B36

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The NetPyNE multiscale modeling tool: latest features and models.

NetPyNE is an NIH-funded tool for data-driven multiscale modeling of brain circuits. It enables users to consolidate complex experimental data from different brain scales into a unified mechanistic computational model. NetPyNE builds on top of NEURON, one of the most widely used neural simulation engines. NetPyNE uniquely integrates all major steps of the modeling workflow under a single framework. The core of NetPyNE consists of a standardized JSON-like declarative language that allows the user to define the model across scales, from molecules to neurons to circuits, and which has been officially endorsed by The International Neuroinformatics Coordinating The functionality of NetPyNE, its robustness, unit-tests coverage and source code quality is constantly improving. Most recent features include automated validation of user-provided network specification, API for selective loading of NEURON mechanisms, a universal way to describe gap junctions, graded synapses or, more generally, any mechanism of continuous information transmission between pre- and post-synaptic variables. Ongoing efforts project to enhance NetPyNE with extended capabilities regarding external stimulation (tACS, MEG). The batch simulations and parameter optimization functionality has been refactored for maintainability and reliability, as well as expanded to utilize Ray Tune's optimization tools and data reporting. To ensure a consistent user experience across various NetPyNE models, we've devised a standardized way for organizing model files, which also simplifies the loading and saving process. In addition, it will set the basis for the "netpyne" command-line application. At least 25 publications describe models or tools that have made use of NetPyNE, including our recent detailed models of the motor, auditory and somatosensory thalamocortical circuits, and of spinal cord circuits. Others have developed NetPyNE models to study Parkinson's disease, schizophrenia, ischemic stroke and epilepsy.