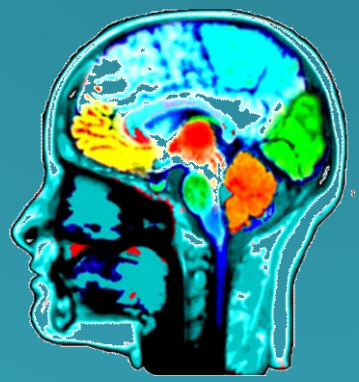
دانشگاه علوم پزشکی
اصفهان

دانشگاه علوم پزشکی
تهران

گروه تصویر برداری و
آنالیز تصاویر مغزی
بیمارستان امام 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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Content

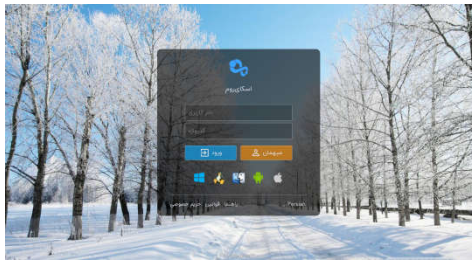
- Workshop-General Picture
- AnyDesk
- MATLAB
- SPM
- DPARSF
- MRIcro
- Dcm2nii

Workshop-General Picture

coordinator

Isfahan fMRI Workshop

Skyroom



recording

Troubleshooting

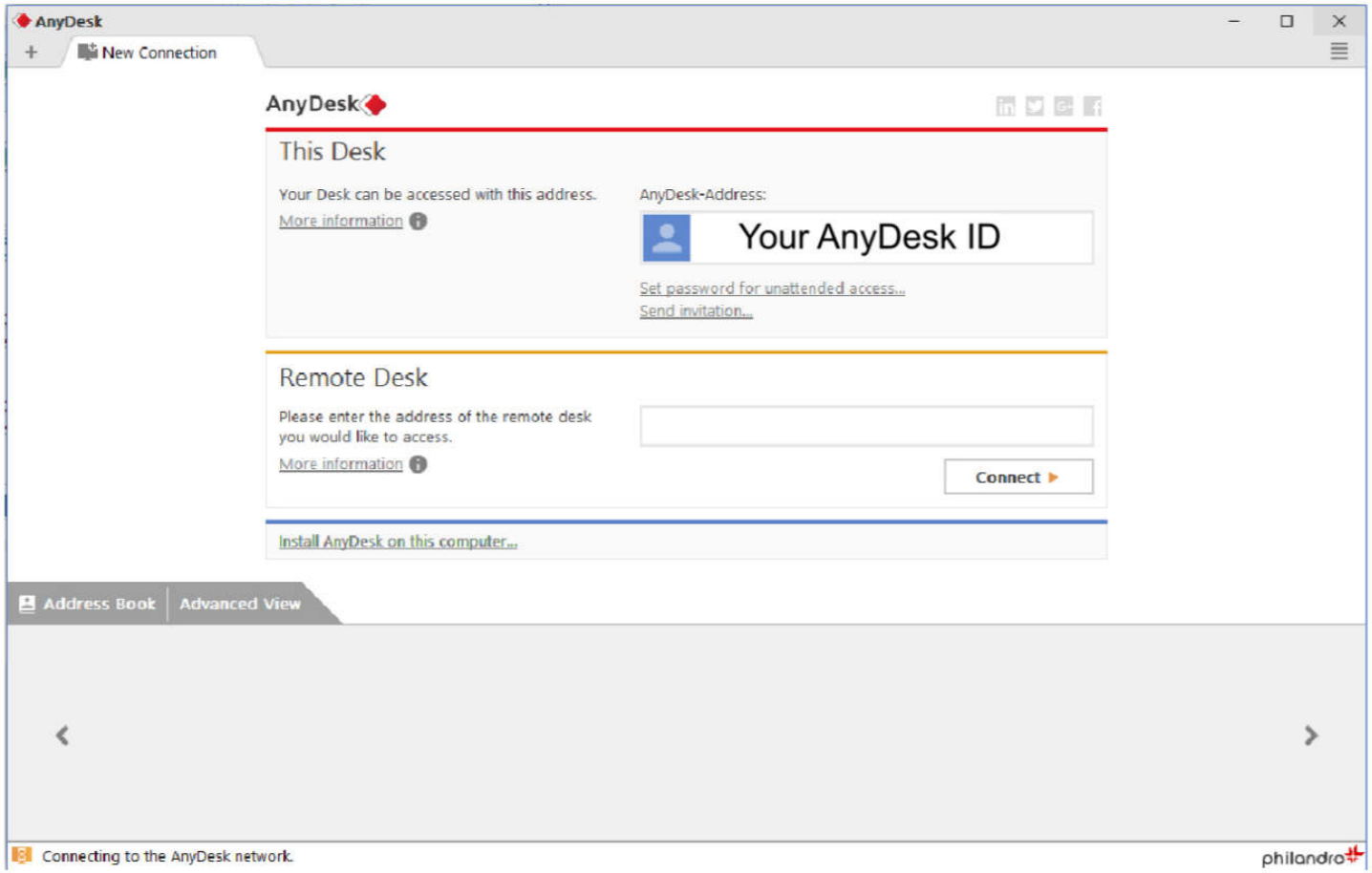
File sharing

Google Drive
Website

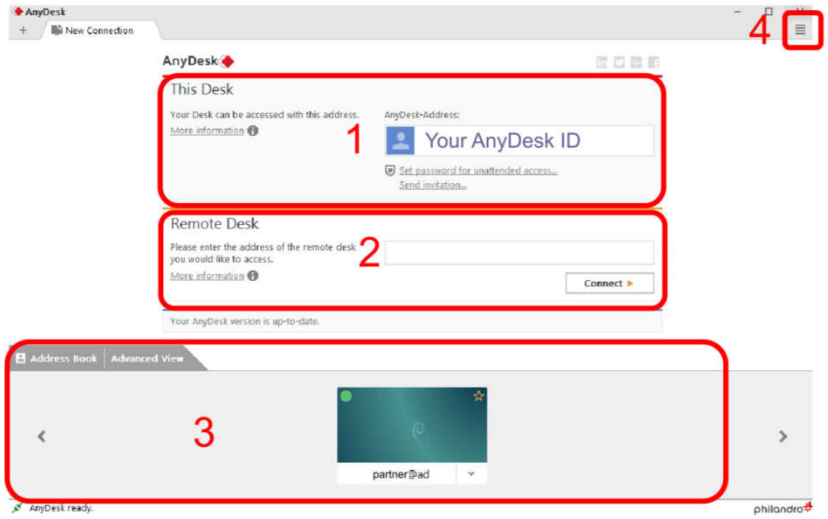
AnyDesk

https://anydesk.com/en

AnyDesk window

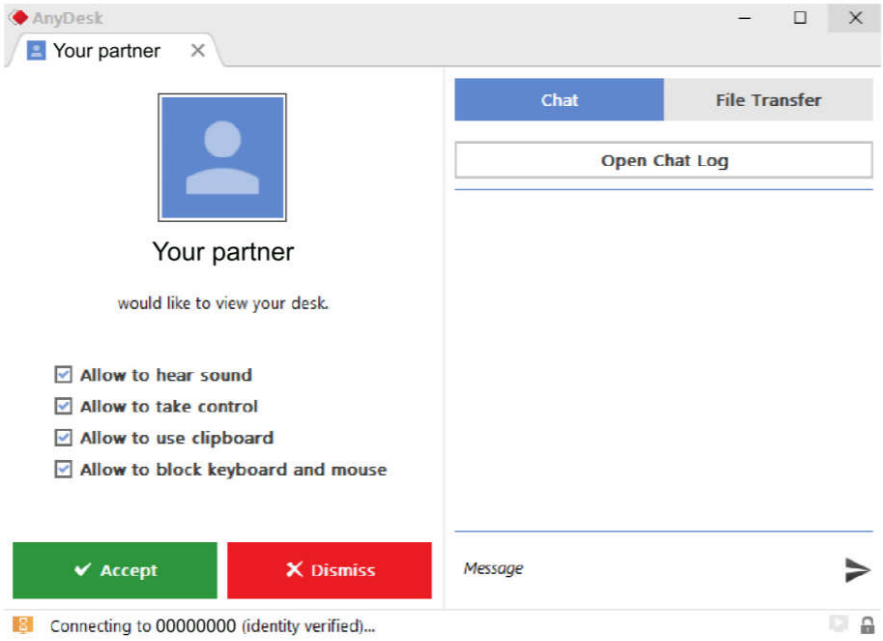


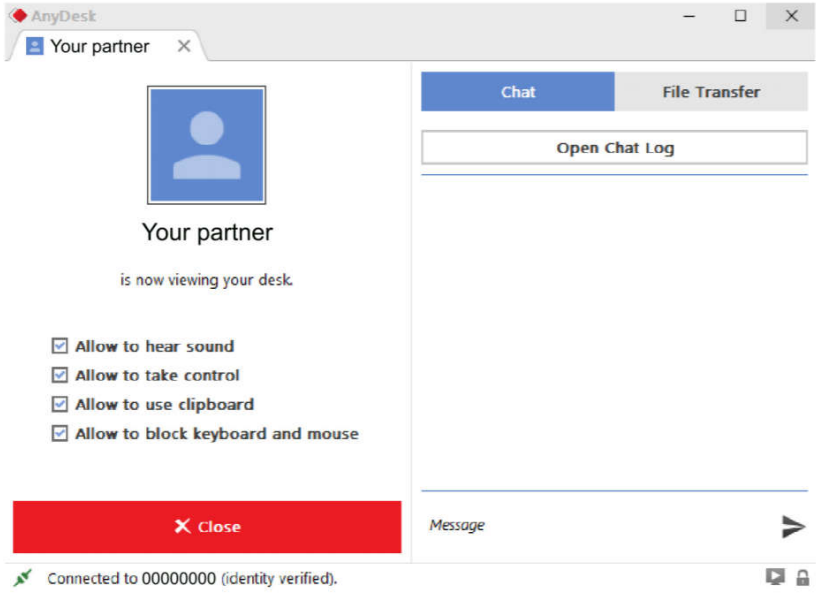
AnyDesk window



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.

