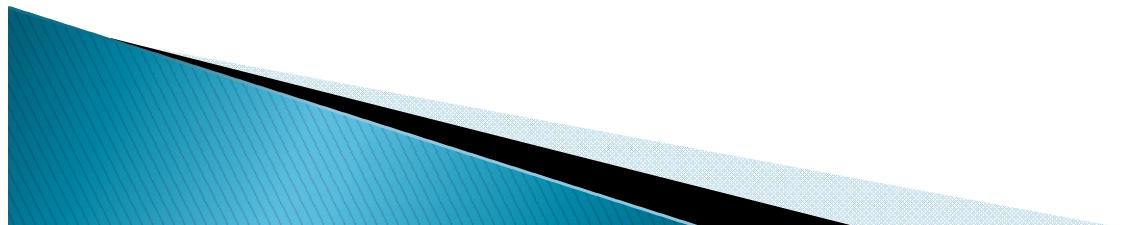


Exercise

- ▶ Download data

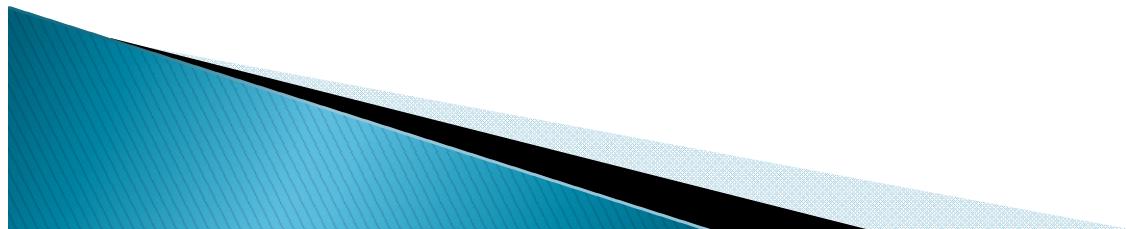
https://wiki.idoimaging.com/index.php?title=Sample_Data

- ▶ Convert dcm file to nii



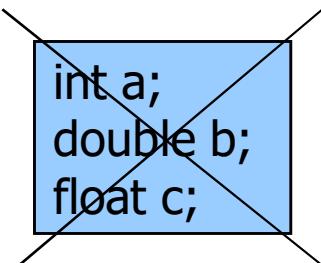
Matlab Extra

»»



Matlab- Variables

- ▶ No need for types. i.e.,



- ▶ All variables are created with double precision unless specified and they are matrices.

Example:
 >>x=5;
 >>x1=2;

- ▶ After these statements, the variables are 1x1 matrices with double precision

Matlab- Array, Matrix

- ▶ A vector $x = [1 \ 2 \ 5 \ 1]$

```
x =  
     1    2    5    1
```

- ▶ Transpose $y = x'$ $y =$

```
1  
2  
5  
1
```

- ▶ A matrix : Rows are separated by semicolon

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

```
x =  
     1    2    3  
     5    1    4  
     3    2   -1
```

Matlab–Long Array, Matrix

► `t = 1:10`

`t =`

1 2 3 4 5 6 7 8 9 10

► `k = 2:-0.5:-1`

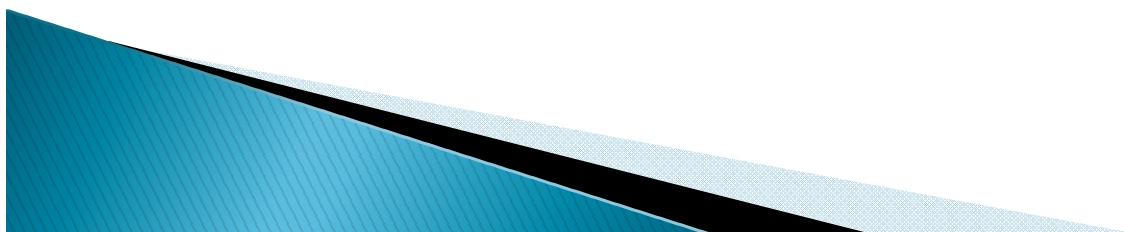
`k =`

2 1.5 1 0.5 0 -0.5 -1

► `B = [1:4; 5:8]`

`x =`

1	2	3	4
5	6	7	8



Matlab-Generating Vectors from functions

- ▶ `zeros(M,N)` MxN matrix of zeros

```
x = zeros(1, 3)
```

```
x =
```

```
0 0 0
```

-
- ▶ `ones(M,N)` MxN matrix of ones

```
x = ones(1, 3)
```

```
x =
```

```
1 1 1
```

