دانشکده روانشناسی و علوم تربیتی

پژوهشگاه دانش‌های بنیادی IPM

MATLAB for Brain and Cognitive Psychology (Signal processing)

Presented by:
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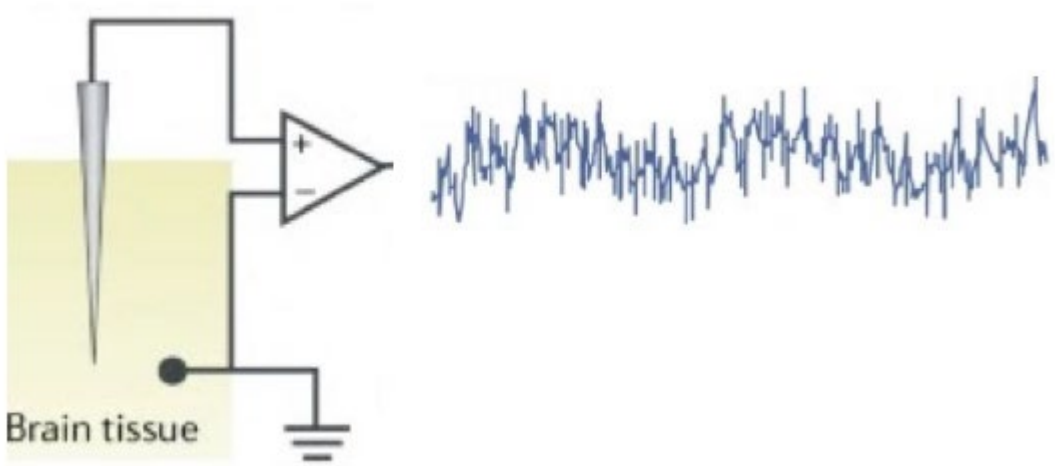
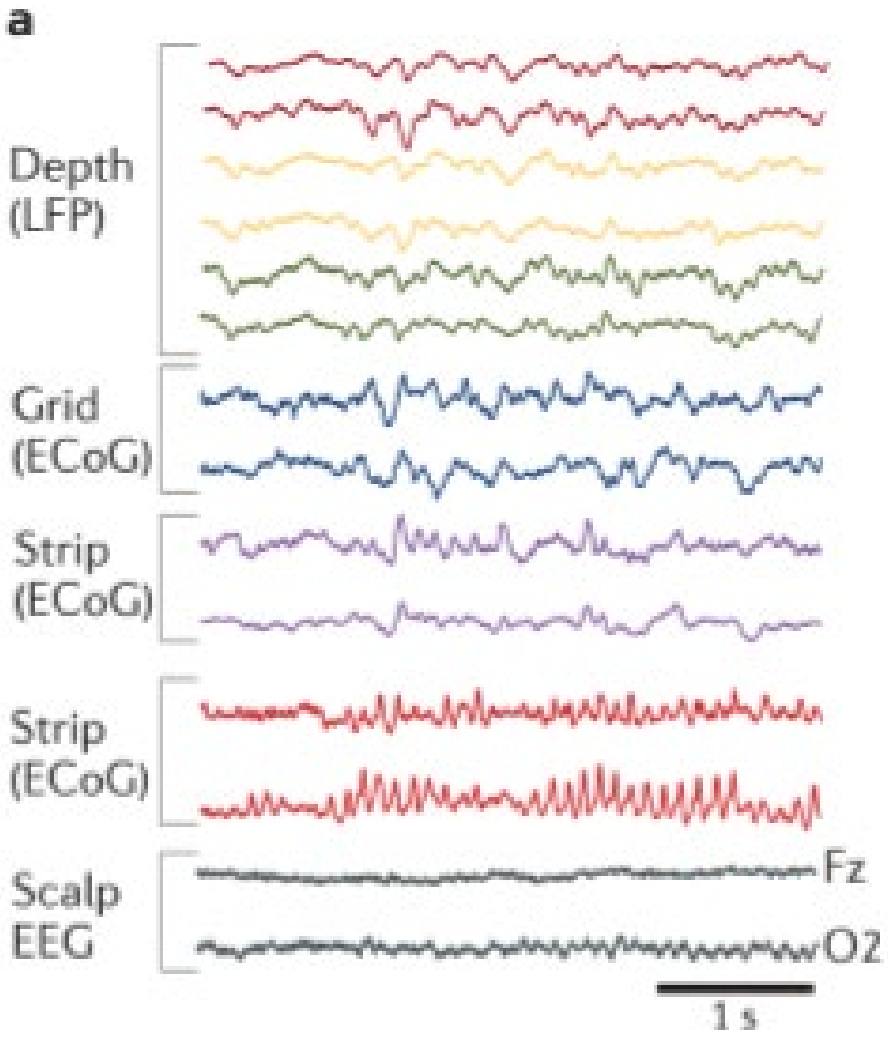
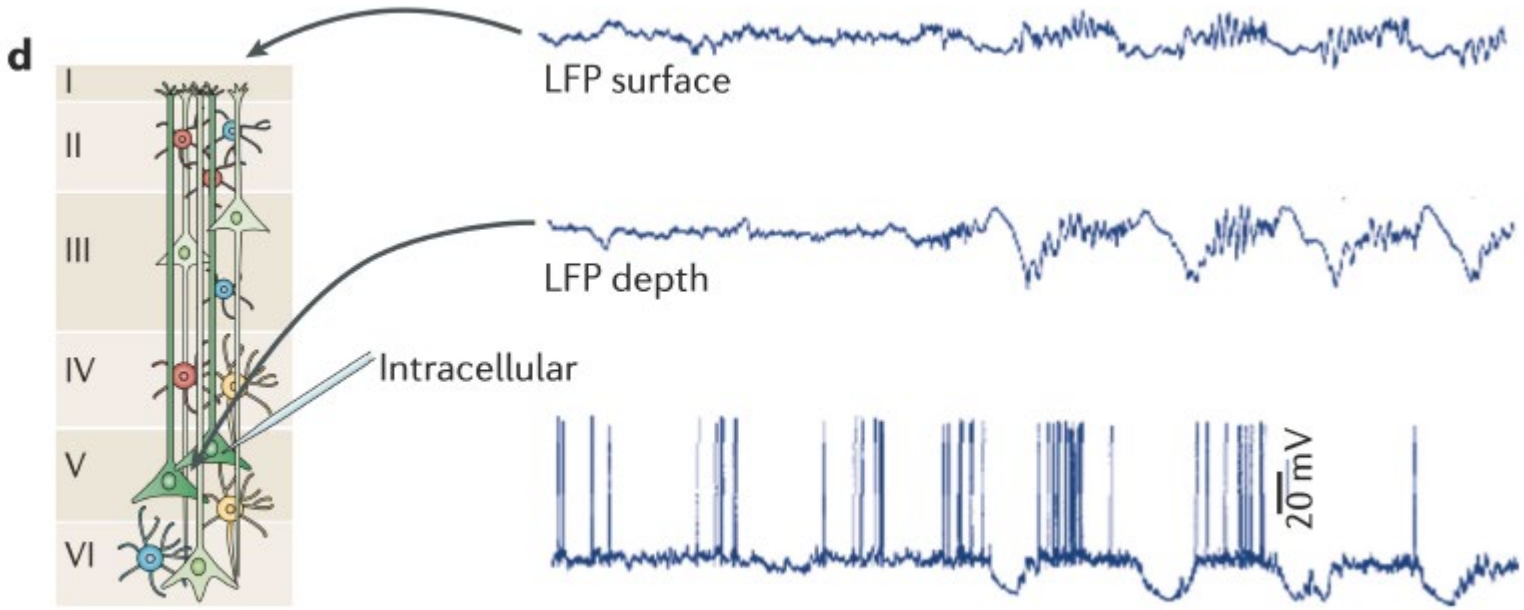
The neural data