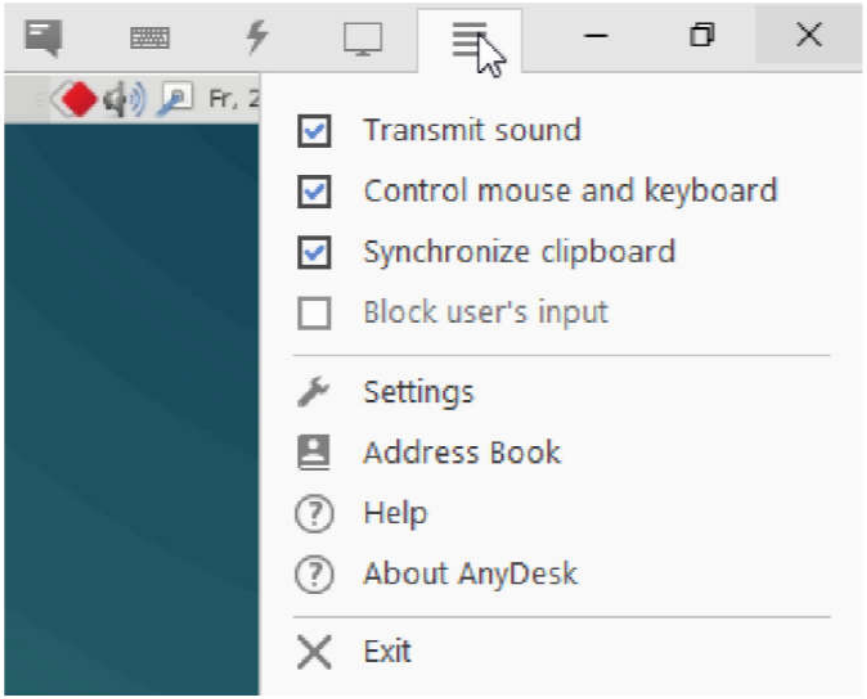
AnyDesk
Allowing access to your own desk