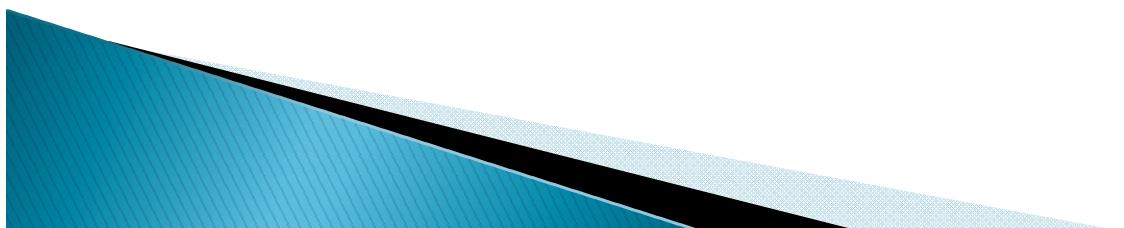
-
- ▶ `rand(M,N)` MxN matrix of uniformly distributed random numbers on (0,1)

```
x = rand(1, 3)
```

```
x =
```

```
0.9501 0.2311
```

```
0.6068
```



Matlab- Matrix Index

- ▶ The matrix indices begin from 1 (not 0 as in C)
- ▶ The matrix indices must be positive integer

Given:

```
A =
```

3	5	3
6	8	2
2	7	3

```
>> A(6)
```

```
ans =
```

```
7
```

```
>> A(3,2)
```

```
ans =
```

```
7
```

A(-2), A(0)

Error: ??? Subscript indices must either be real positive integers or logicals.

A(4,2)

Error: ??? Index exceeds matrix dimensions.

Exercise

- ▶ Create A matrix

```
A =  
3 5 3  
6 8 2  
2 7 3
```

- ▶ Print the element in row 3 and column 2 $\gg A(3, 2)$

```
ans =
```

- ▶ Print all elements in row 2 $\gg A(2, :)$

```
7
```

```
ans =
```

```
6 8 2
```

- ▶ Print first and second elements in column 2 $\gg A(1:2, 2)$

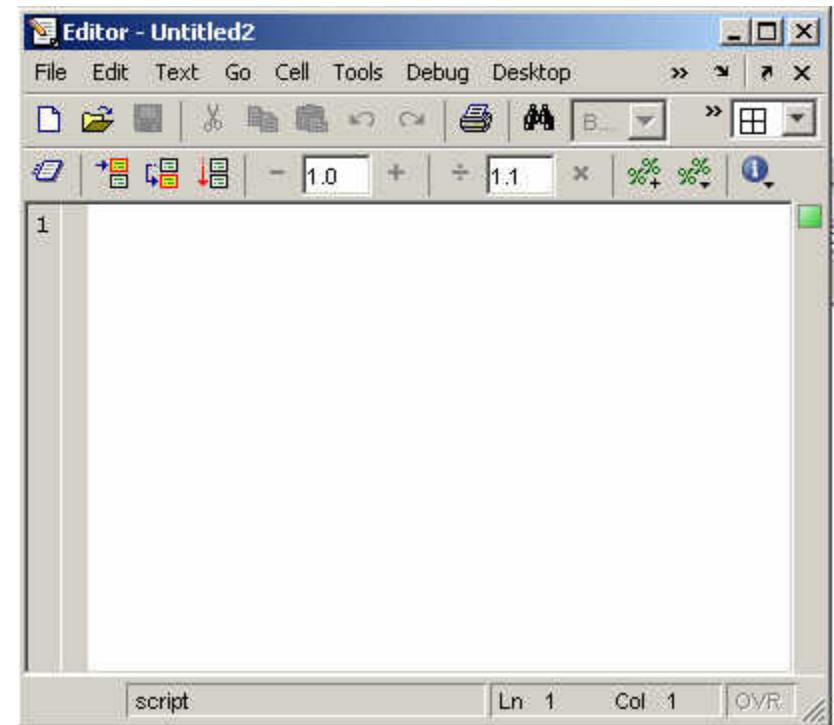
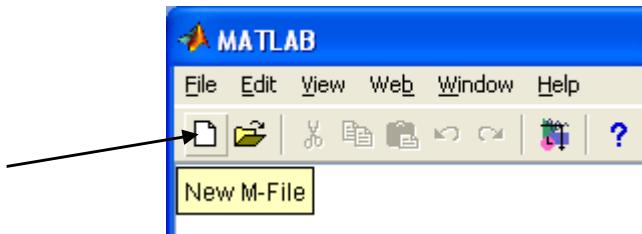
```
ans =
```

```
5  
8
```

