spiking neural network simulator

Forschungszentrum Jülich / Ralf-Uwe Limbach / SBC Lehmann   Capone et al., 2019, Potjans, 2014   Capone et al., 2019, Senk et al., 2018

wide scalability — *open model structure* — *scientific insight*

NEURAL SIMULATION TOOL

▶▶ TECHNOLOGY DESCRIPTION

NEST is a simulator for spiking neural network models that focuses on the dynamics and structure of neural systems, rather than the exact morphology of individual neurons.

It is ideal for networks of any size, including models of information processing (e.g. in the visual or auditory cortex of mammals), models of network activity dynamics (e.g. laminar cortical networks or balanced random networks) and models of learning and plasticity. NEST is openly available for download and installable through various standard methods like apt, conda, docker or homebrew. Any developed model can grow with the user's experience seamlessly, running the same code from laptops to the largest supercomputers.

SPIKING AND CONTINUOUS INTERACTIONS ~ USER DEFINABLE NEURON, SYNAPSE AND NETWORK MODELS ~ RE-USABLE REFERENCE IMPLEMENTATIONS OF MANY MODELS AVAILABLE ~ ALL NEURON AND SYNAPSE STATE INFORMATION ACCESSIBLE ~ FROM MODEL EQUATIONS TO LARGE NETWORK DYNAMICS IN A FEW STEPS

OPEN-SOURCE ~ COMMUNITY DRIVEN DEVELOPMENT ~ PYTHON API ~ C++ BASED KERNEL ~ MPI/OpenMP HYBRID PARALLELIZATION ~ EXASCALE READY ~ VARIOUS I/O INTERFACES ~ CONTAINER DEPLOYMENT OPTIONS

AREAS

Network Dynamics | Point-neurons | Exascale Computing

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▶▶ COMPETITIVE ADVANTAGES

- NEST code runs on your laptop or on large supercomputers
- Based on over 20 years of experience in parallel computing
- High-quality results through code review and extensive testing and validation
- Compatibility and interoperability with other modelling tools such as PyNN
- Many standard models for neurons and synapses available by default and easy to extend
- Easy use and integration through Python-based user interface
- Simplified installation procedures using virtual machines, Conda, and Docker
- Active developer and user community, structured high-level support and dedicated user, developer and maintenance docs
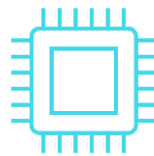
nest::

nest-simulator.org

SIMULATOR FOR SPIKING NEURAL NETWORK MODELS OF ANY SIZE

▶▶ APPLICATION & MARKET POTENTIAL

Research
Simulate neuroscientifically realistic models seamlessly from laptops to supercomputers

Neurorobotics and AI
Many new technologies can build on NEST as a back-end and profit from biological and neuroscientific insight.

Neuromorphic Hardware
NEST acts as a reference implementation to validate neuromorphic systems and is an active competitor for fastest simulation speeds and lowest energy consumption.

Education & Teaching
The graphical front-end NEST Desktop provides a low threshold, installation-less entry to neuroscientific models and the analysis of network dynamics. An intuitive tool for teaching & learning.

▶▶ REFERENCES

Homepage: https://nest-simulator.org/
Download: https://www.nest-simulator.org/download/
Documentation: https://nest-simulator.org/documentation
Community: https://nest-simulator.org/community/
Github: https://github.com/nest/nest-simulator
Twitter: @NestSimulator

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TECHNOLOGY READINESS LEVEL

1 2 3 4 5 6 **7** 8 9

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