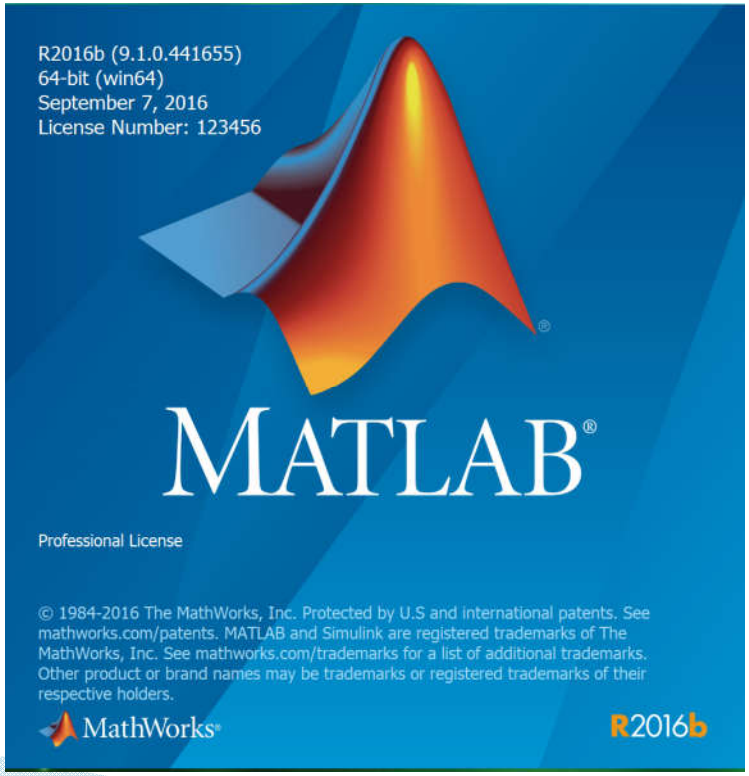
AnyDesk-Menu

"General" menu

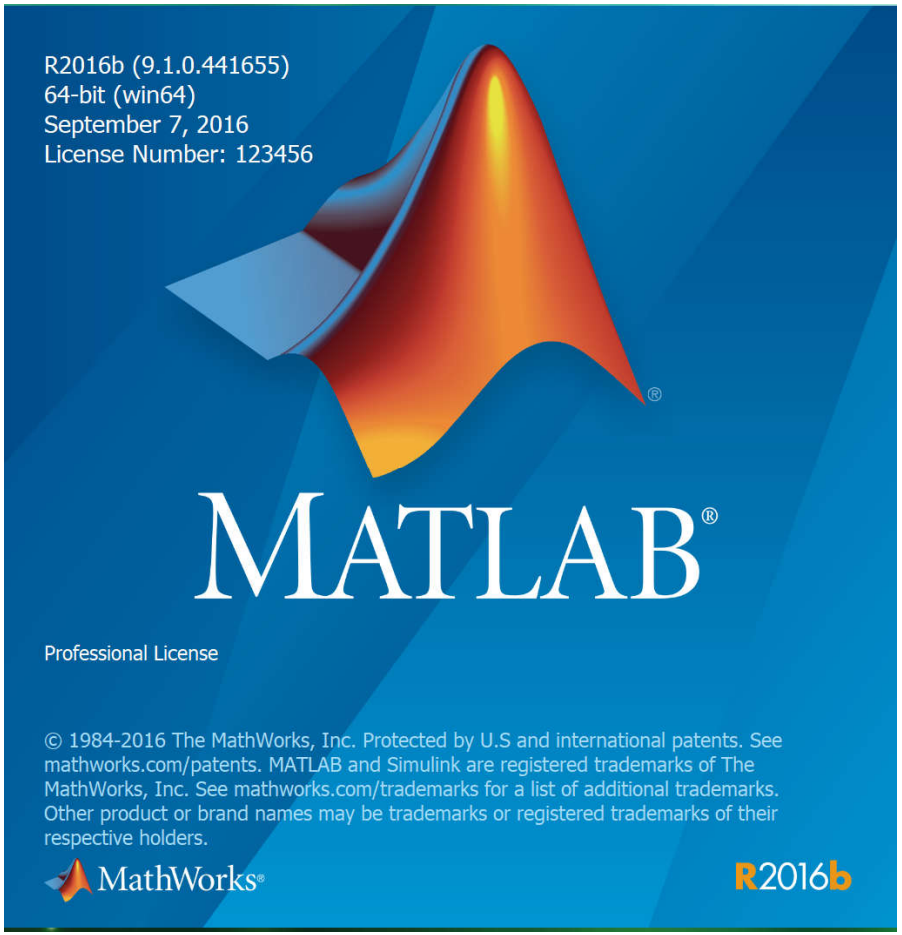


MATLAB

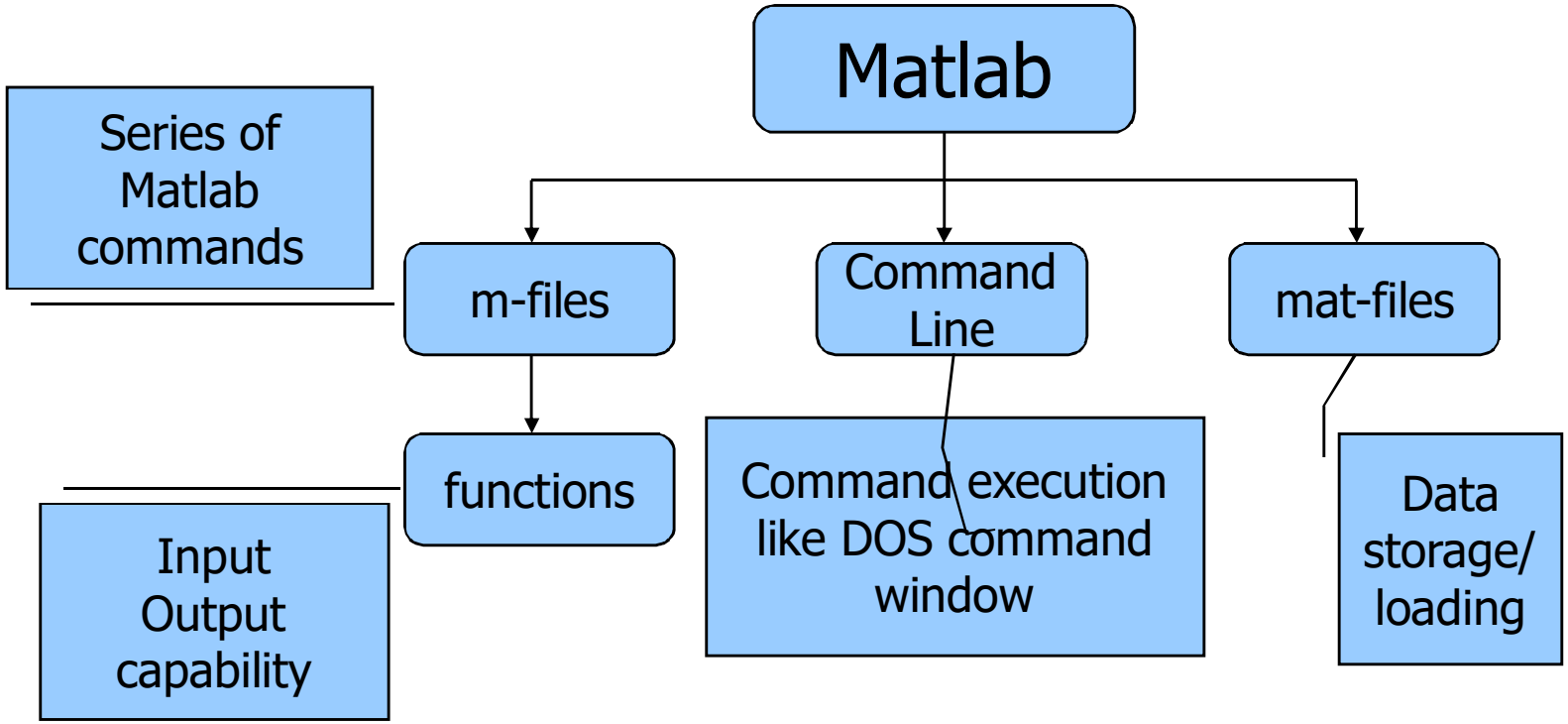
- Matlab = Matrix Laboratory
- Easy to learn
- Robust



MATLAB-setup

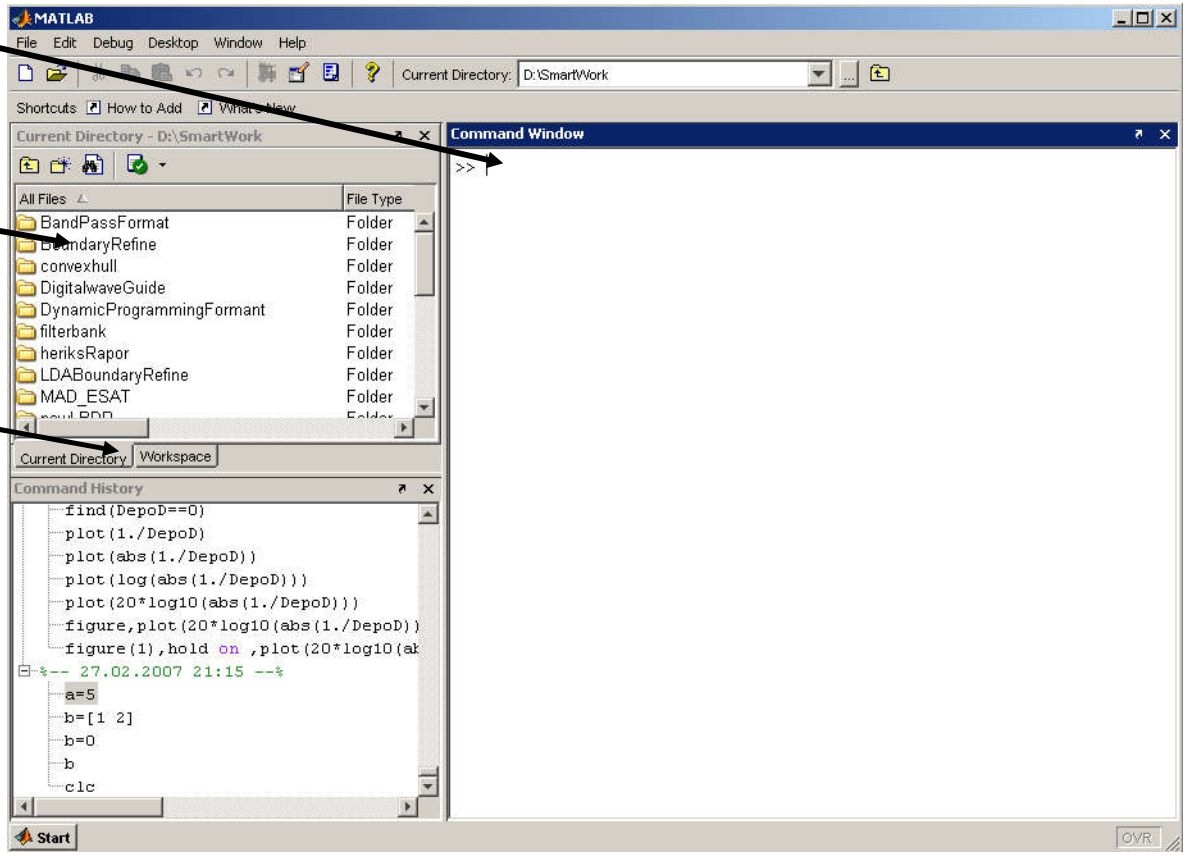


MATLAB-General Picture



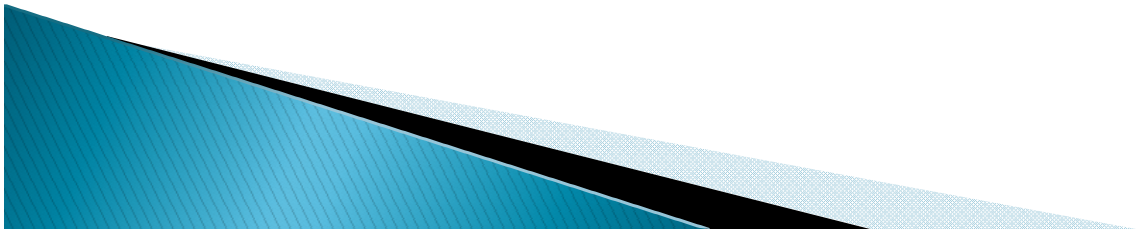
MATLAB-General Picture

- 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



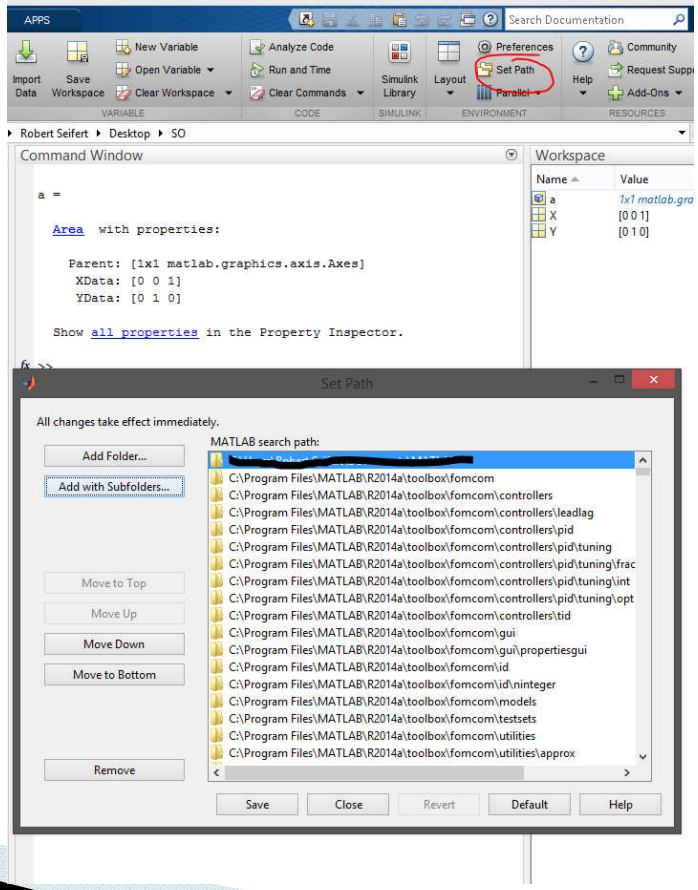
Exercise

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



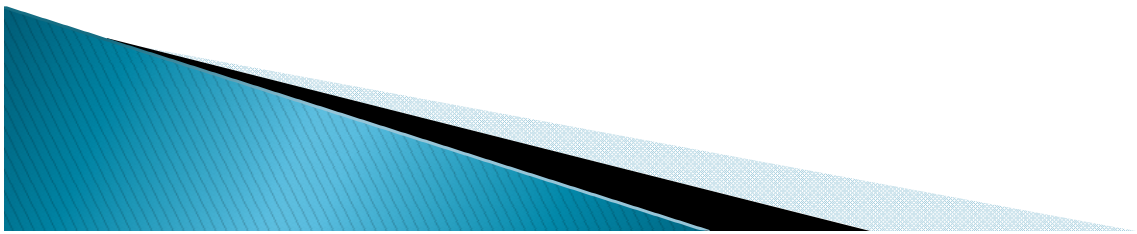
Matlab–use other tools

- 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)

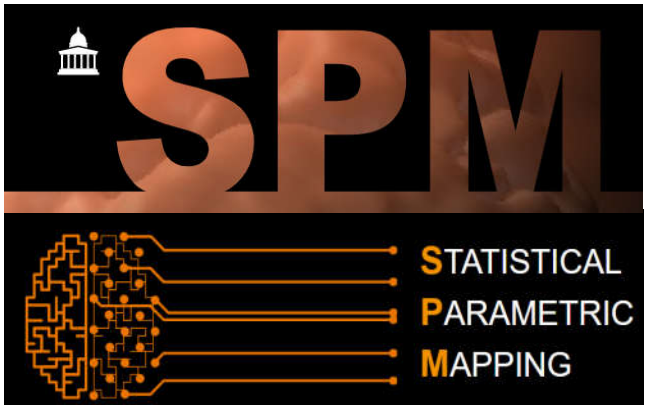
fMRI, PET, SPECT, EEG and MEG.