Print the element in row 3 and column 2

Use of M-File

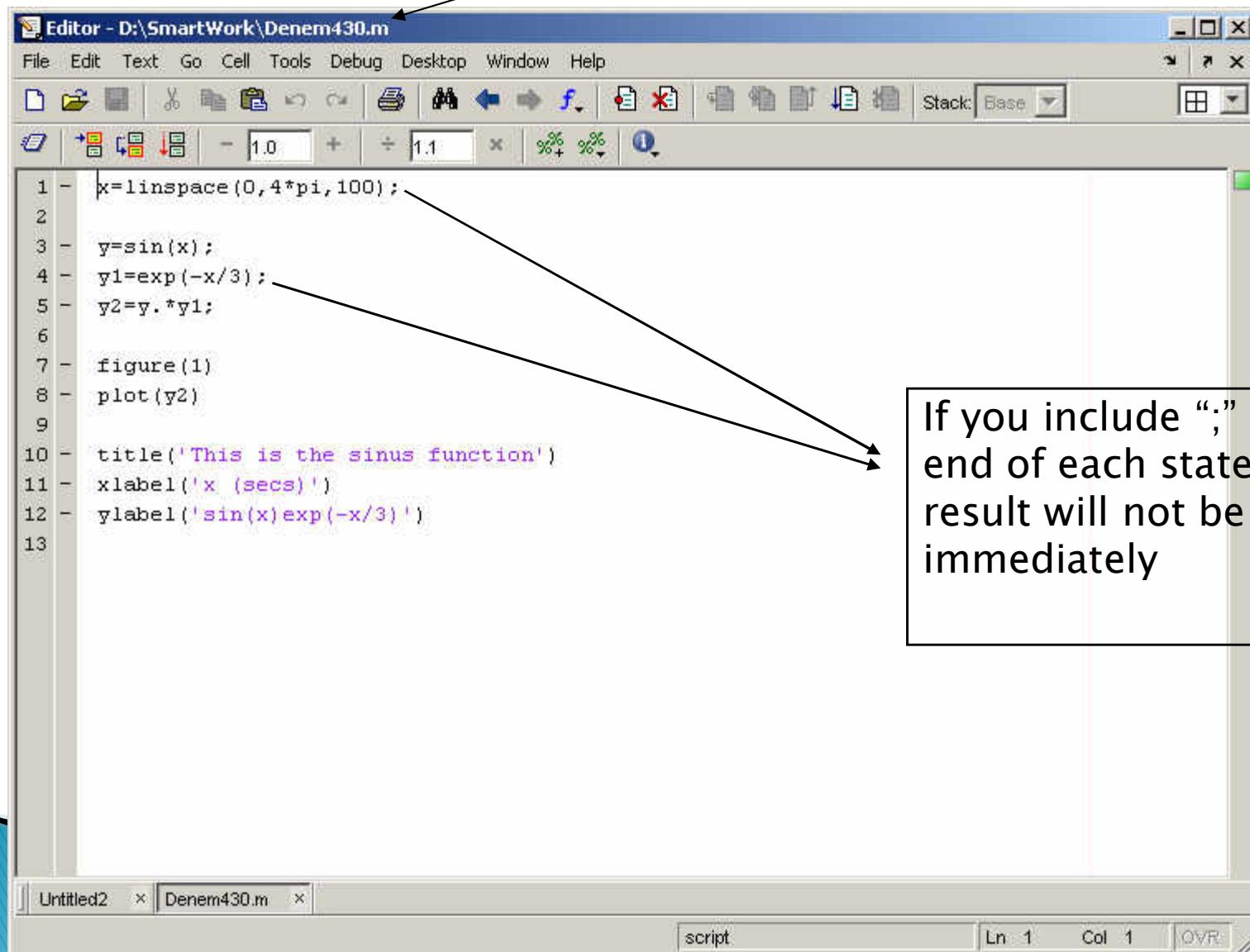
Click to
create a new
M-File



- Extension “.m”
- A text file containing script or function or program to run

Use of M-File

Save file as *Denem430.m*



```
Editor - D:\SmartWork\Denem430.m
File Edit Text Go Cell Tools Debug Desktop Window Help
Stack: Base
1 - x=linspace(0,4*pi,100);
2
3 - y=sin(x);
4 - y1=exp(-x/3);
5 - y2=y.*y1;
6
7 - figure(1)
8 - plot(y2)
9
10 - title('This is the sinus function')
11 - xlabel('x (secs)')
12 - ylabel('sin(x)exp(-x/3)')
13
```

If you include ";" at the end of each statement, result will not be shown immediately