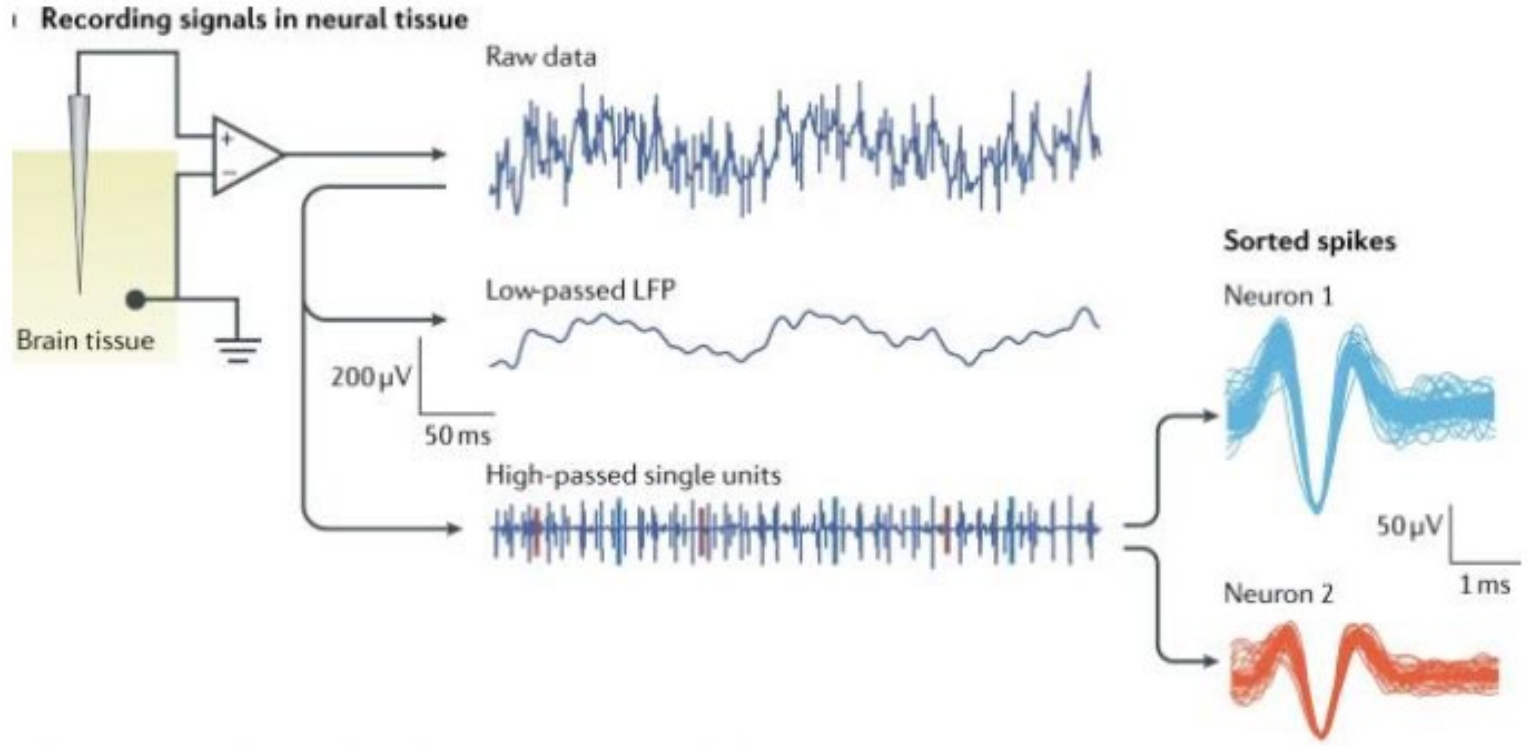


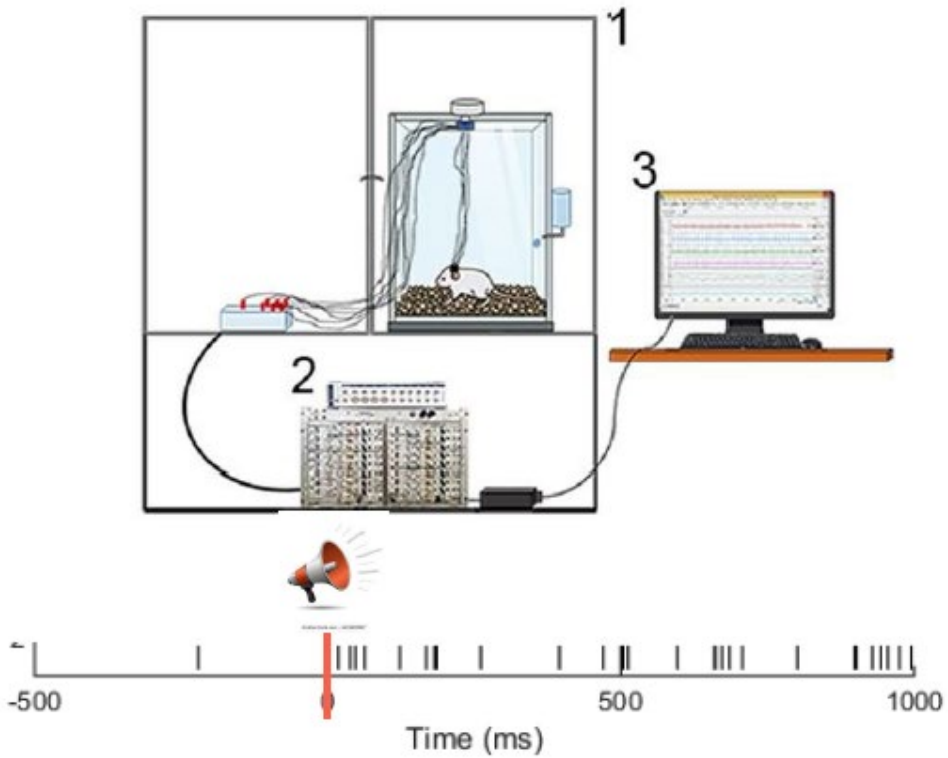


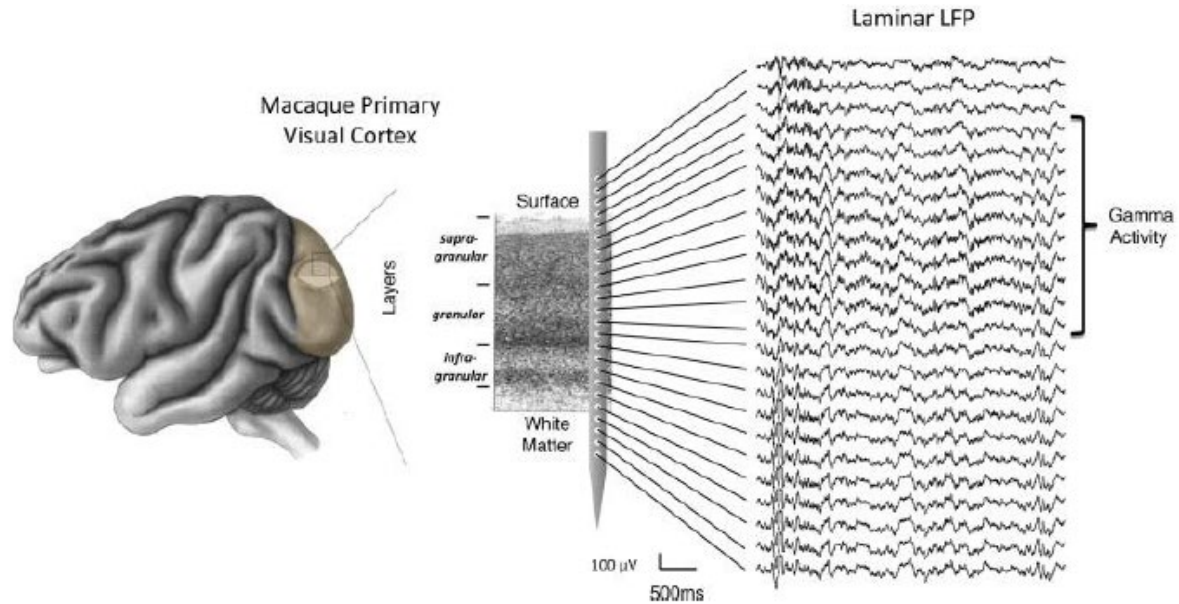
Neural data components



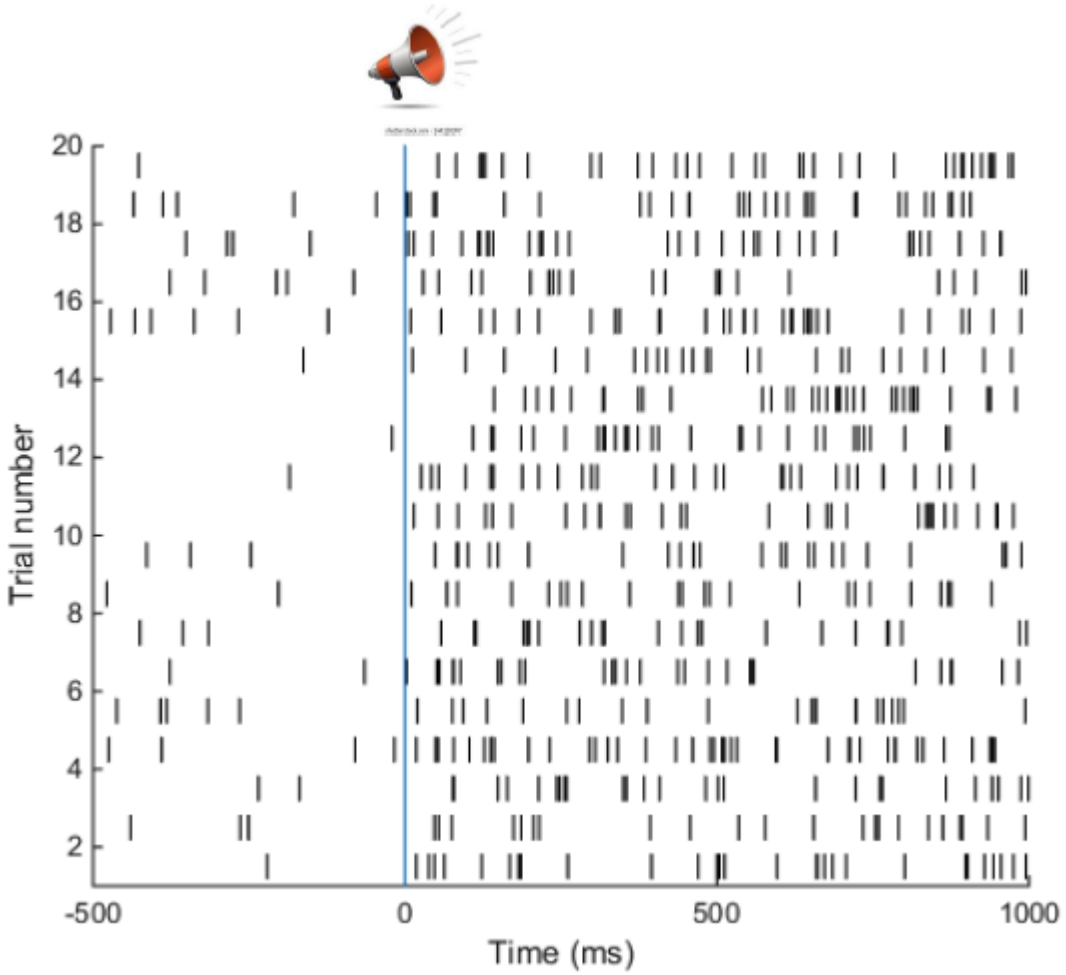
Neural data components



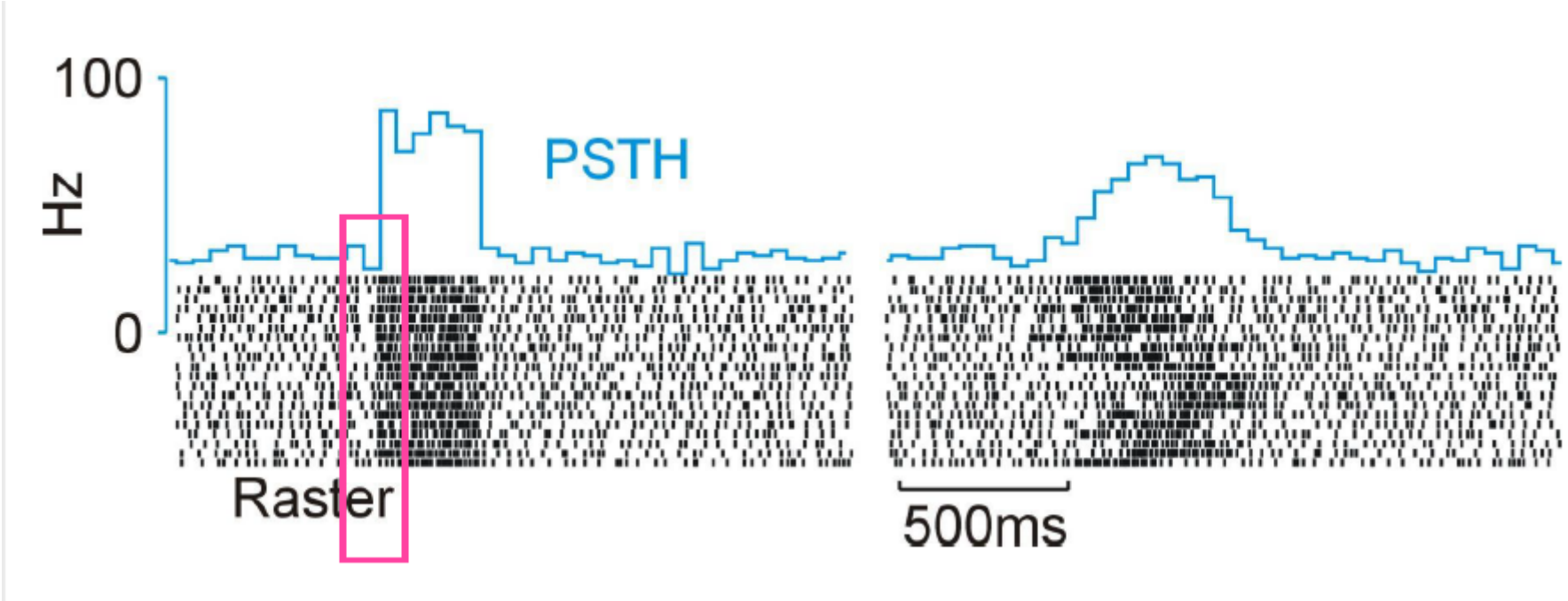

1
2
3
-500
500
1000
Time (ms)


Laminar LFP
Macaque Primary
Visual Cortex
Layers
Surface
supra-
granular
granular
infra-
granular
White
Matter
Gamma
Activity
100 µV
500ms