Requirements

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

Standalone version

From 1998(**SPM99**)-2020(**SPM12**)

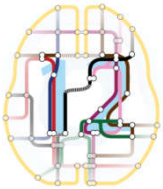


MATLAB Compatibility with SPM [edit]

Version	Release	Date	SPM12	SPM8	SPM5 [1]	SPM2	SPM99
9.8	R2020a	2020			[3]	[4]	[5]
9.7	R2019b	2019					
9.6	R2019a	2019					
9.5	R2018b	2018					
9.4	R2018a	2018					
9.3	R2017b	2017					
9.2	R2017a	2017					
9.1	R2016b	2016					
9.0	R2016a	2016					
8.6	R2015b	2015					
8.5	R2015a	2015					
8.4	R2014b	2014					
8.3	R2014a	2014					
8.2	R2013b	2013					
8.1	R2013a	2013					
8.0	R2012b	2012					
7.14	R2012a	2012					
7.13	R2011b	2011					

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

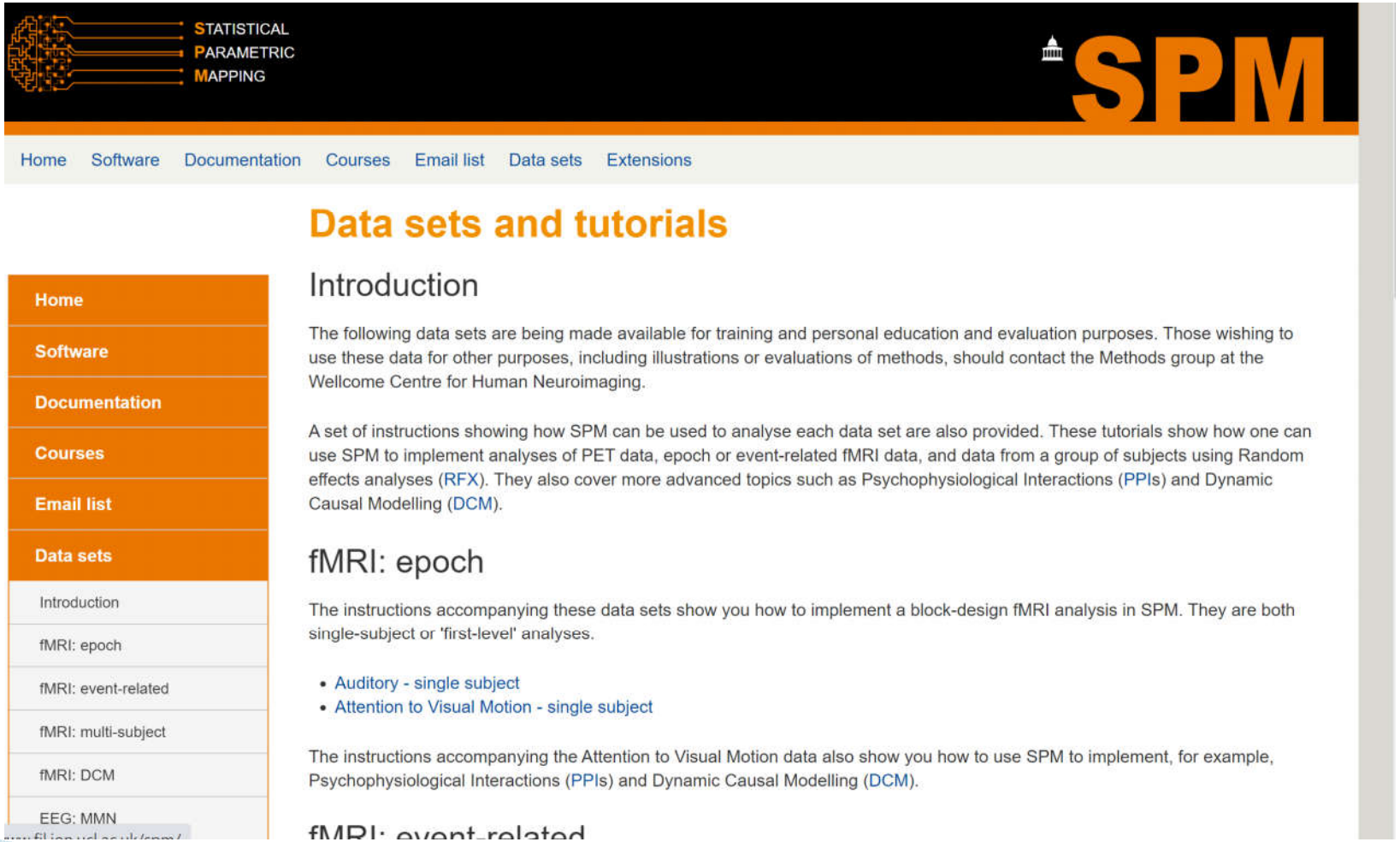
Copy left!



SPM– Courses


STATISTICAL
PARAMETRIC
MAPPING
SPM
Home
Software
Documentation
Courses
Email list
Data sets
Extensions
SPM Courses
Home
Software
Documentation
Courses
London courses
Other courses
Slides
Recordings
Email list
Data sets
Extensions
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


STATISTICAL
PARAMETRIC
MAPPING
SPM
Home
Software
Documentation
Courses
Email list
Data sets
Extensions
Data sets and tutorials
Home
Software
Documentation
Courses
Email list
Data sets
Introduction
fMRI: epoch
fMRI: event-related
fMRI: multi-subject
fMRI: DCM
EEG: MMN
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).

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

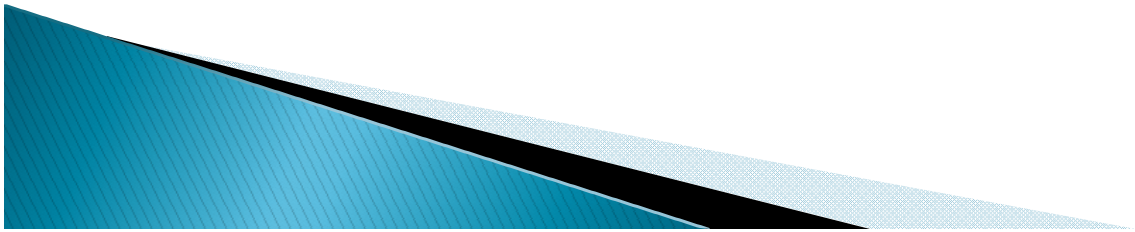
Statistical Inference

- 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

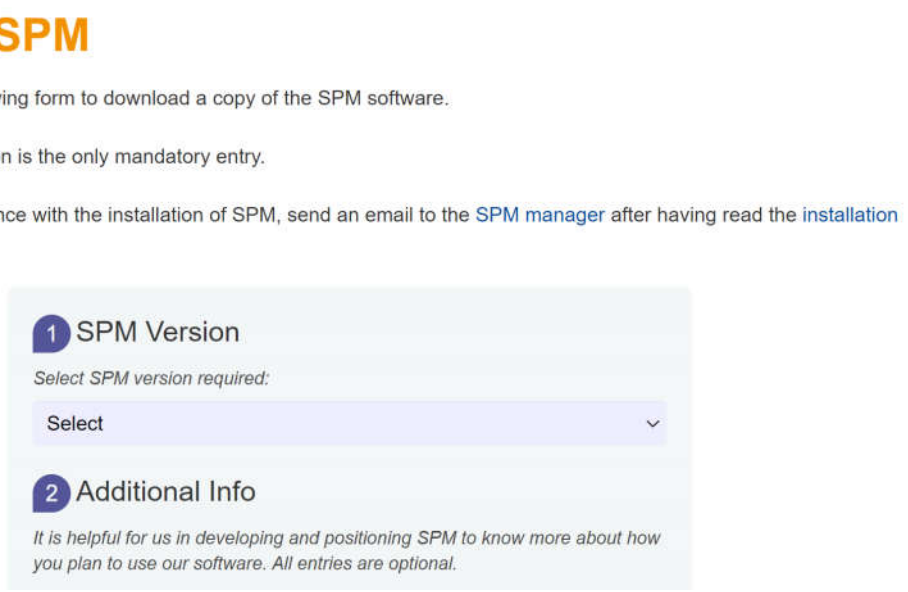
- Cogent a MATLAB-based stimulus presentation software
- MRIcron and MRIcroGL medical images viewers
- MarsBaR region of interest toolbox for SPM
- SnPM Statistical nonParametric Mapping
- Anatomy SPM Anatomy toolbox
- AAL Anatomical Automatic Labeling
- WFU_PickAtlas a region of interest toolbox for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