Exercise

- ▶ Create M file(test.m) plot line

```
a= (1:100);  
plot(a);
```

- ▶ Run test.m from command line



دانشگاه علوم پزشکی
اصفهان



دانشگاه علوم پزشکی
قزوین

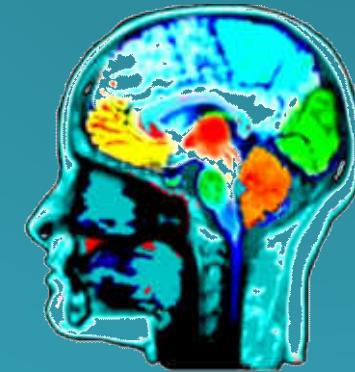


گروه تصویر پردازی و
آنالیز تصاویر مغزی
بیمارستان آمام خمینی
تهران



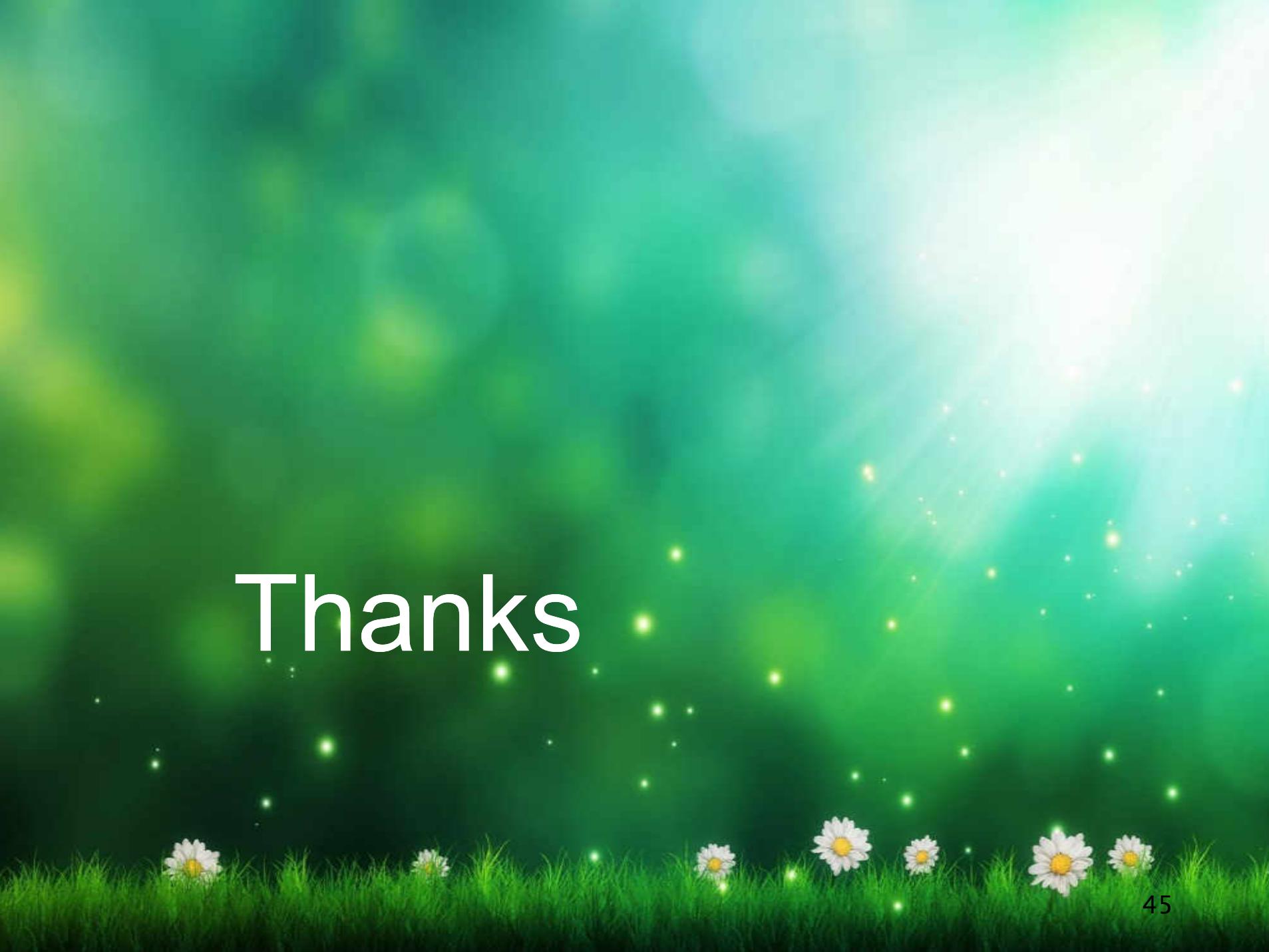
Workshop on Imaging and analysis of fMRI data

School of Advanced Technologies in Medicine
13th Esfand 1399 - 12th Khordad 1400
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Software Introduction

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Thanks