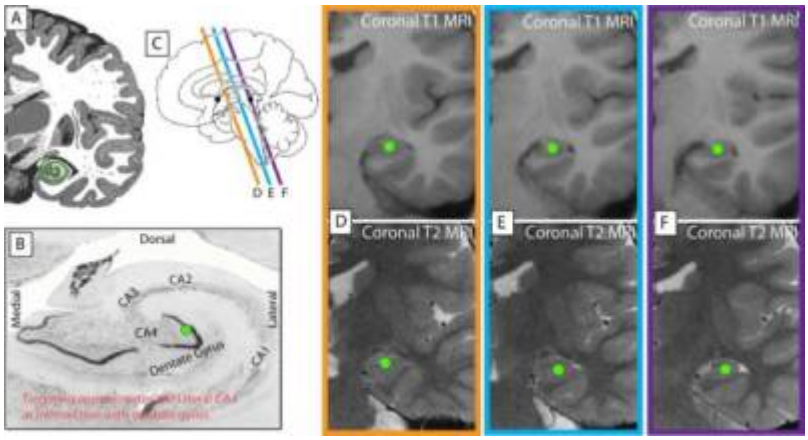
MATLAB

MATLAB is a multi-paradigm numerical computing environment and proprietary programming language developed by MathWorks.

Mathematical modeling of behavior during a psychophysical task, referred to as “computational psychiatry,” could greatly improve our understanding of mental disorders. One barrier to the broader adoption of computational methods, is that they often require advanced statistical modeling and mathematical skills. Biological and behavioral signals often show skewed or non-Gaussian distributions, and very few toolboxes and analytical platforms are capable of processing such signal categories. We developed the Computational Psychiatry Adaptive State-Space (COMPASS) toolbox, an open-source MATLAB-based software package. This toolbox is easy to use and capable of integrating signals with a variety of distributions. COMPASS has the tools to process signals with continuous-valued and binary measurements, or signals with incomplete-missing or censored-measurements, which makes it well-suited for processing those signals captured during a psychophysical task. After specifying a few parameters in a small set of user-friendly functions, COMPASS allows users to efficiently apply a wide range of computational behavioral models. The model output can be analyzed as an experimental outcome or used as a regressor for neural data and can also be tested using the goodness-of-fit measurement. Here, we demonstrate that COMPASS can replicate two computational behavioral analyses from different groups. COMPASS replicates and can slightly improve on the original modeling results. We also demonstrate the use of COMPASS application in a censored-data problem and compare its performance result with naïve estimation methods. This flexible, general-purpose toolkit should accelerate the use of computational modeling in psychiatric neuroscience [1)].

Miller et al., from the Department of Neurosurgery of Stanford and Kaiser Permanente Redwood City Medical Center, proposed and presented a novel stereotactic coordinate system based on mesial temporal anatomical landmarks to facilitate the planning and delineation of outcomes based on extent of ablation or region of stimulation within mesial temporal structures.



The body of the hippocampus contains a natural axis, approximated by the interface of cornu ammonis (CA4) and the dentate gyrus. The uncal recess of the lateral ventricle acts as a landmark to characterize the anterior-posterior extent of this axis. Several volumetric rotations are quantified for alignment with the mesial temporal coordinate system. First, the brain volume is rotated to align with

standard anterior commissure-posterior commissure (AC-PC) space. Then, it is rotated through the axial and sagittal angles that the hippocampal axis makes with the AC-PC line.

Using this coordinate system, customized MATLAB software was developed to allow for intuitive standardization of targeting and interpretation. The angle between the AC-PC line and the hippocampal axis was found to be approximately 20°-30° when viewed sagittally and approximately 5°-10° when viewed axially. Implanted electrodes can then be identified from CT in this space, and laser tip position and burn geometry can be calculated based on the intraoperative and postoperative MRI.

With the advent of stereotactic surgery for mesial temporal targets, a mesial temporal stereotactic system is introduced that may facilitate operative planning, improve surgical outcomes, and standardize outcome assessment [2].

Using an administrative database and chart review, Ramayya et al., identified 101 first-time external ventricular drain placements performed at the bedside. They collected data regarding demographics, medical comorbidities, complications, and catheter tip location. They performed univariate and multivariate statistical analysis using MATLAB. They corrected for multiple comparisons using the false discovery rate (FDR) procedure.

Multivariate regression analyses revealed that revision procedures were more likely to occur after drain blockage (odds ratio [OR] 17.9) and hemorrhage (OR 10.3, FDR-corrected P values < 0.01, 0.05, respectively). Drain blockage was less frequent after placement in an “optimal location” (ipsilateral ventricle or near foramen of Monroe; OR 0.09, P = 0.009, FDR-corrected P < 0.03) but was more likely to occur after placement in third ventricle (post-hoc P values < 0.015). Primary diagnoses included subarachnoid hemorrhage (n = 30, 29.7%), intraparenchymal hemorrhage with intraventricular extravasation (n = 24, 23.7%), tumor (n = 20, 19.8%), and trauma (n = 17, 16.8%). Most common complications included drain blockage (n = 12, 11.8%) and hemorrhage (n = 8, 7.9%). In total, 16 patients underwent at least 1 revision procedure (15.8%).

Bedside external ventricular drain placement is associated with a 15% rate of revision, that typically occurred after drain blockage and postprocedure hemorrhage. Optimal placement within the ipsilateral frontal horn or foramen of Monroe was associated with a reduced rate of drain blockage [3].

References

1)
Yousefi A, Paulk AC, Basu I, Mirsky JL, Dougherty DD, Eskandar EN, Eden UT, Widge AS. COMPASS: An Open-Source, General-Purpose Software Toolkit for Computational Psychiatry. Front Neurosci. 2019 Jan 11;12:957. doi: 10.3389/fnins.2018.00957. eCollection 2018. PubMed PMID: 30686965; PubMed Central PMCID: PMC6336923.
2)
Miller KJ, Halpern CH, Sedrak MF, Duncan JA, Grant GA. A novel mesial temporal stereotactic coordinate system. J Neurosurg. 2018 Jan 1:1-9. doi: 10.3171/2017.7.JNS162267. [Epub ahead of print] PubMed PMID: 29372873.
3)
Ramayya AG, Glauser G, Mcshane B, Branche M, Sinha S, Kvint S, Buch V, Abdullah KG, Kung D, Chen HI, Malhotra NR, Ozturk A. Factors Predicting Ventriculostomy Revision at a Large Academic Medical Center. World Neurosurg. 2018 Nov 29. pii: S1878-8750(18)32755-4. doi:

10.1016/j.wneu.2018.11.196. [Epub ahead of print] PubMed PMID: 30503293.