NEST Conference 2024



Contribution ID: 4 Contribution code: K-1

Type: Keynote

Diversity and inclusion: Distributed simulation of multiple brain and body models in multiple simulators on multiple computers across multiple organizations

Monday 17 June 2024 09:15 (45 minutes)

NEST is the one of the most standard and widely used simulation environment. It is the first-class simulator in our project endorsed by Program for Promoting Researches on the Supercomputer Fugaku [1], where we develop a spiking network model of the mouse brain in NEST on Fugaku, and connect it to a musculoskeletal body model running on a local PC to realize a closed-loop brain-body simulation over the Internet while passing firewalls. Moreover, we include another brain model written in C++ with CUDA on a local GPU machine into the closed loop. To realize this, we needed a way to connect multiple models implemented in multiple simulators running on multiple computers across multiple organizations. We solved this by using Robot Operating System (ROS) [2], which is a de-facto standard communication framework used in the field of robotics, and rosbridge, which encapsulates ROS messages with JSON and transfers via websocket to pass firewalls. Specifically, we developed a C++ library for rosbridge that allows simulators written in C/C++ to communicate over rosbridge. By using those technologies, we were able to realize a closed-loop simulation among a cortico-basal ganglia-thalamus model in NEST on Fugaku, a mouse body model in Gazebo on a local PC, and a cerebellar model in C++ with CUDA on another local GPU machine [3]. These results suggest that ROS and rosbridge can provide more flexibility to and enhance the versatility of NEST.

Acknowledgements

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References

[1] https://www.r-ccs.riken.jp/en/fugaku/org-relations/promoting-research/; [2] M Quigley et al. (2009). "ROS: an open-source robot operating system," in ICRA Workshop on Open Source Software (Kobe); [3] Y Kuniyoshi et al. Embodied bidirectional simulation of a spiking cortico-basal ganglia-cerebellar-thalamic brain model and a mouse musculoskeletal body model distributed across computers including the supercomputer Fugaku. Frontiers in Neurorobotics, 17:1269848 (13 pages), 2023.

Preferred form of presentation

Talk (& optional poster)

Keywords

Distributed simulation, Brain-body simulation, Closed-loop simulation, ROS, Fugaku, Neurorobotics Platform

Topic area

Interoperability, data and infrastructure

Speaker time zone

UTC+9

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