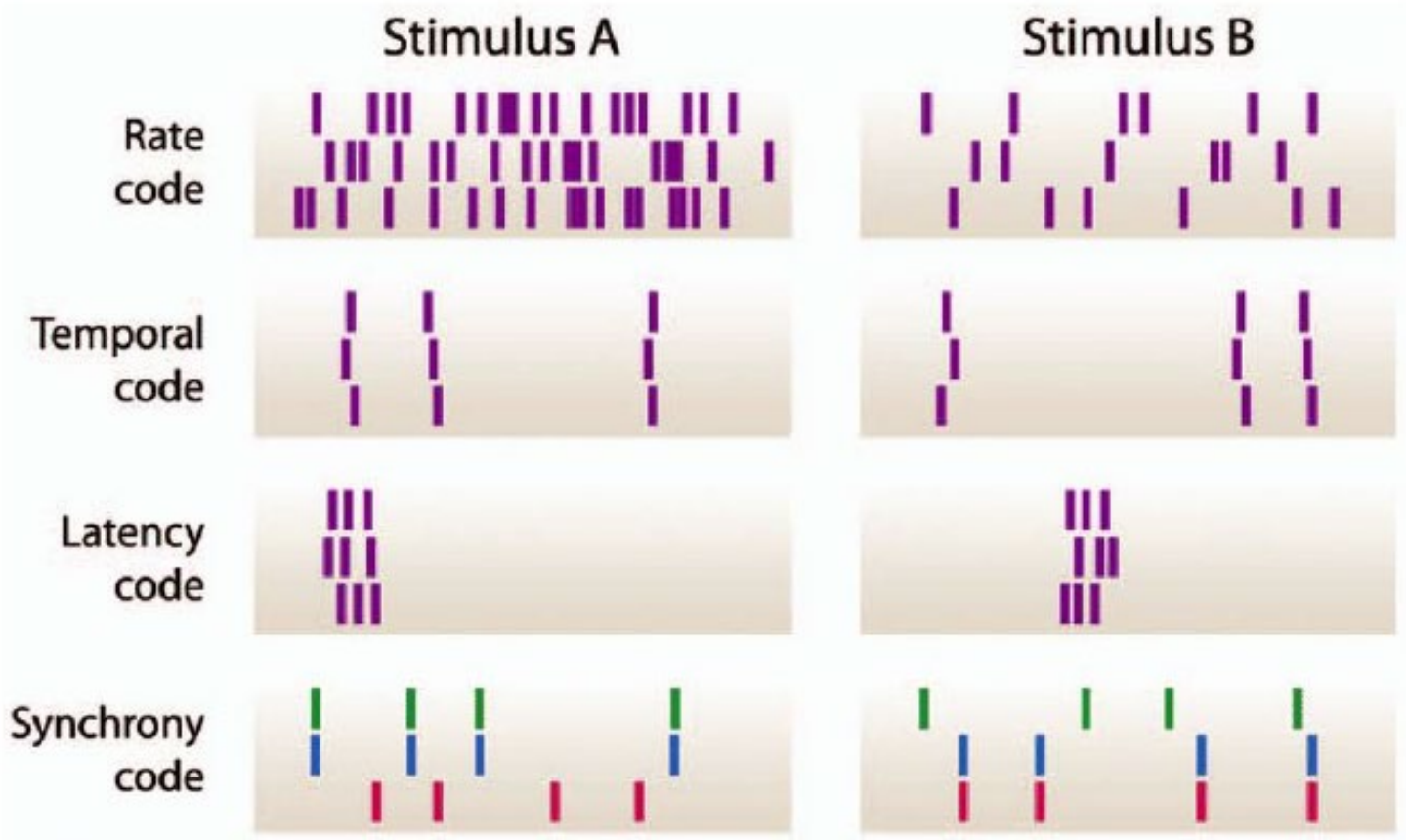
Spiking activity



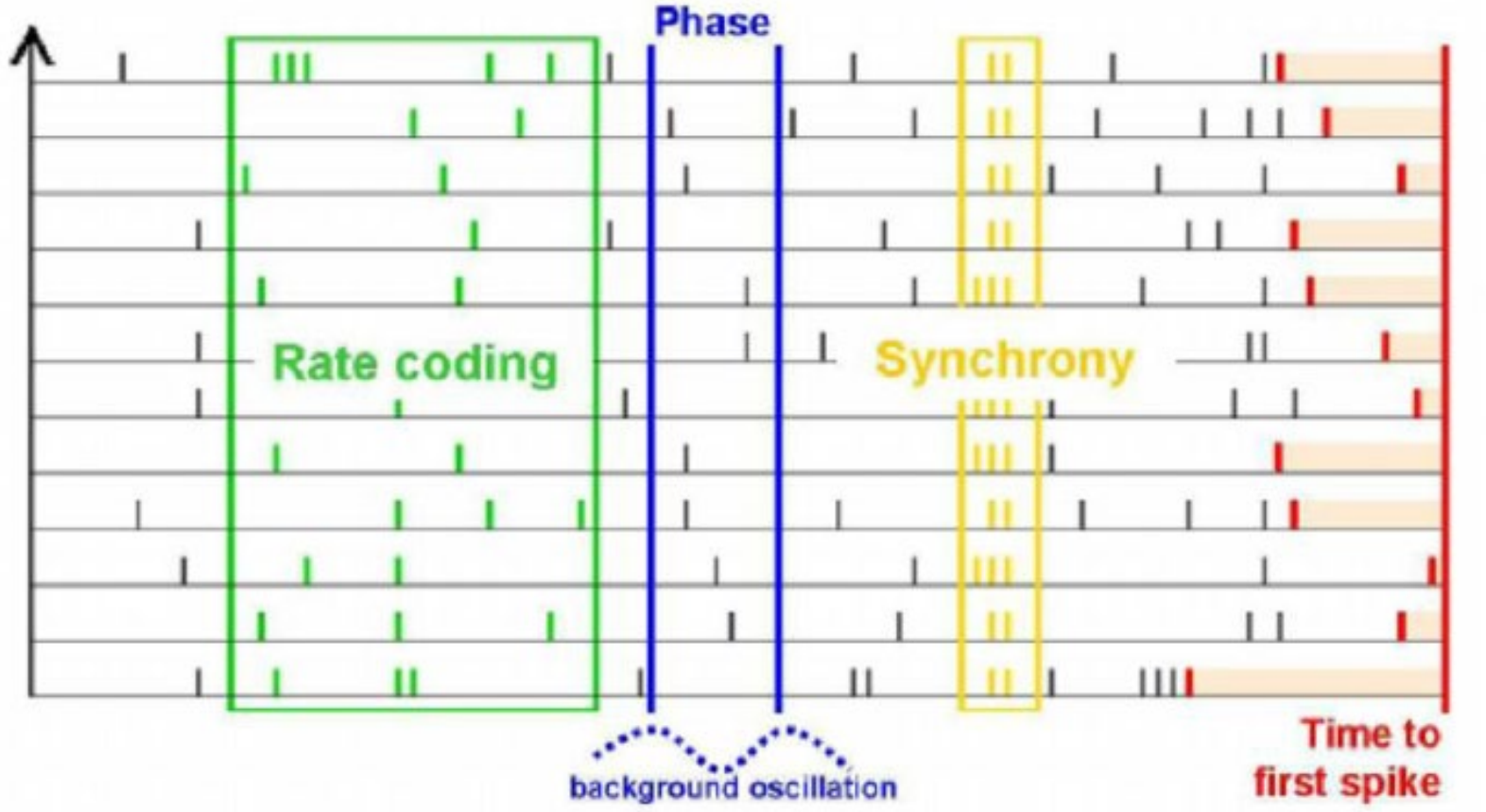
Rate coding



Different coding based on spiking activity

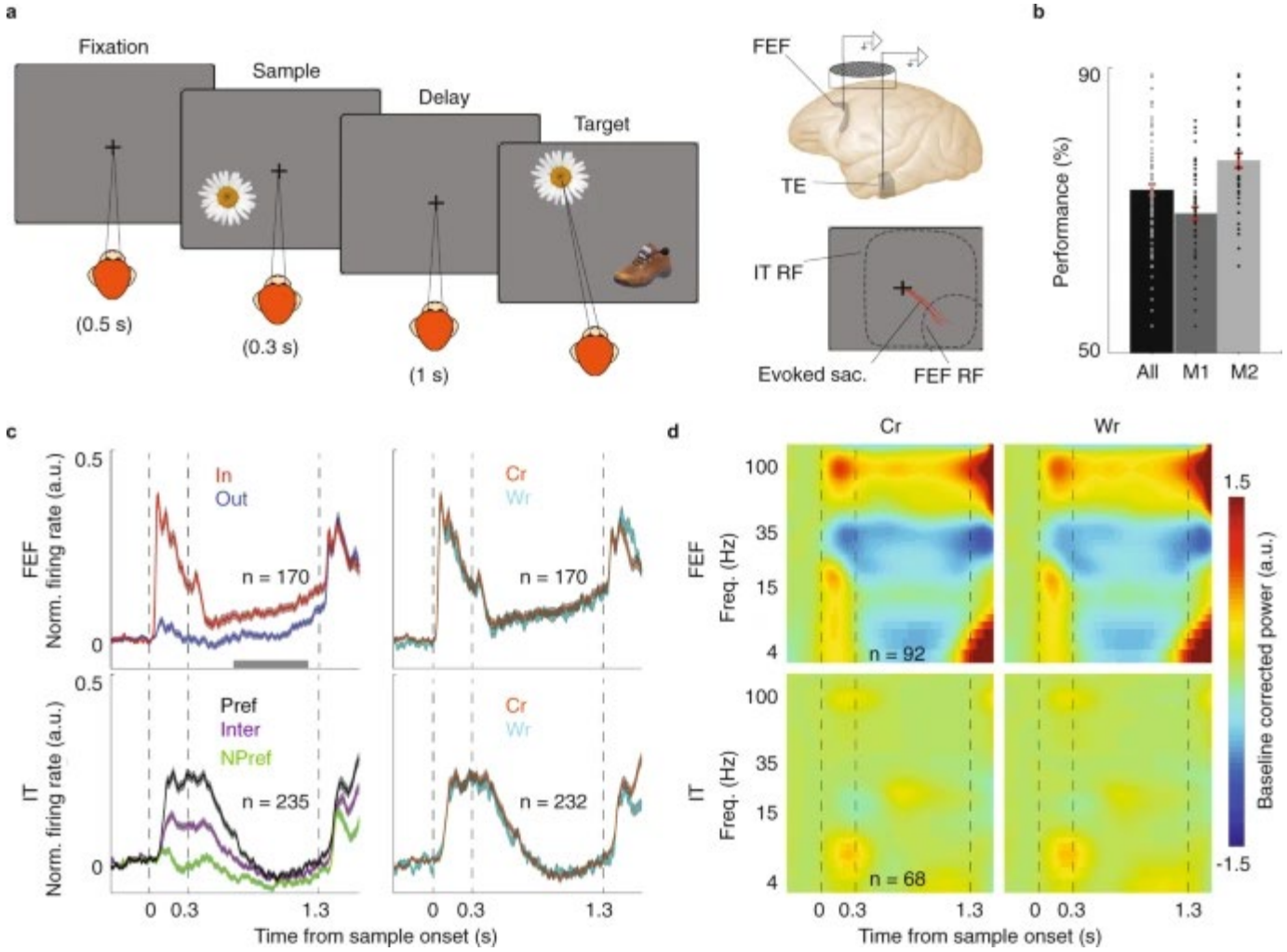


Different coding based on spiking activity



Example of rate coding

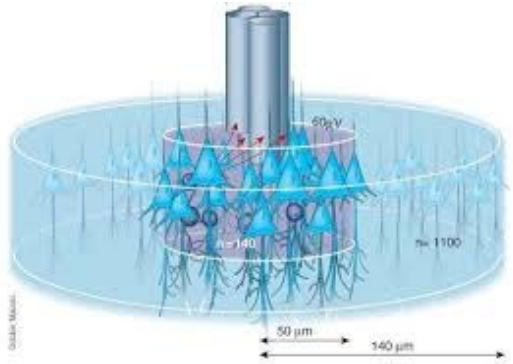
- Frontal eye field sample

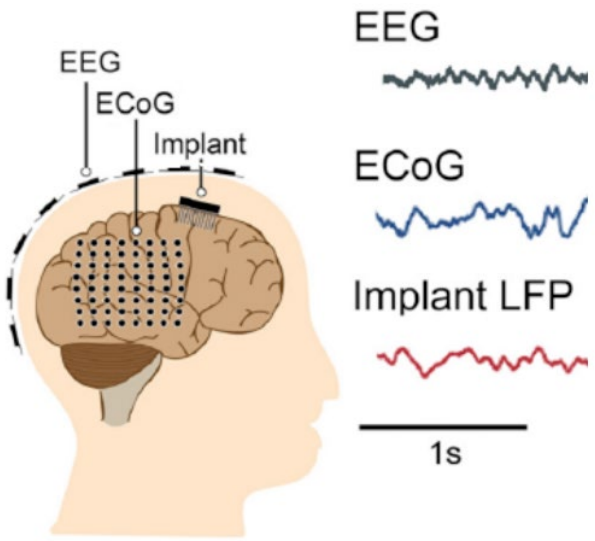