SPM

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

- website



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

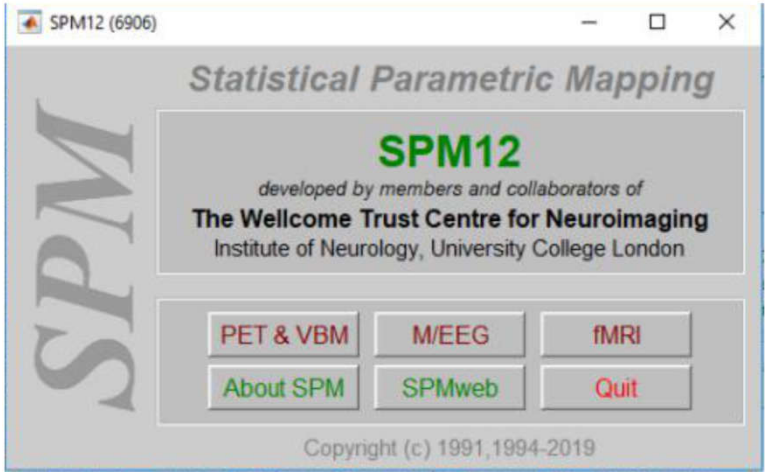
```
>> spm
```

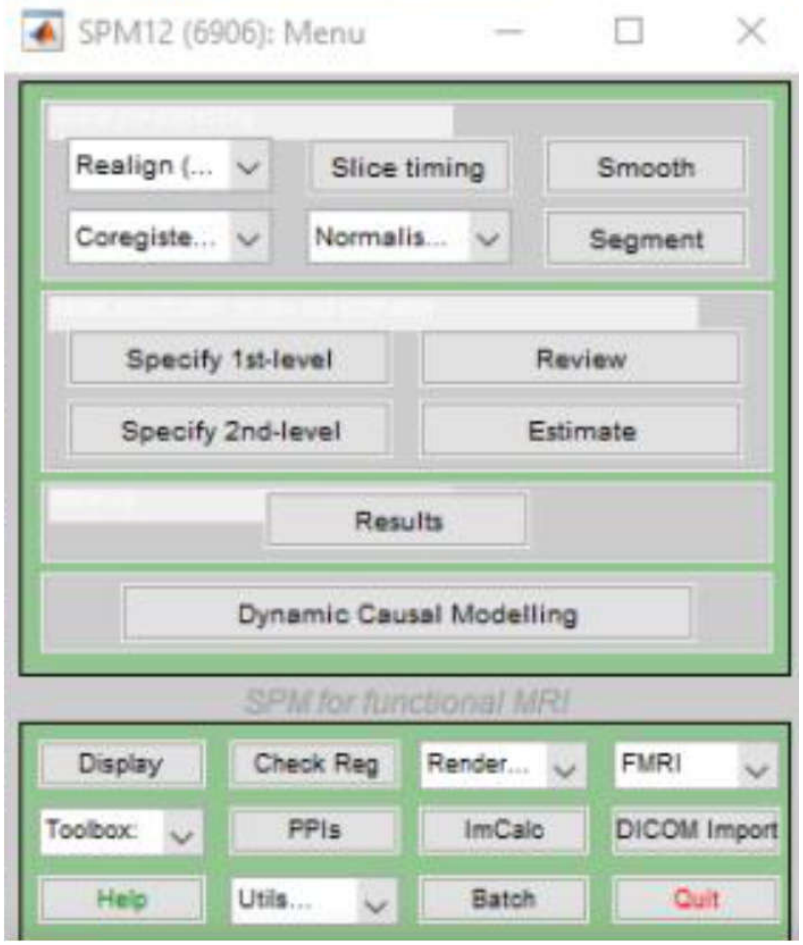
You might have to install the VC++ 2005 and 2008 Redistributable Packages (*vcredist_x86.exe*) from Microsoft:

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

SPM

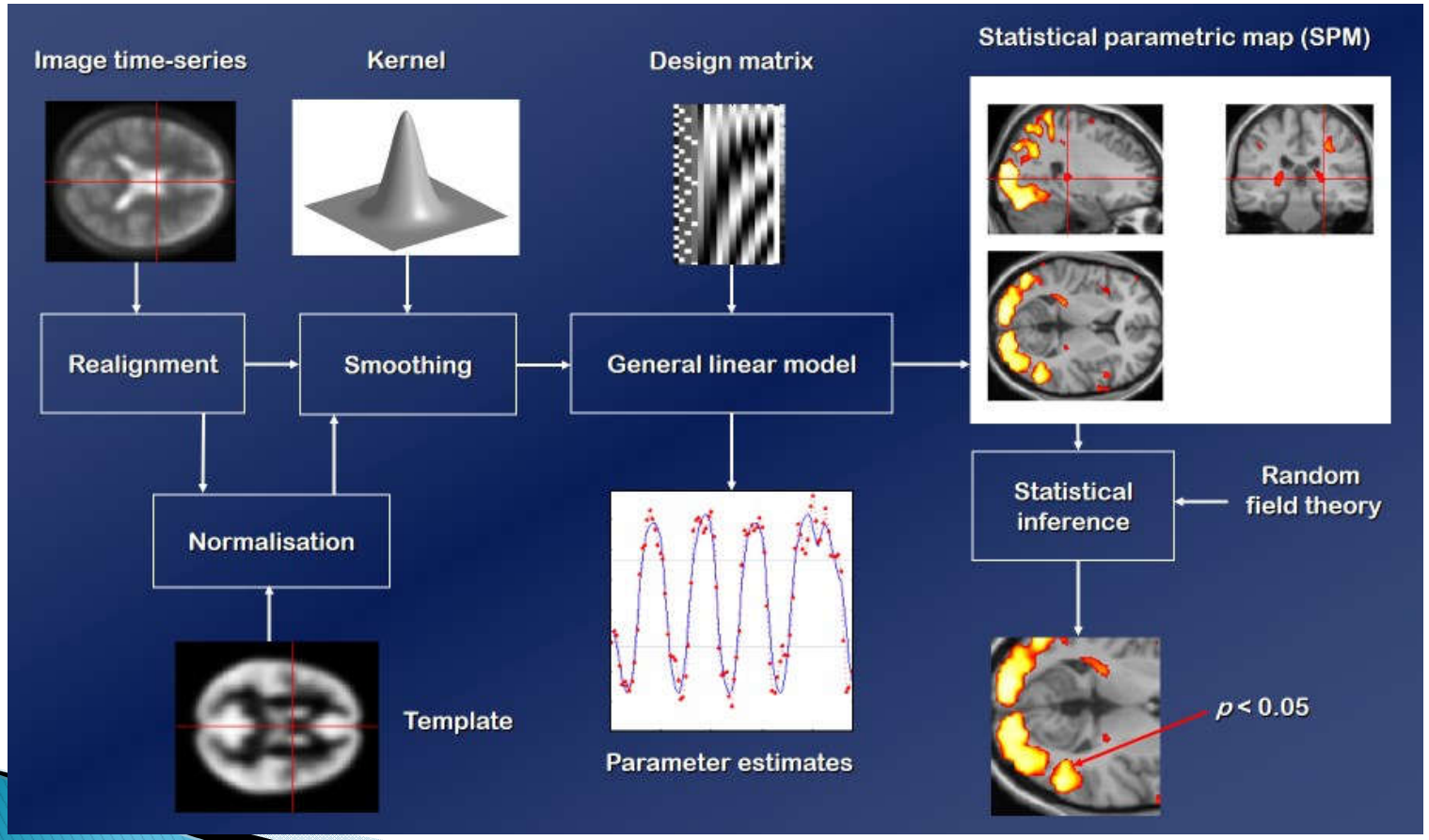
- Window


SPM12 (6906)
Statistical Parametric Mapping
SPM
SPM12
developed by members and collaborators of
The Wellcome Trust Centre for Neuroimaging
Institute of Neurology, University College London
PET & VBM
M/EEG
fMRI
About SPM
SPMweb
Quit
Copyright (c) 1991,1994-2019


SPM12 (6906): Menu
Realign (...
Slice timing
Smooth
Coregiste...
Normalis...
Segment
Specify 1st-level
Review
Specify 2nd-level
Estimate
Results
Dynamic Causal Modelling
SPM for functional MRI
Display
Check Reg
Render...
FMRI
Toolbox
PPIs
ImCalc
DICOM Import
Help
Utils...
Batch
Quit

