**Introduction**

Intracranial electroencephalography (iEEG) provides a unique opportunity to measure human brain function with implanted electrodes. A key step in neuroscience inference is localizing the implanted electrodes relative to individual subject anatomy and identified regions in brain atlases. While there are many existing solutions for electrode localization, they suffer from three major limitations. First, they require scientists to install and use many different software packages to complete the process. Second, they are time consuming: while most iEEG analysis is automated, electrode localization is still largely a manual process. Third, they have limited functionality beyond creating a table of coordinates.

We developed the YAEL (Your Advanced Electrode Localizer) software package to overcome these obstacles. First, YAEL is completely integrated, requiring installation of only a single package and a single easy-to-use graphical user interface (GUI) for every step of the process. Second, YAEL uses advanced visualization and automation tools to make accurate localization of electrodes quick and easy. Third, YAEL contains a flexible 2D/3D viewer which allows users to visualize iEEG data, such as the response to tasks or clinical measures. YAEL is a full-featured iEEG software toolbox and contains approximately 30,000 lines of code.

**Electrode localization**

The YAEL 3dViewer, powered by hardware acceleration, renders in any web browser, making it platform independent. Users have the flexibility to zoom or rotate the 3dViewer using intuitive mouse controls or convenient keyboard shortcuts.

Double-click on CT density blobs to localize electrodes

**YAEL Workflow**

Prior to electrode localization, the CT and MRI datasets must be registered. Installing YAEL also installs two popular image registration tools: Advanced Normalization Tools (ANTs) and NiftyReg. After selecting the CT and MRI datasets with the built-in file browser, users can call either package with a single click from within YAEL. From within YAEL, users may also call the FMRIB Linear Image Registration Tool (FLIRT) in the FSL software library (separate installation required). FreeSurfer is a very commonly used package for creating surface models from MRI datasets, and automatically parcellates many cortical and subcortical structures. Users can call FreeSurfer with a single click from within YAEL.

**Comparison between down-sampled CT vs. original CT with native resolution**

A. Electrode design diagram; the mini-electrode diameters are 0.5mm
B. Visualization using down-sampled CT
C. YAEL uses native resolution; mini-electrodes are clearly visible

**Group analysis**

Template MNI coordinates

YAEL provides 3 ways
* Affine transform
* SDR (symmetric diffeomorphism registration)
* Gyrification matching (surface electrodes only)

Automatic atlas labels

YAEL derives anatomical labels automatically from Desikan-Killiany and Destrieux parcellations, or any other standard atlas.

**Easy installation:** https://yael.wiki

Support is available on a dedicated yael_support Slack channel, over Zoom, or via in-person workshops.

Funding provided by NIH 1R24MH117529.