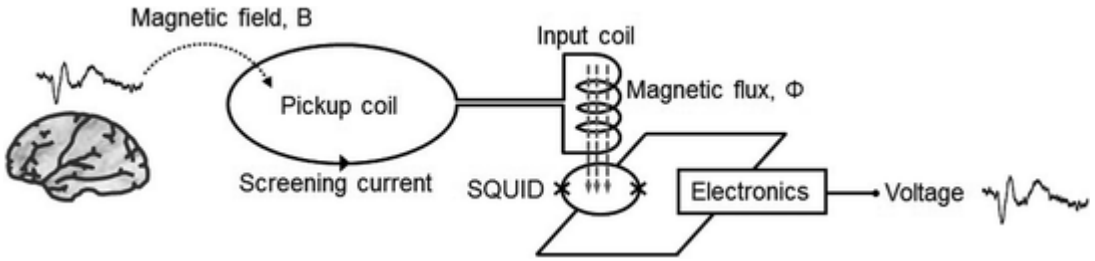
Rezayat,,et al. (2021). Frontotemporal coordination predicts working memory performance and its local neural signatures. *Nature communications*, *12*(1), 1103.

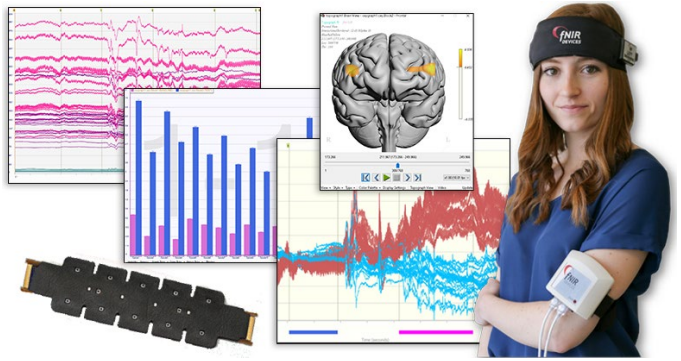
Continues signals

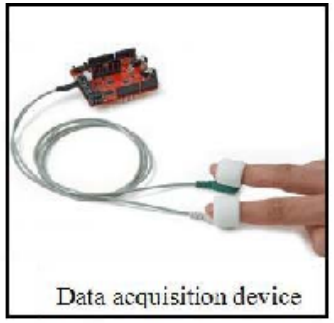
- Local field potential (LFP)
- ECOG
- EEG
- MEG
- FNIR
- GSR
- EMG
- ECG

