## Combining NEST Simulator and Python Modules in Parallel HPC Implementation

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During our work on implementation of a hierarchical spike timing model of dynamic visual information processing and decision making via reinforcement learning [1] we have encountered a problem to conduct complete simulation combining an open source Python module [2] of retinal ganglion cells with NEST module for the rest of modelled brain structures. It appeared that the bottleneck in overall simulation was the retinal ganglion cell layer that took much more computational time than the rest of the model so we have implemented it in parallel simulation using mpi4py [3] that shortened computational time more than 17 times even on a 8 cores desktop computer. However, joint simulation of both Python and NEST modules still remained a challenging task. That is why in our recent work [4] we have implemented a joint parallel simulation of both modules via spawning the Python module and consecutive running the NEST module. We have tested our parallel implementation of a piece of our model from [1] consisting of a layer of retinal ganglion cells in Python and a layer of LGN cells in NEST version 2.18 [5] on the HPC facility of our institute - the supercomputer Avitohol. Simulations of the developed module on different number of nodes and varying number of parallel processes were investigated and compared with respect to their time consumption.

## Acknowledgements

This work was partially supported by the Bulgarian Science Fund under the project No DN02/3/2016 "Modelling of voluntary saccadic eye movements during decision making". We also acknowledge the provided access to the e-infrastructure of the NCHDC - part of the Bulgarian National Roadmap on RIs, with the financial support by the Grant No DO1 – 387/18:12:2020.

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