



5th international Lead-DBS workshop 2020, Brisbane, Australia

The aim of this workshop is to give a comprehensive overview on a state-of-the-art neuroimaging pipeline for the context of deep brain stimulation (www.lead-dbs.org). The workshop will cover the processes of precise electrode localizations, multispectral spatial normalization, brain shift correction, subcortical electrophysiology mapping, structural and functional connectomics in DBS using patient-specific or normative connectome data, and related topics. After the workshop, participants will be able to analyze DBS electrode placement and connectivity as well as perform spatial mapping of clinical scores or electrophysiological measures.

TARGET AUDIENCE & PREPARATION

Ideally, participants should have at least minimal pre-existing experience with the use of Matlab and Lead-DBS. It is recommended that participants try the software on their own using online resources (see [walkthrough videos](#), [manual](#) and [help-forum / slack channel](#) on the website) in preparation for the workshop. Of note, Lead-DBS is not intended for clinical use but instead is a research tool that allows flexible and powerful analyses to empower scientific studies.

For best experience, it is important that participants bring their own laptops with Matlab >R2015b and the newest version of Lead-DBS preinstalled. Additionally, [SPM12](#) is needed, optionally, [3D Slicer software](#). We recommend at least 16 GB of RAM. Optimally, participants are expected to bring their own test datasets (pre- and postoperative imaging data) of DBS patients. Please see last page for further information.

SUGGESTED READING

As mentioned, best preparation is to walk through the basic steps of Lead-DBS before the workshop. Lead-DBS software can be freely downloaded from the [website](#). The following manuscripts give an up-to-date overview of analyses that are currently possible using Lead-DBS:

- [Lead-DBS v2 manuscript \(Horn, Li et al. 2018\)](#)
 - This manuscript gives a good overview on the current processing pipeline
- [Example of mapping electrophysiology to anatomy \(Horn et al. 2017\)](#)
 - This manuscript is an up-to-date example of the [subcortical electrophysiology mapping](#) approach.
- [Example study for connectivity benefit mapping \(Horn et al. 2017\)](#)
 - This manuscript is the first example of the [connectivity benefit mapping](#) method implemented in Lead-DBS.

We are looking forward to meeting you in Brisbane!

Best regards, Friederike and Andy

PROGRAMME

22nd February 2020		
09:00 AM	<i>Arrival / Welcome / Coffee</i>	
<i>Potential installation questions, setup of datasets</i>		
10:00 AM	Andreas Horn	Electrode localizations with Lead-DBS: Introduction and Examples
11:15 AM	Friederike Irmen	<i>Linear Deformations and Basics in Volumetric Imaging</i> Hands-On Session: Co-registrations in Lead-DBS
12:15 PM	Andreas Horn	<i>Function & anatomy of the subthalamic region, cortex-basal-ganglia loops and specialized MRI sequences for imaging the basal ganglia</i>
1:15 PM	<i>Lunch Break</i>	
2:15 PM	Andreas Horn	<i>Nonlinear Deformations, Atlases, Spaces and Advanced Concepts</i> Hands-On Session: Spatial Normalization, The MAGeT-Brain Approach and working with Lead-DBS on a High-Performance Compute Cluster
3:00 PM	Philip Mosley	<i>DBS Imaging of Nonmotor Effects: Experience in Brisbane</i>
3:45 PM	Friederike Irmen	<i>Electrode Reconstructions, VTA modeling</i> Hands-On Session: FEM based VTA model in Lead-DBS
4:00 PM	<i>Coffee break</i>	
4:30 PM	Andreas Horn	<i>Lead Connectome – functional and structural Connectomics</i> Hands-On Session: Processing a non-DBS structural / functional dataset
5:00 PM	Friederike Irmen	<i>Troubleshooting: What to do if co-registrations or normalizations fail</i> Hands-On Session: CT / MR Fusions using 3D Slicer
5:45 PM	<i>Clearing of open questions, re-cap / individual help on localizing DBS electrodes. In this session, processes that were explained too fast for individual participants may be reiterated</i>	
7:15 PM	<i>Social Dinner, Customs House</i>	

23rd February 2020

9:00 AM		<i>Arrival</i>
9:15 AM	Andreas Horn	<i>Connectomic Deep Brain Stimulation</i>
10:00 AM		<i>Coffee break</i>
10:15 AM	Andreas Horn	<i>Processing patient specific structural connectivity in Lead Connectome (DTI, Global Tractography, Generalized q-sampling imaging) Hands-On Session: Structural Connectomics in DBS</i>
11:15 AM	Andreas Horn	<i>Processing patient specific resting-state fMRI data in Lead Connectome (Preprocessing, graph theory, Hands-On Session: Functional Connectomics in DBS</i>
12:15 AM	Andreas Horn	<i>Using Normative Connectomes to analyze data in Lead Connectome Mapper</i>
1:15 PM		<i>Lunch Break</i>
2:15 PM	Friederike Irmen	<i>Concept: Analyzing task-DBS data with Lead-DBS</i>
3:15 PM	Friederike Irmen	<i>Group Analyses with Lead-DBS</i>
4:15 PM	Andreas Horn	<i>Subcortical Electrophysiology Mapping / Mapping Clinical Improvement Scores to the spatial domain</i>
5:15 PM	Andreas Horn	<i>Discriminative Fibertracts</i>
5:45 PM		<i>Clearing of open questions, re-cap / individual help on localizing DBS electrodes. In this session, processes that were explained too fast for individual participants may be reiterated</i>
06:15 PM		<i>End of workshop</i>

Dear Participants,

*for best experience during the course, please bring a laptop and
if you can, prepare the following:*

The latest **Lead-DBS** can be downloaded here:

http://lead-dbs.org/release/download.php?id=lead_dropbox

The latest **SPM12** can be download from here:

<http://www.fil.ion.ucl.ac.uk/spm/download/restricted/eldorado/spm12.zip>

An **example dataset** to be processed during the course can be downloaded here:

https://filedn.com/lsPIJ4ragTWjImV6PvIDQLu/data/course_example.zip

System requirements of the computer:

- Better to have a fast CPU, e.g. Intel Core i5 at least
- Better to have large RAM, 8 GB at least. To run ANTs registration, one would need at least 16 GB RAM.
- 64-bit OS
- MATLAB version > R2015b, newer versions preferable
- Matlab Statistics & Machine learning, as well as Image Processing toolboxes

For Windows users:

- It's recommended to install the runtime libraries: <https://www.lanzous.com/i1j69id> (all-in-one installer)

Other useful software:

- **Windows**
- MRICron: https://github.com/neurolabusc/MRICron/releases/download/v1.0.20180614/mricron_windows.zip
- ITK-SNAP: <https://master.dl.sourceforge.net/project/itk-snap/itk-snap/3.6.0/itksnap-3.6.0-20170401-win64.exe>
- 3DSlicer: <https://download.slicer.org/bitstream/738956>
- TrackVis: http://trackvis.org/bin/TrackVis_setup_v0.6.1.exe (**free but license needed**, register here: <http://www.trackvis.org/download/>)
- **Mac**
- MRICron: https://github.com/neurolabusc/MRICron/releases/download/v1.0.20180614/MRICron_macOS.dmg
- ITK-SNAP: https://master.dl.sourceforge.net/project/itk-snap/itk-snap/3.6.0/itksnap-3.6.0-20170401-MacOS-x86_64.dmg
- 3DSlicer: <https://download.slicer.org/bitstream/738961>
- TrackVis: http://trackvis.org/bin/TrackVis_v0.6.1_x86_64.dmg (**free but but license needed**, register here: <http://www.trackvis.org/download/>)