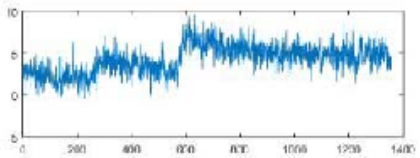






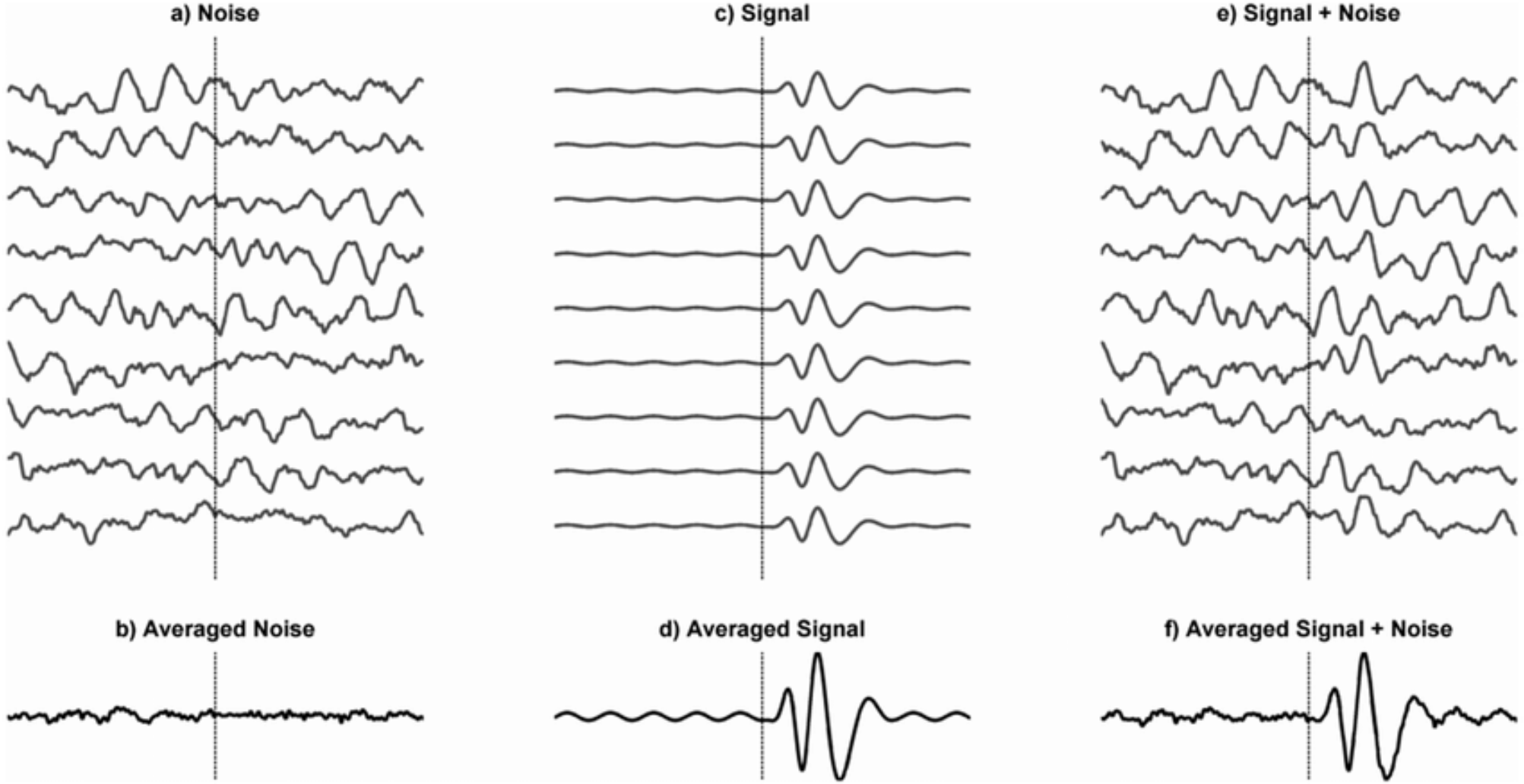




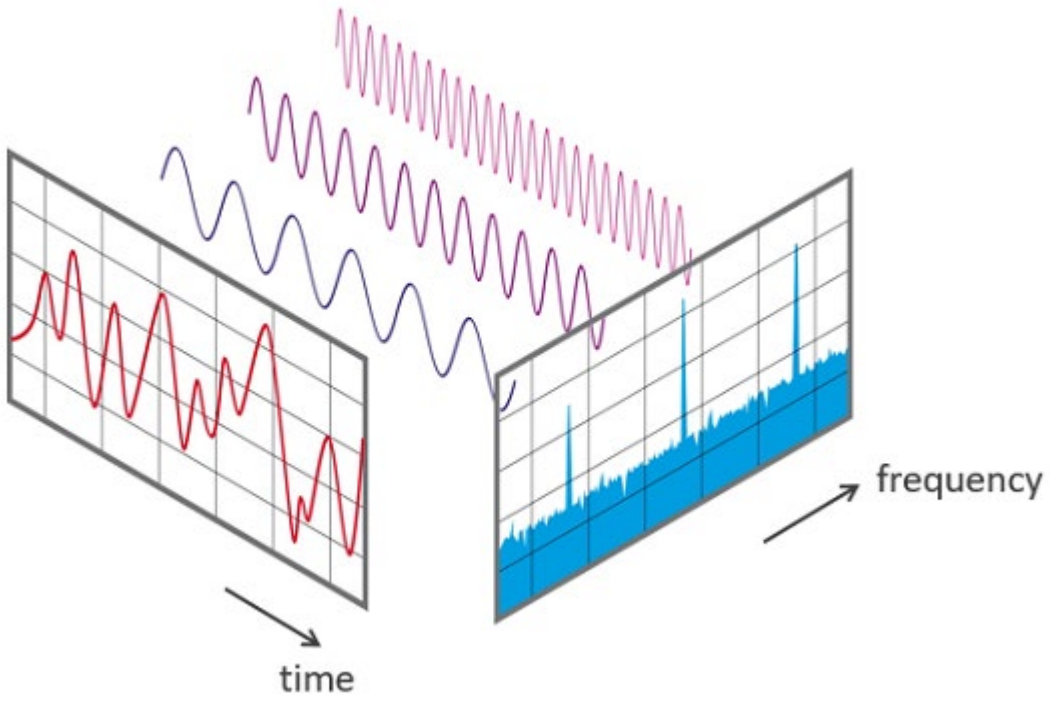


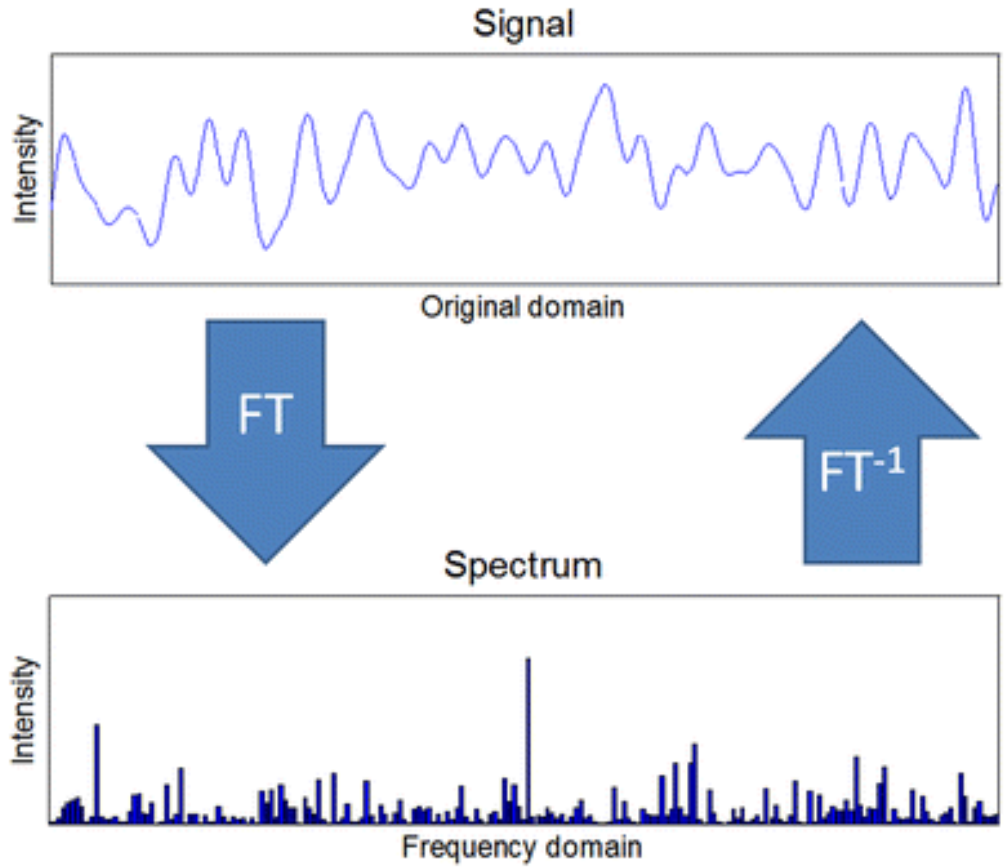
To be filtered signal

ERP signals

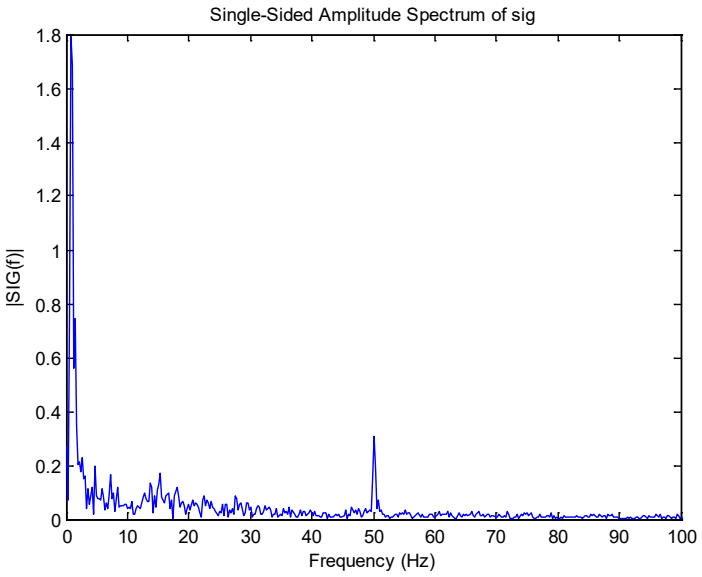

a) Noise
c) Signal
e) Signal + Noise
b) Averaged Noise
d) Averaged Signal
f) Averaged Signal + Noise