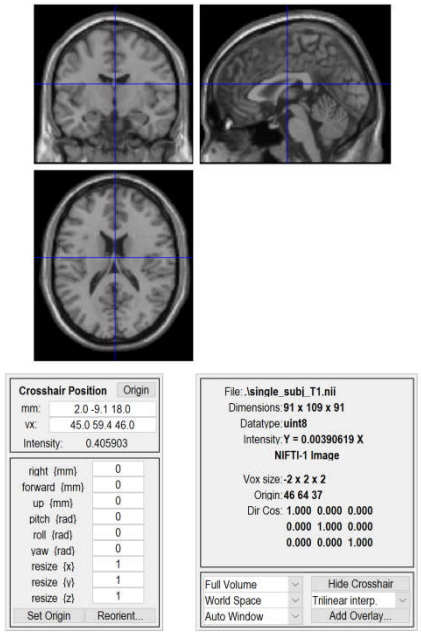
SPM–Task fMRI

- 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

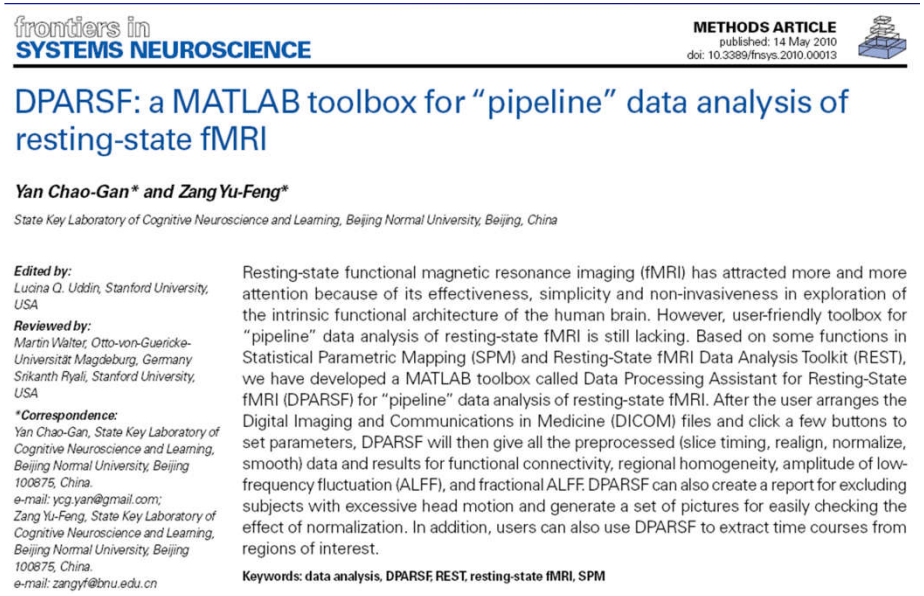
2010-2020

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

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e-mail: zangyf@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, DPARSF, REST, resting-state fMRI, SPM

DPARSF

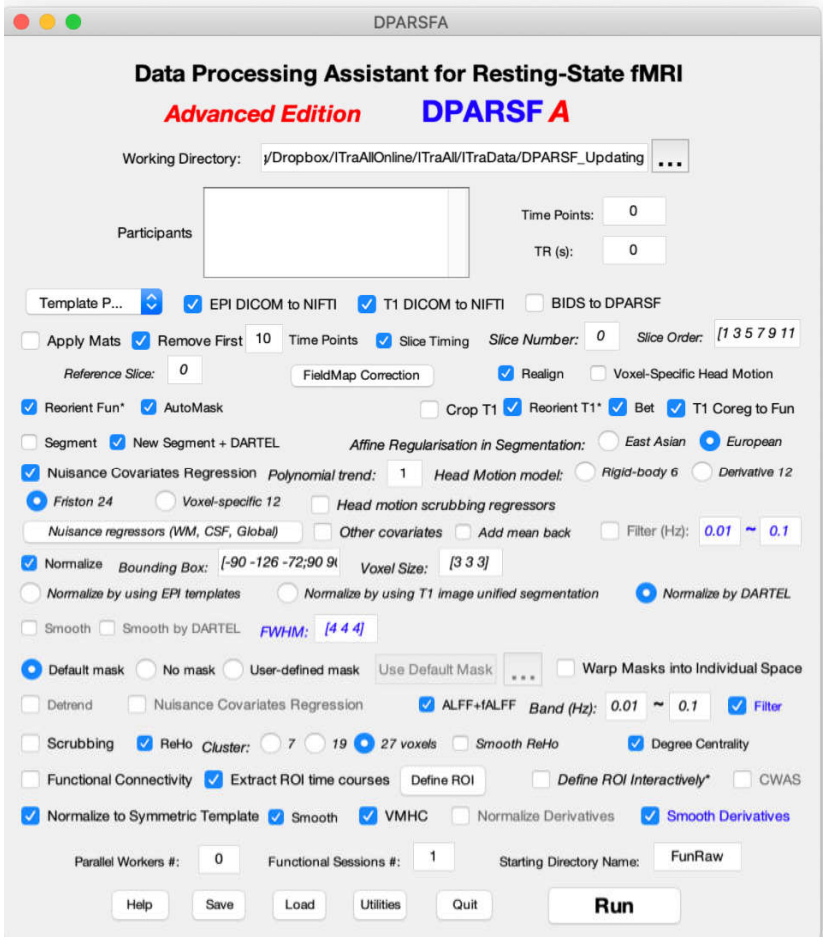
The R-fMRI Network

a network for supporting resting-state fMRI related studies.

- Download link

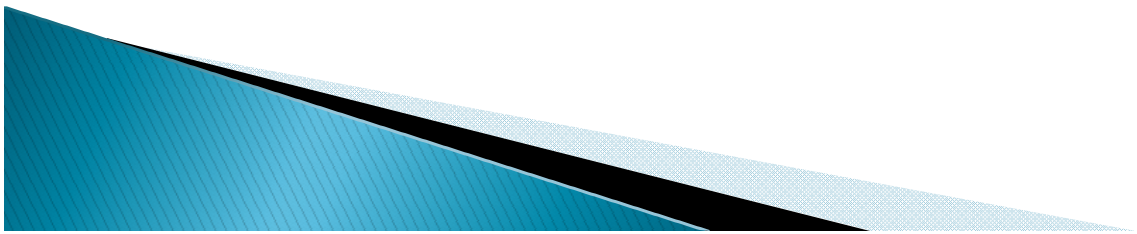
http://rfmri.org/DPARSF

- GUI



Exercise

- Run Dparsf



Mricron

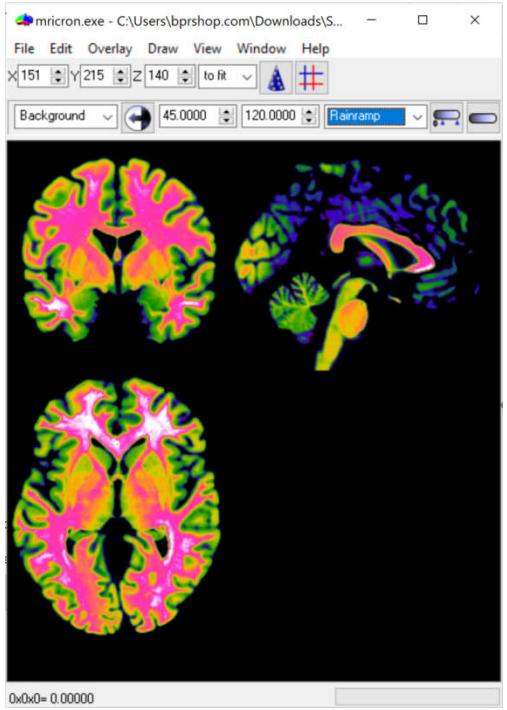
https://people.cas.sc.edu/rorden/mricron/install.html

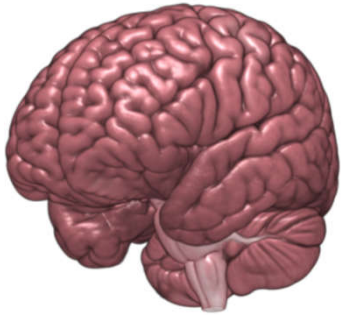
load multiple layers of imageS

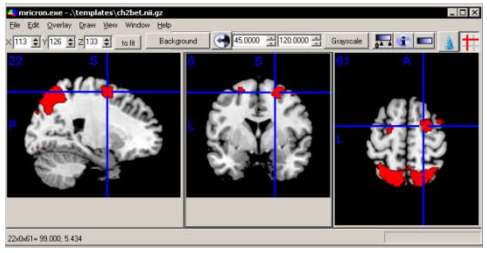
draw volumes of interest.

