



dMRI-IEEG WIKI

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1 Overview

This wiki was authored by Jordan Bilderbeek. The document will walk through how to obtain, preprocess, and configure scripts or functions to obtain figures/descriptive statistics. The code repository is public and can be found on the MNL GitHub or at Jordan's repository: https://github.com/JordanBld/mnl_dmri_ieeg_tools

At a glance, this wiki will have multiple sections: a) what dMRI-IEEG tools can do, b) diffusion tracking in DSI studio, c) dMRI scripts, d) dMRI functions and i) conclusions. Important items throughout the wiki will be **bolded**.

2 What the tools can do

The following figures (1-4) will illustrate some of the tool's functionality.

1. Create high-quality renders integrating sEEG and DBS electrodes, diffusion tracks, and regions of interest.
2. Calculate distances from contacts to regions of interest (and their sub-fields).
3. Calculate distances/angles from contacts to track streamlines.
4. Create connectivity matrices for given contacts.

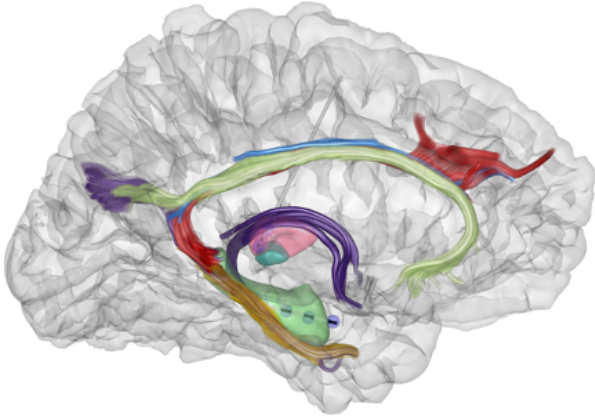


Figure 1: Glass brain render with limbic DSI studio tracks, electrode localization, and ROIs rendered to represent electrode targets.

3 dMRI scripts/functions setup

dMRI scripts and functions rely on two local (hidden to hide sub numbers and machine paths) scripts that need to be generated. They are fairly basic.

1. setMyMatlabPaths

Script to add path to dependencies.

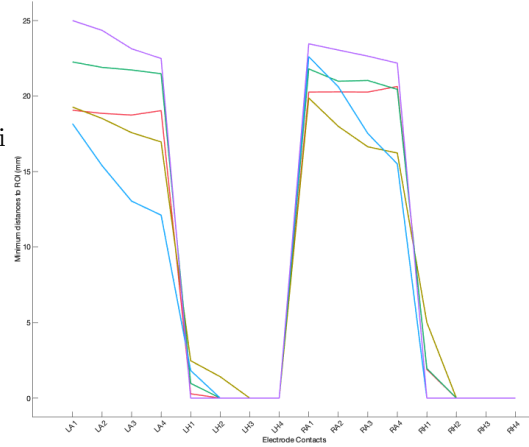


Figure 2: Distance (in mm) from DBS contacts to the hippocampus. L=Left, R=Right, A=ANT Target, H=Hippocampal Target, contact level (1=deepest).

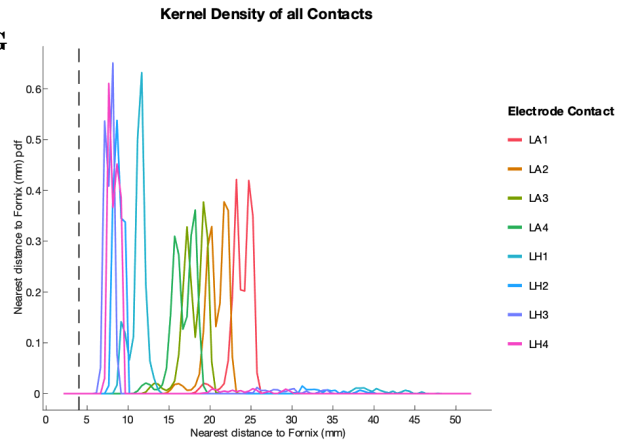


Figure 3: Kernel density of distances to track (Fornix). The vertical line at 4mm represents the stimulation distance threshold (under 4mm=activate).