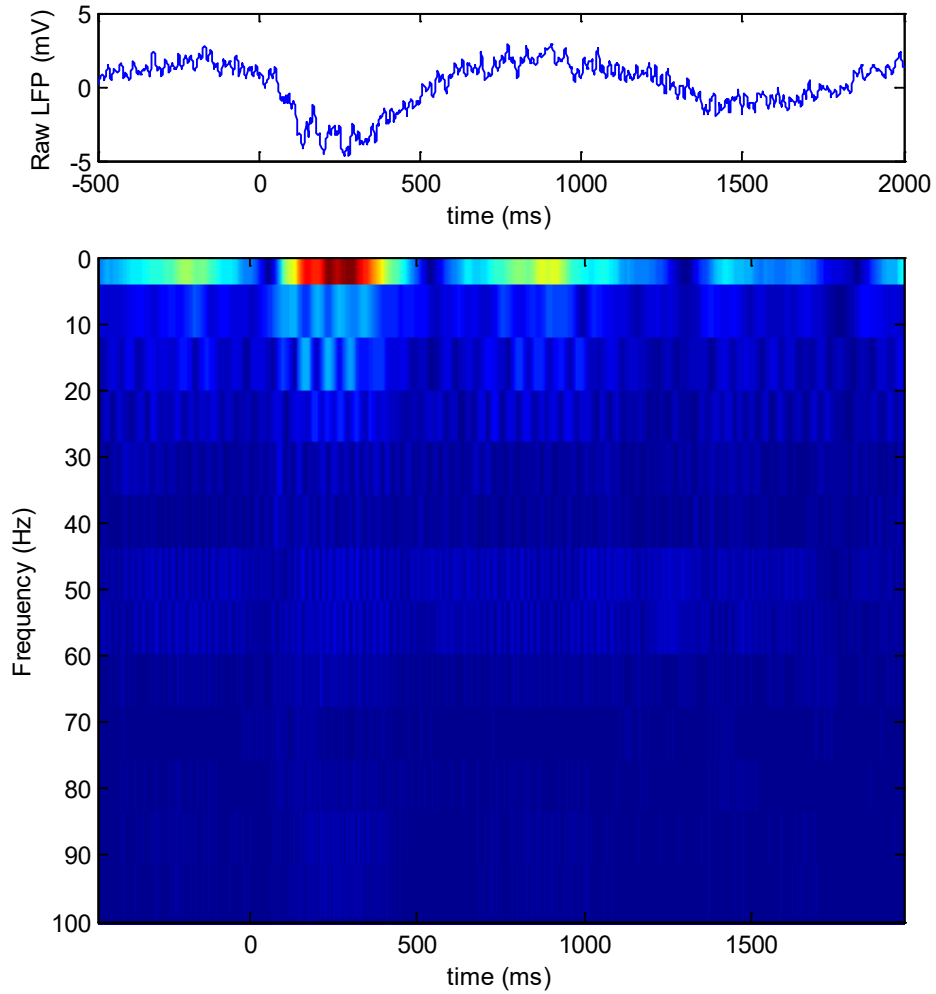
Fourier transform frequency domain



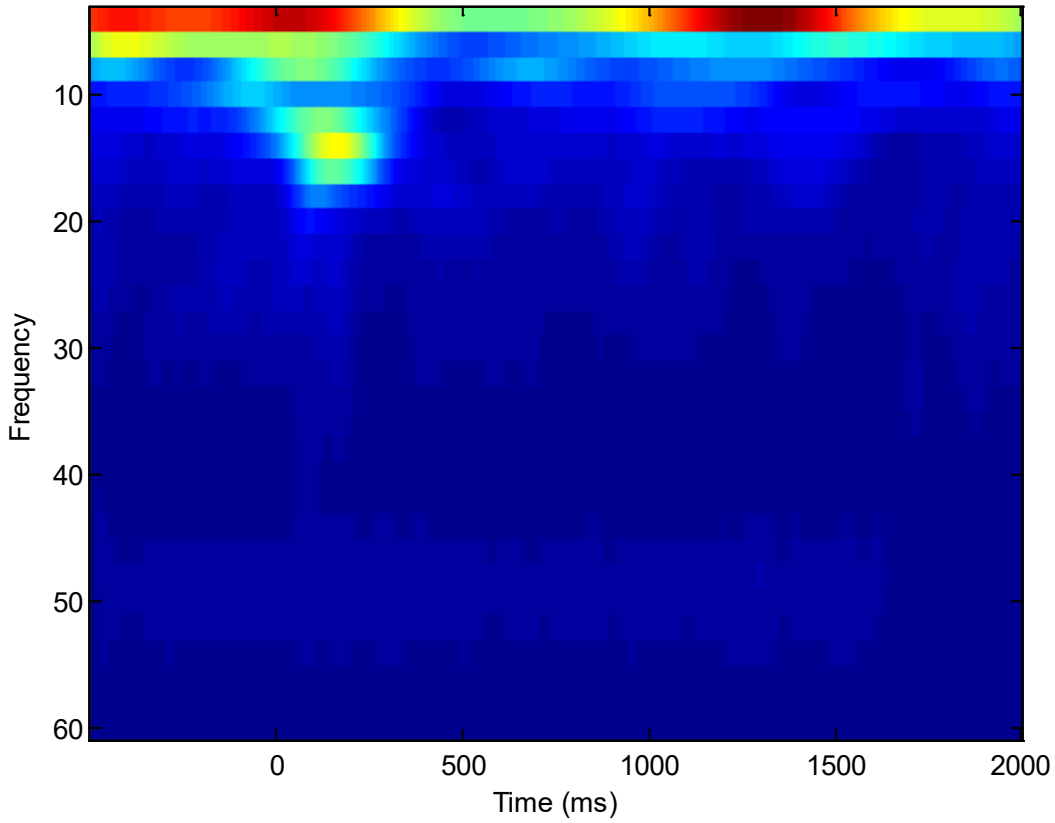


Time frequency map of signal

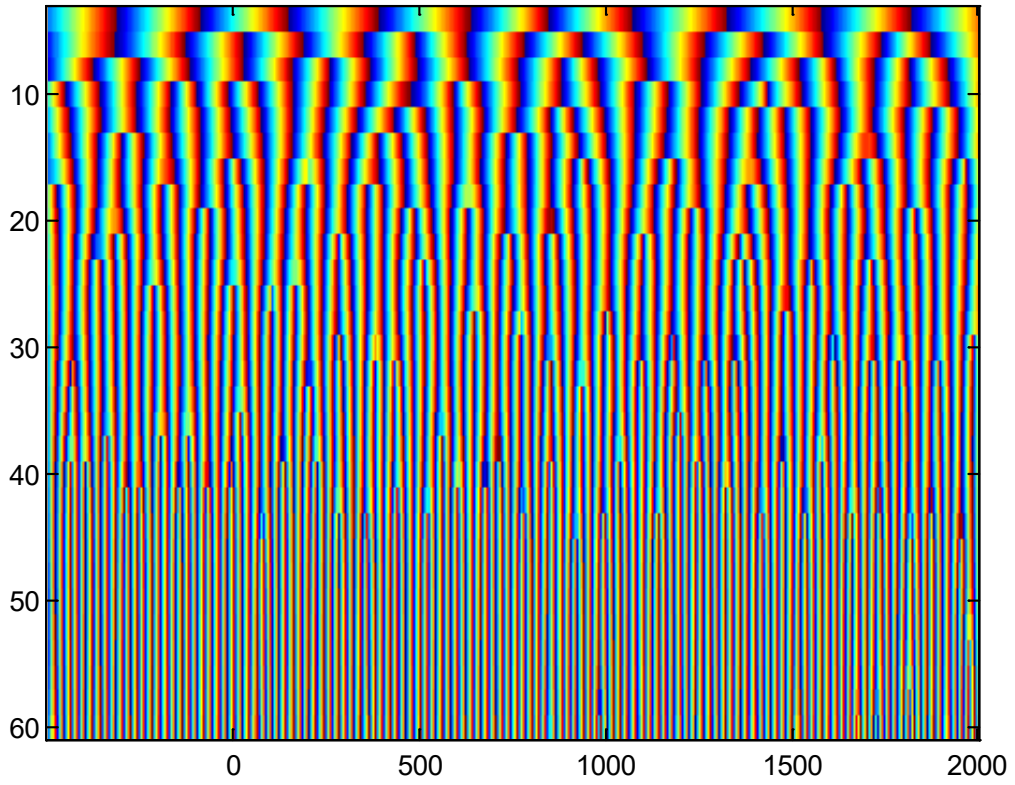




Power

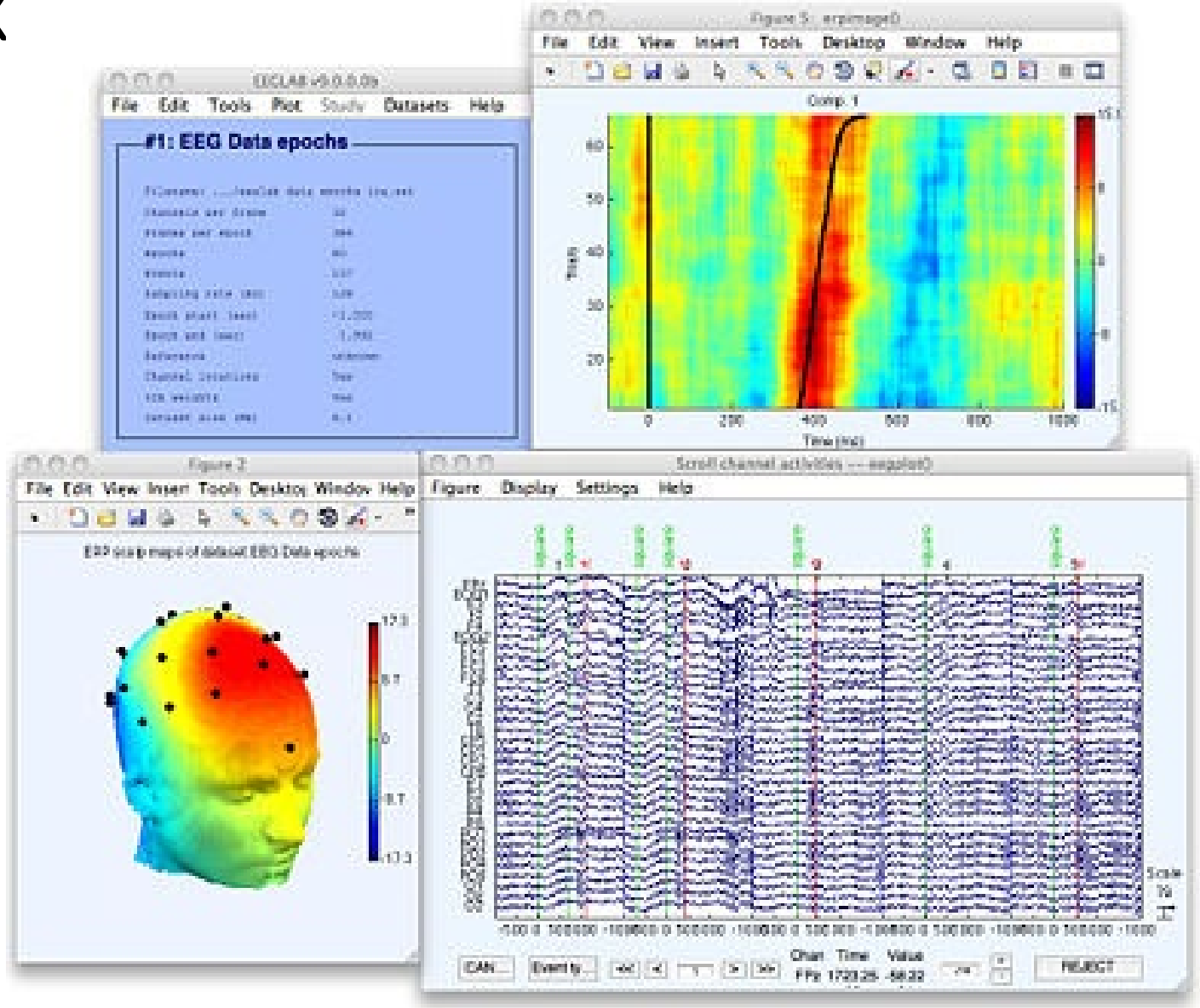


Phase Map



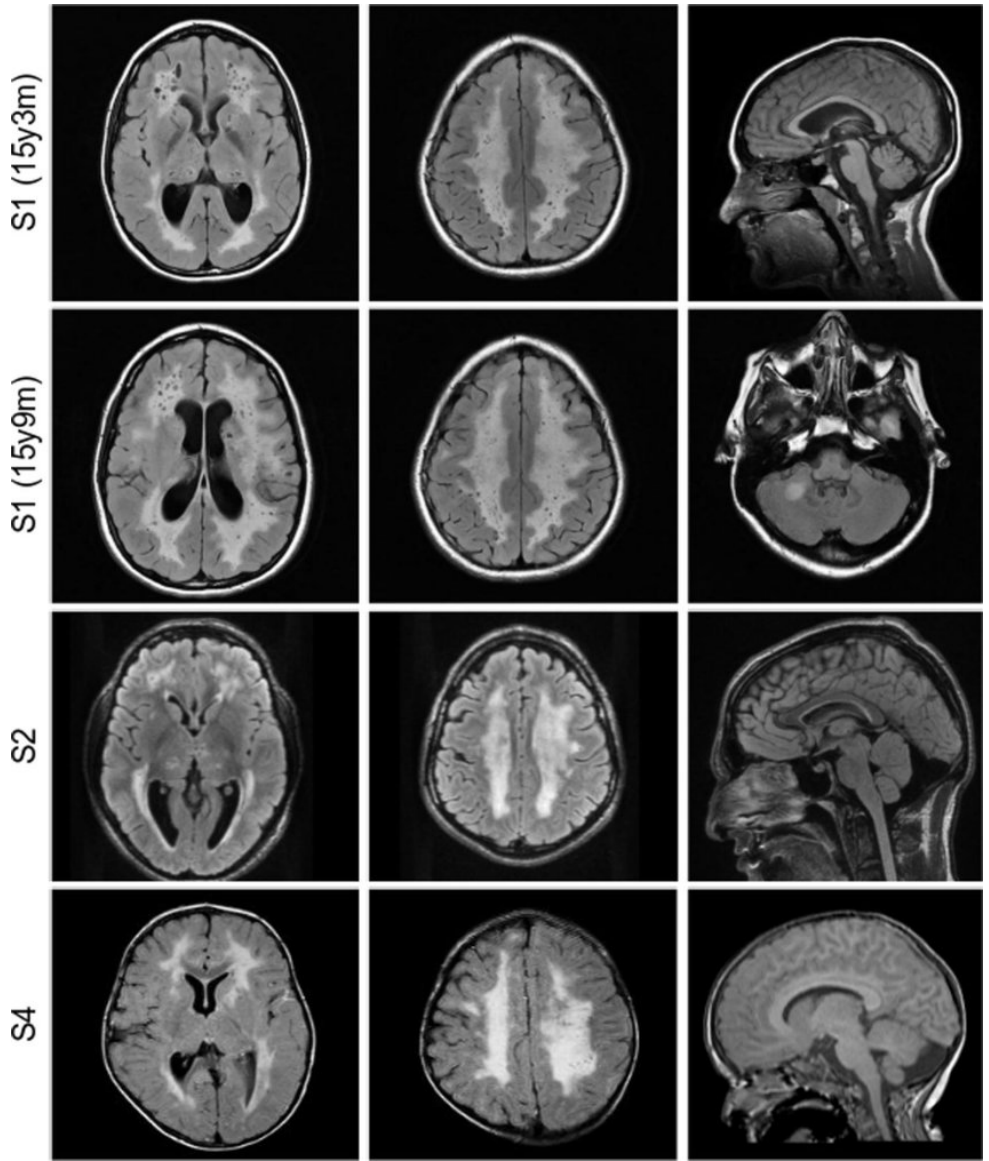
EEG Lab toolbox

https://sccn.ucsd.edu/eeglab/index.php



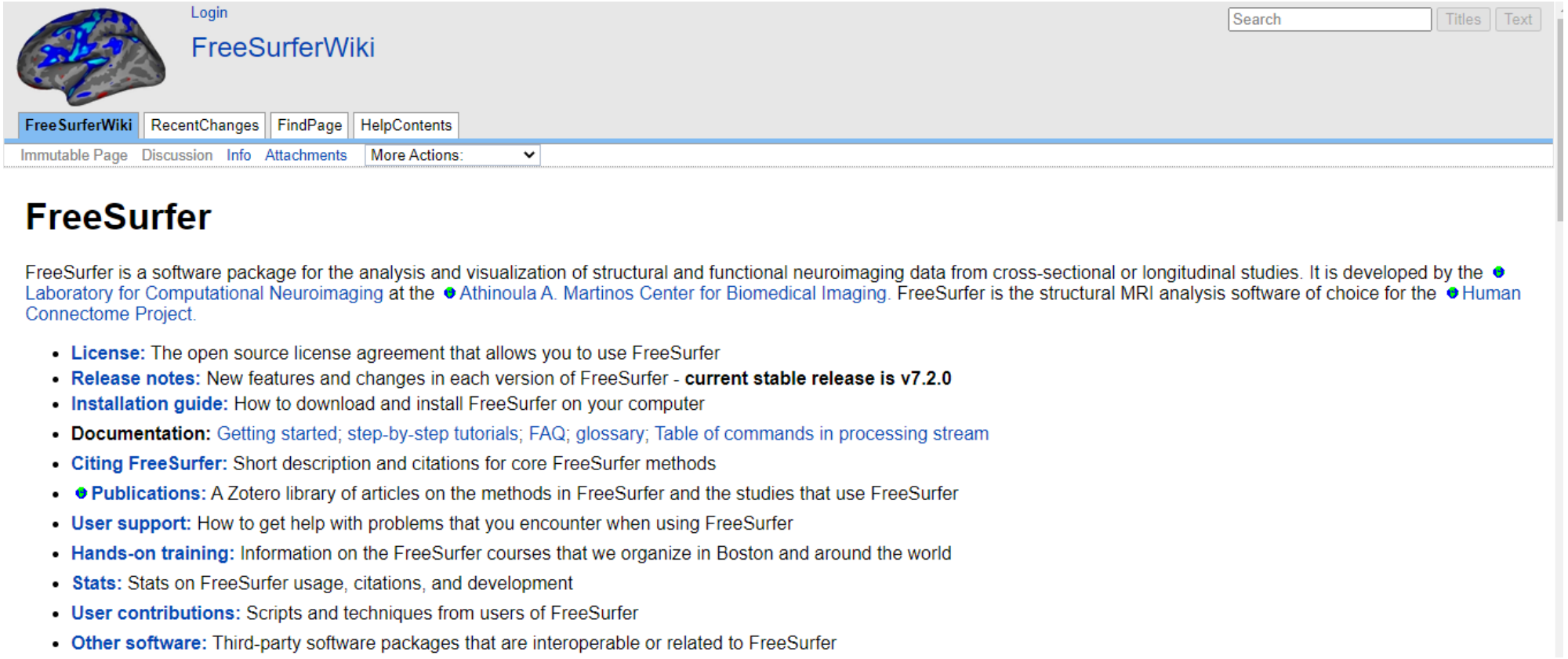
Imaging techniques

- MRI
- fMRI
- DTI
- CT scan
- PET scan



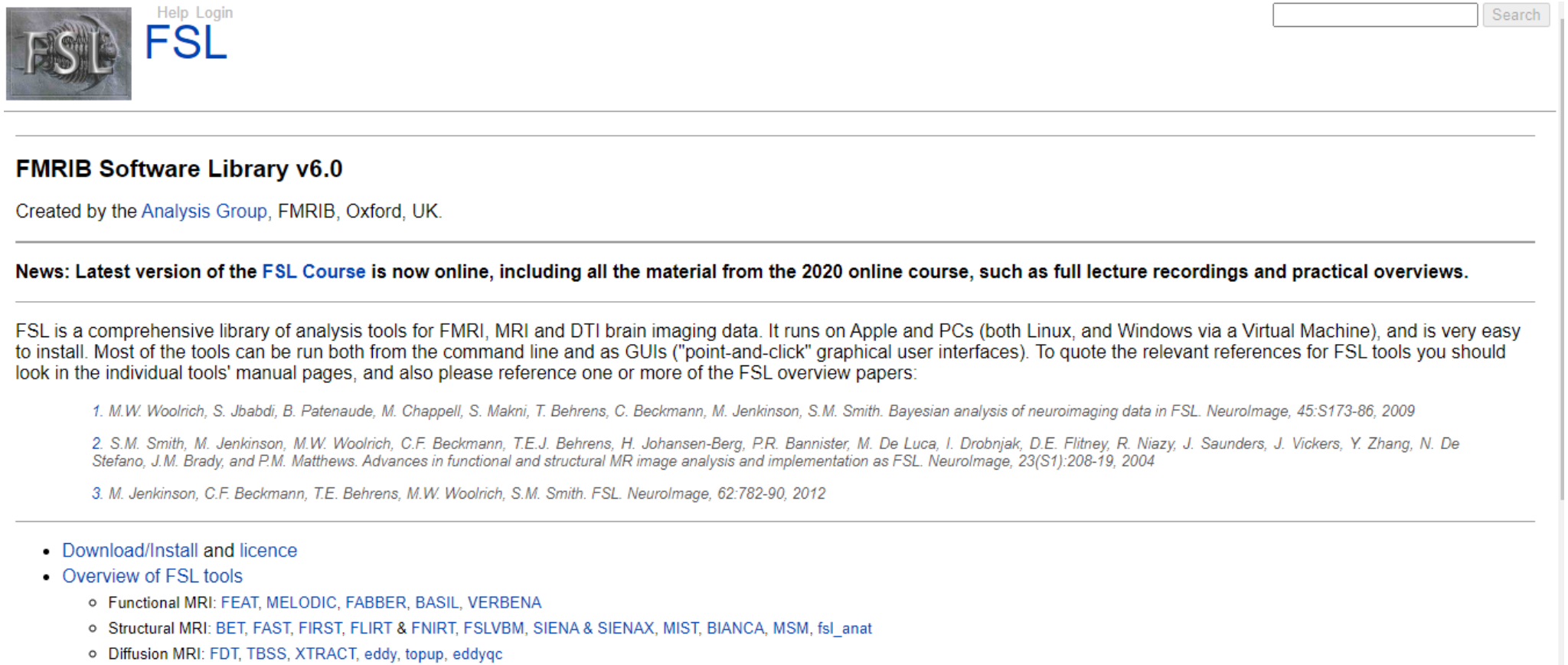
FreeSurfer

- https://surfer.nmr.mgh.harvard.edu/fswiki



FSL

- https://fsl.fmrib.ox.ac.uk/fsl/fslwiki



Help Login

FSL

Search

FMRIB Software Library v6.0

Created by the Analysis Group, FMRIB, Oxford, UK.

News: Latest version of the FSL Course is now online, including all the material from the 2020 online course, such as full lecture recordings and practical overviews.

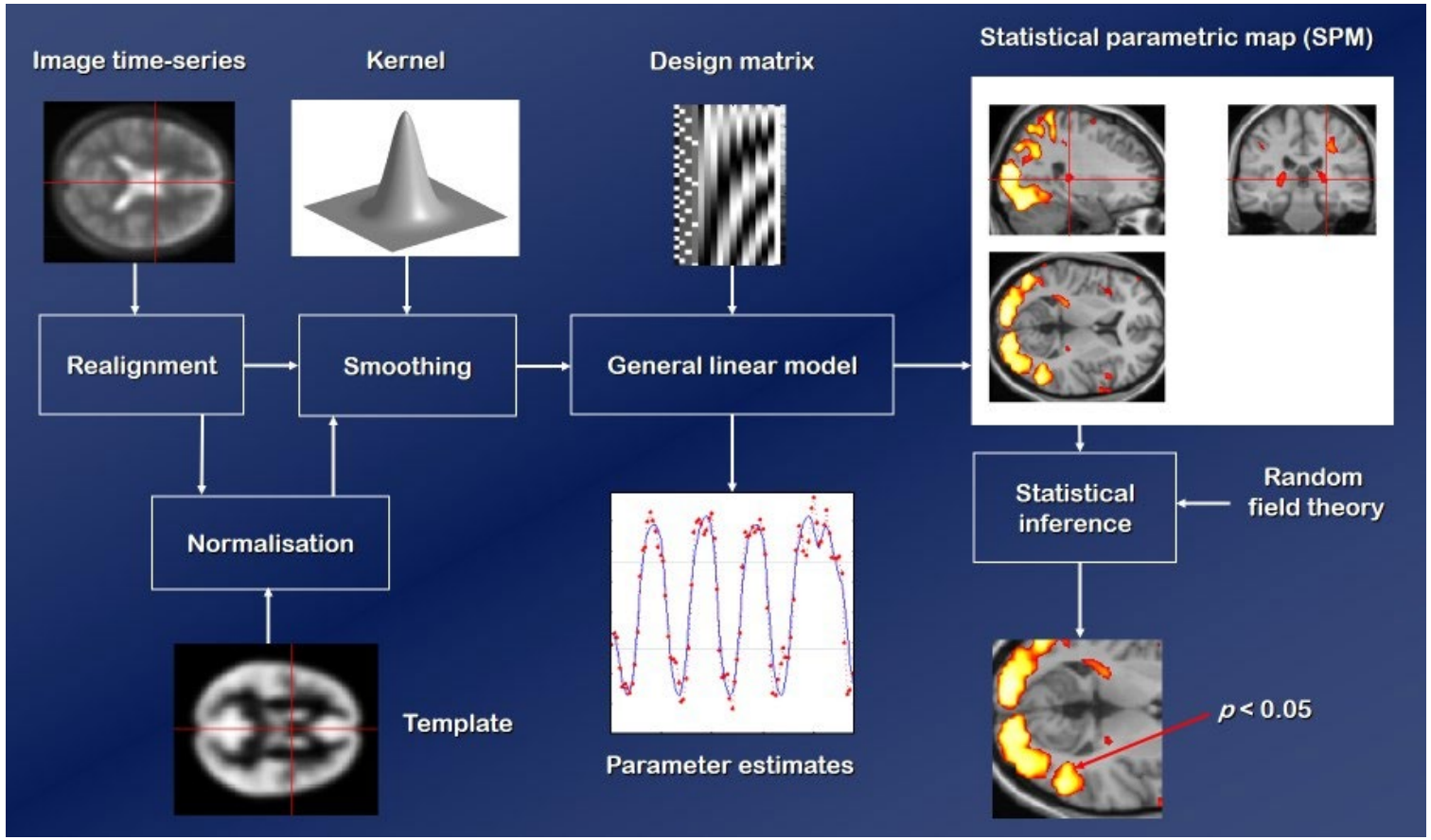