New MRICRonGL

- https://www.mccauslandcenter.sc.edu/mricrogl/home

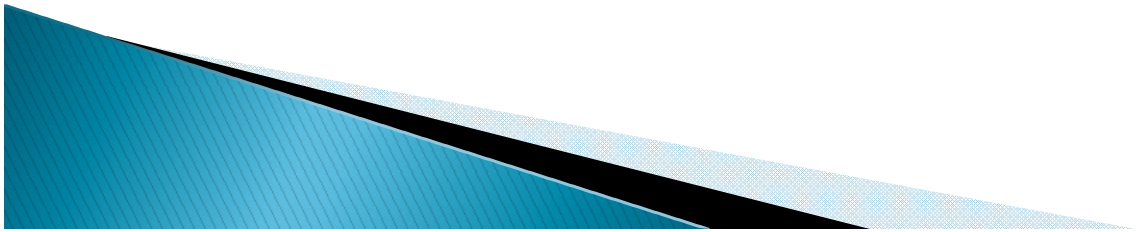






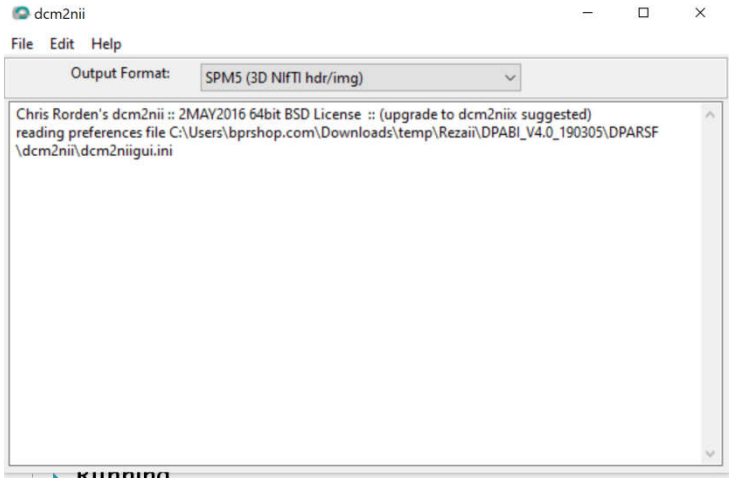
Exercise

- Show the MRI data



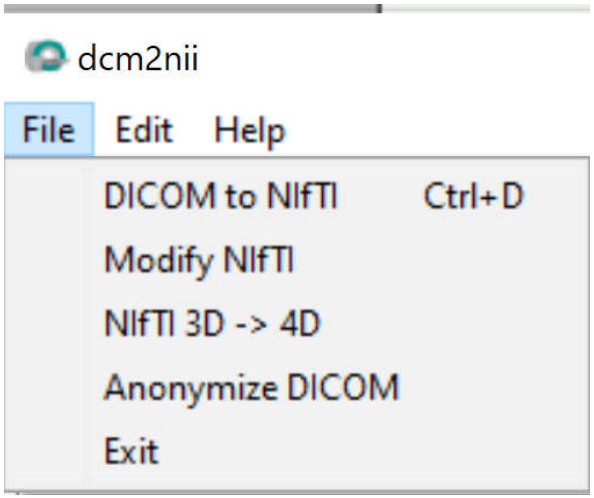
dcm2nii

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)

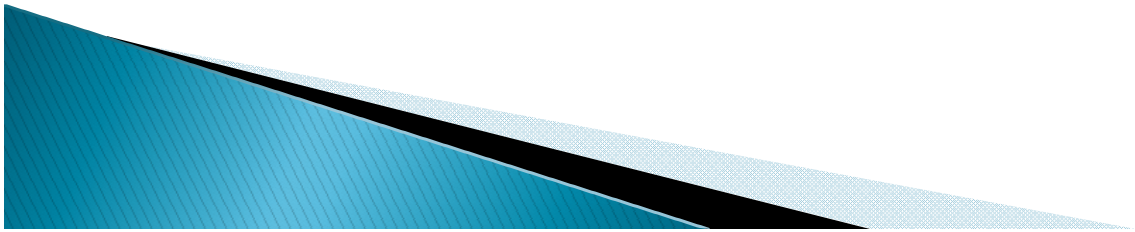
Modify NifTI

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.,

```
int a;
double b;
float c;
```

- 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

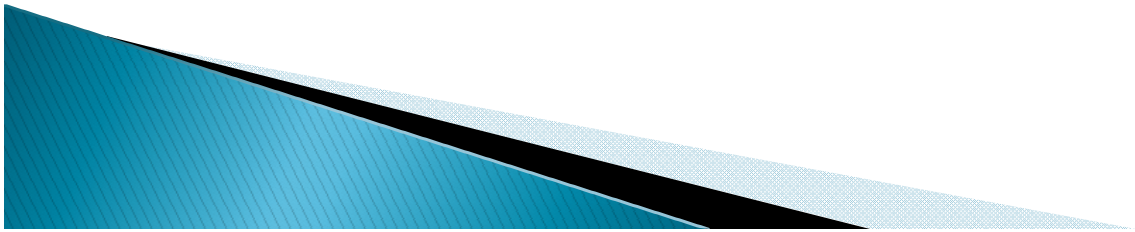
```
x = [1 2 5 1]

x =
     1     2     5     1
```

- Transpose

```
y = x'

y =
     1
     2
     5
     1
```

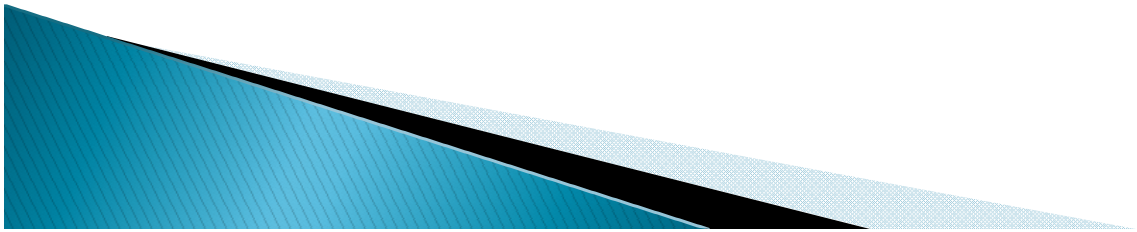
- A matrix : Rows are seperated by semicolumn

```
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 =
    2.0000    1.5000    1.0000    0.5000         0   -0.5000   -1.0000

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

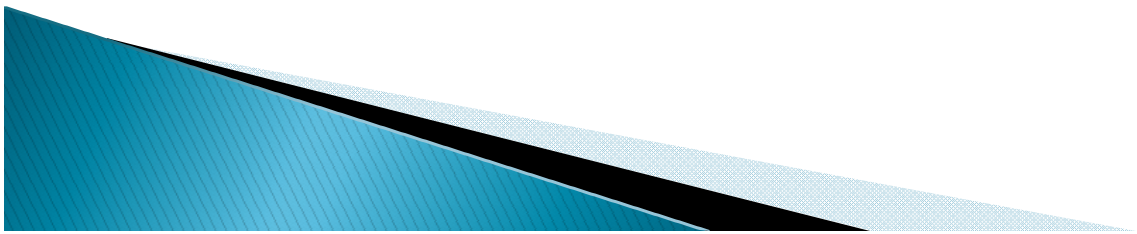
```
x = zeros(1,3)
x =
  0     0     0
```

- 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

```
>> A(3,2)

ans =

     7
```

- Print all elements in row 2

```
>> A(2,:)

ans =

     6     8     2
```

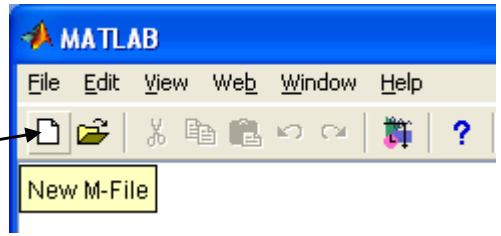
- Print first and second elements in column 2

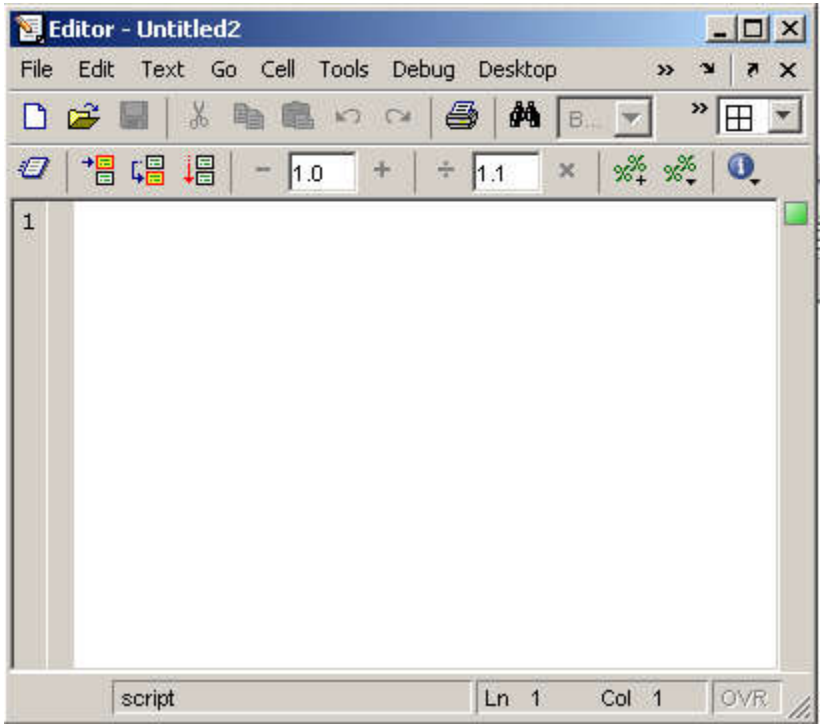
```
>> A(1:2,2)