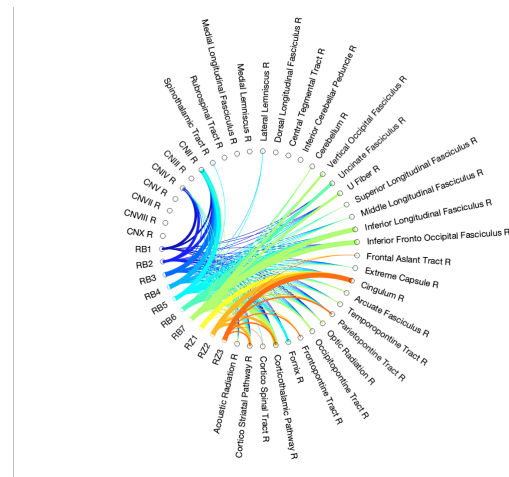


Figure 4: Connectivity matrix represented as circular connection plot. Lines emerge from electrode contacts and project to track ROI if DSI seed tracking passes through the region.

2. dmri_subject_list

Function with output my_subject_labels and bids_path. Subject label output is cell array i.e. = 'sub01', 'sub01'. Bids path is path to high level bids directory.

3. Dependencies

Dependencies are Vistasoft, along-tract-stats, AFQ, mnl_ieegBasics, SPM12, mnl_dataCuration, mnl_seegview

Furthermore, based on variations in where/how data is stored and managed, you may be required to configure paths in the scripts and functions.

4 dMRI scripts

This section will highlight the most important scripts within the dMRI-IEEG tools repository.

script04_renderTractswithDBS (rendering)

This script is primarily used for DBS glass brain figures and can be used for sEEG (render_dbs_lead call must be adjusted on line 89/91 for each electrode lead).

script08_calc_statistics (calculations)

This script calculates distances to tracks and ROIs and angles to tracks if within 4mm. Must be re-run with an alternate subnum to change through the subject labels.

script09_renderTracts_sEEG (rendering)

Renders sEEG electrode(s) with tracks. Prompts for user input and allows for comma sep values (for multiple sEEG electrodes in one figure). Can also render ROIs using the renderROI function.

script10_renderROIwithElectrodes (rendering)

Script to plot ROIs and leads within glass brain volume without tractography.

script11_eval_statistics (evaluating calculations)

Evaluates calculations from script08. Uses gramm toolbox to perform ggplot-like plotting. Analogous to script13 (different cohort) and script16 (multiple subjects).

script14_dist_btwn_pairs (calculations)

A script to evaluate conduction velocity. Given an electrode pair along the same track, the script takes the nearest track point for each electrode, clips the track, and finds the distance between the two points.

script14_writeseg_MRICroGL

A script that copies python code to the clipboard, which can be used in MRICroGL to script mosaic figures.

5 dMRI functions

This section will highlight the most important functions within the dMRI-IEEG repository. Each function is well documented in their .m file, but this section aims to provide a broad-level overview of how things run under the hood.

addElectrode (rendering)

Plots colored spheres based on electrode contact points. Can fit a spline through it if needed for a cheap visualization of a DBS/sEEG lead.

custom_legend (rendering)

A custom legend function that takes the track names and associates it with the colors they are plotted as, can also include ROIs.

glass_brain_fig (rendering)

Function-version of render_dbs_lead. Allows us to iterate through different subjects and save the figure files.

render_dbs_lead (rendering)

The main heavy-lifting function which performs all of the lead renderings (for sEEG and DBS).

renderROI (rendering)

Renders an ROI from a nifti-loaded structure. The third argument will specify if we have to take a subset of the nifti file for the ROI.

create_trkstruct (helper)

Creates a structure that holds all of the tracks to be plotted, which can then be fed into AFQ.

getDSITracks (helper)

Pulls all .trk.gz files based on a given path input.

gz_unzip (helper)

Unzips .trk.gz files for plotting if necessary.

sEEGsorter (helper)

Reads the electrodes.tsv file and sorts probe locations based on names. Will create a 1xN structure with the fields name and position. struct(1).name and struct(1).positions will give the probe name (ex: RB) and xyz positions for all contacts in the probe.

linreg3 (calculations)

Performs best fit via SVD along the principal component axis to improve electrode CTMR output.

roi_distance (calculations)

Calculates distance from electrode contact to the nearest vertex of an ROI file.

strm_angle (calculations)

Calculates the angle between a principal component axis vector on a track and contact to track vector.

strm_distance (calculations)

Performs Euclidean distance calculation from one electrode contact to all tracks.

trk_distance (calculations)

Calculates the total distance from the start of a streamline to the end of the streamline. Jitter is added in case a X, Y, or Z value along the streamline is not unique.

6 Conclusions

I hope this wiki has been informative and detailed enough in order to use the repository in a viable manner. For more information regarding use, bugs, or questions, contact Jordan Bilderbeek at j.bilderbeek@icloud.com or jbilderbeek@uchicago.edu.