FSL is a comprehensive library of analysis tools for FMRI, MRI and DTI brain imaging data. It runs on Apple and PCs (both Linux, and Windows via a Virtual Machine), and is very easy to install. Most of the tools can be run both from the command line and as GUIs ("point-and-click" graphical user interfaces). To quote the relevant references for FSL tools you should look in the individual tools' manual pages, and also please reference one or more of the FSL overview papers:

1. *M.W. Woolrich, S. Jbabdi, B. Patenaude, M. Chappell, S. Makni, T. Behrens, C. Beckmann, M. Jenkinson, S.M. Smith. Bayesian analysis of neuroimaging data in FSL. NeuroImage, 45:S173-86, 2009*
2. *S.M. Smith, M. Jenkinson, M.W. Woolrich, C.F. Beckmann, T.E.J. Behrens, H. Johansen-Berg, P.R. Bannister, M. De Luca, I. Drobnjak, D.E. Flitney, R. Niazy, J. Saunders, J. Vickers, Y. Zhang, N. De Stefano, J.M. Brady, and P.M. Matthews. Advances in functional and structural MR image analysis and implementation as FSL. NeuroImage, 23(S1):208-19, 2004*
3. *M. Jenkinson, C.F. Beckmann, T.E. Behrens, M.W. Woolrich, S.M. Smith. FSL. NeuroImage, 62:782-90, 2012*

- Download/Install and licence
- Overview of FSL tools
  - Functional MRI: FEAT, MELODIC, FABBER, BASIL, VERBENA
  - Structural MRI: BET, FAST, FIRST, FLIRT & FNIRT, FSLVBM, SIENA & SIENAX, MIST, BIANCA, MSM, fsl_anat
  - Diffusion MRI: FDT, TBSS, XTRACT, eddy, topup, eddyqc

SPM

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

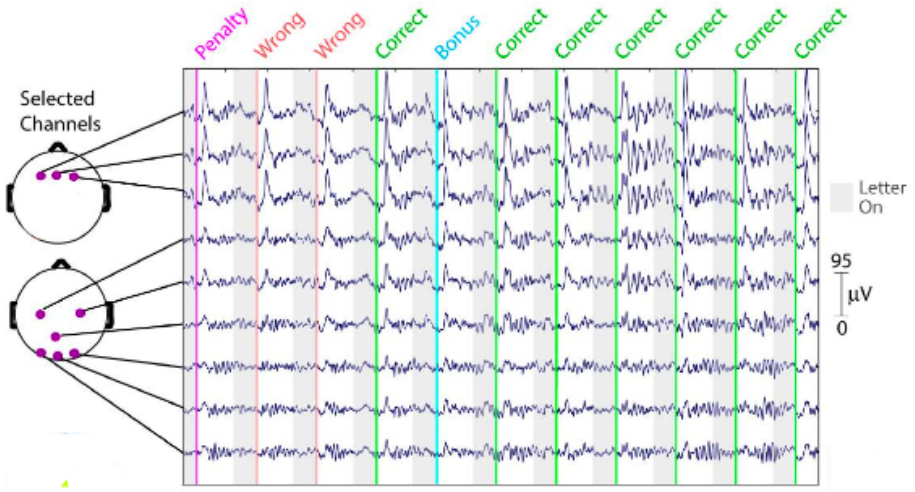


Assignment#15

https://sccn.ucsd.edu/~arno/fam2data/publicly_available_EEG_data.html

- Load S
  chann
- Calcul
- Load y

ne



EEG / ERP data available for free public download (updated 2020)

History of this page

Since there was no public database for EEG data to our knowledge (as of 2002), we had decided to release some of our data on the Internet. We have kept the page as it seems to still be usefull (if you know any database or if you want us to add a link to data you are distributing on the Internet, send us an email at arno@sccn.ucsd.edu).