ans =

     5
     8
```

Print the element in row 3 and column 2

Use of M-File

Click to create a new M-File

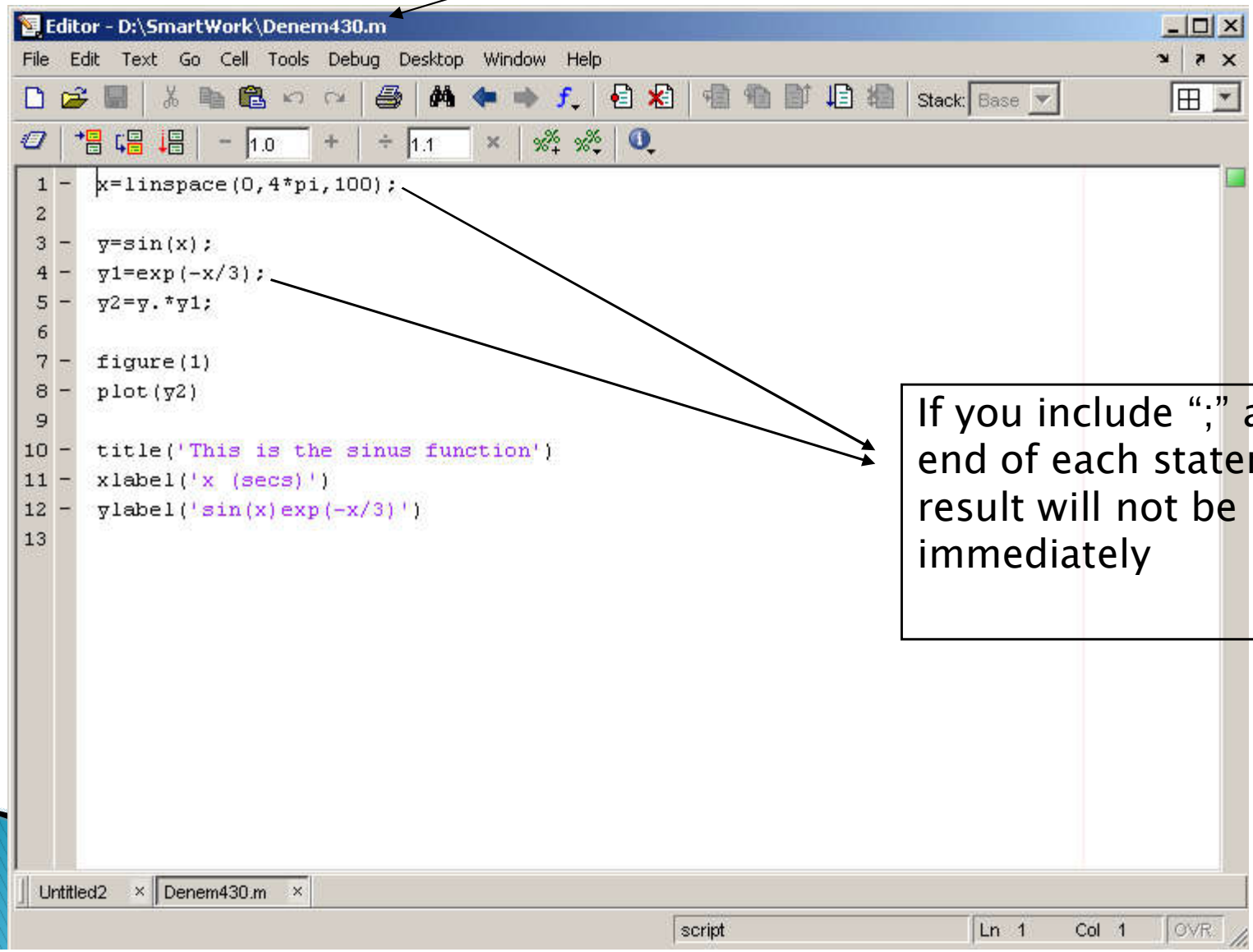




- Extension ".m"
- A text file containing script or function or program to run

Use of M-File

Save file as *Denem430*.m



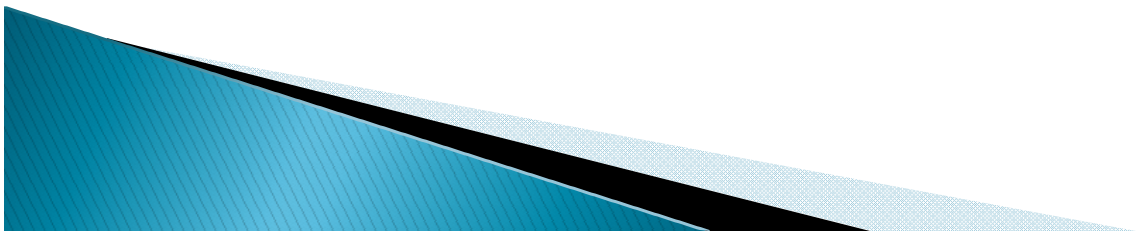
If you include ";" at the end of each statement, result will not be shown immediately

Exercise

- Create M file(test.m) plot line

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

- Run test.m from command line



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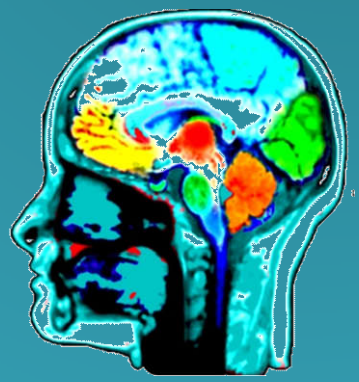

Software Introduction

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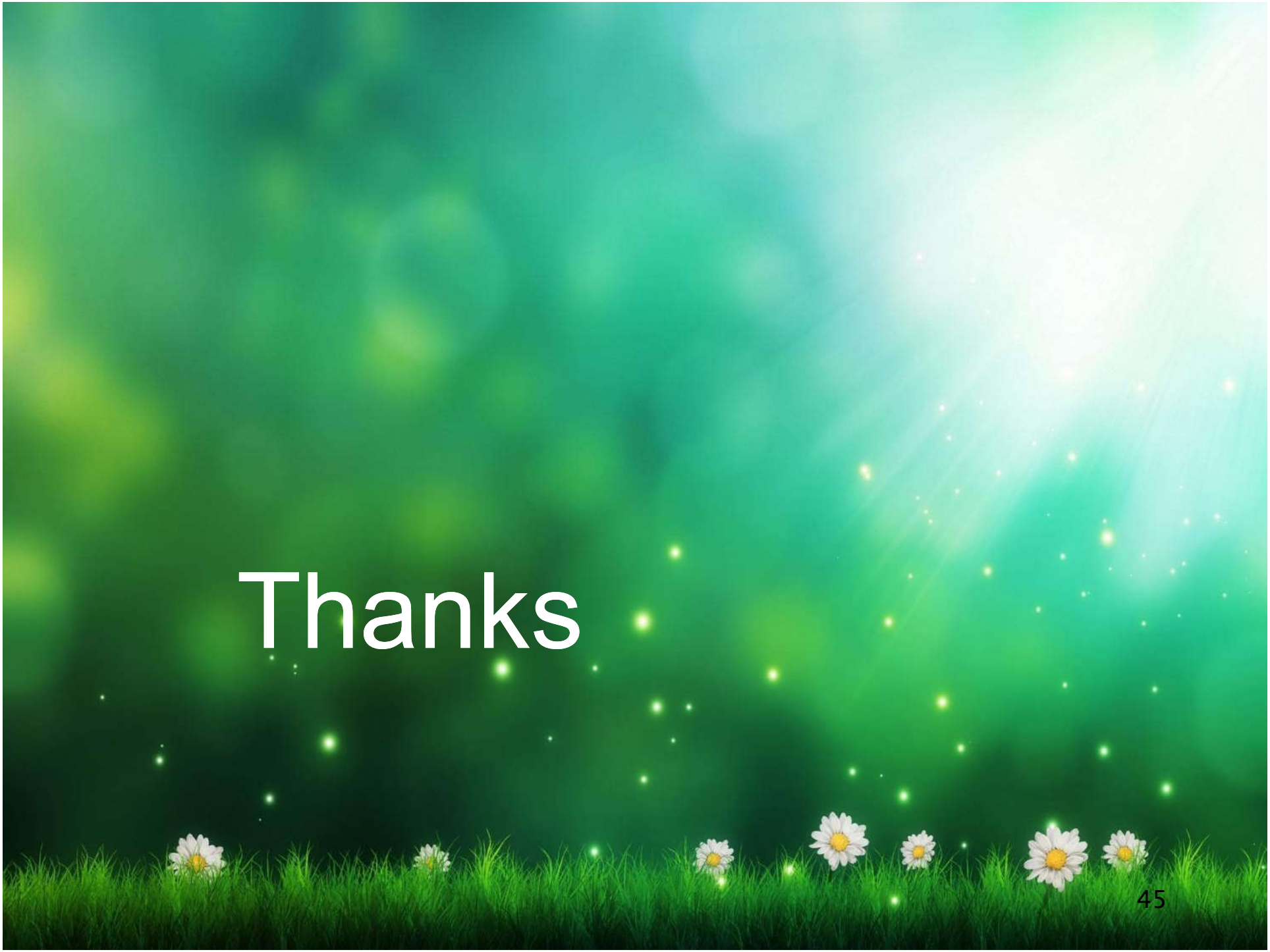
Thanks