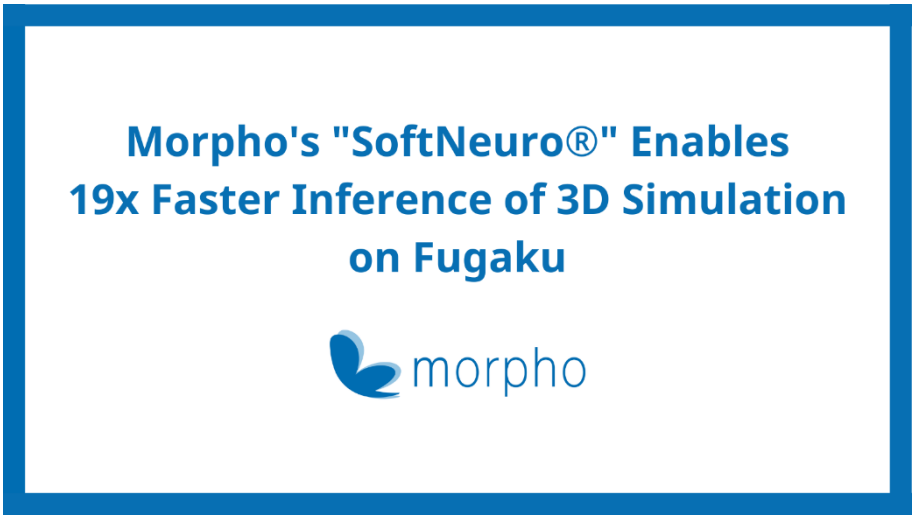
Morpho's "SoftNeuro" Enables 19x Faster Inference of 3D Simulation on Fugaku

Tokyo, Japan – February 8th, 2023– Morpho, Inc. (hereinafter, "Morpho"), a global leader in image processing and imaging AI solutions, announced today that it has provided deep learning inference engine "SoftNeuro®" to a project promoted by the University of Tokyo, Tohoku University, and Kobe University to accelerate high-resolution galaxy formation simulations using deep learning on the supercomputer Fugaku. The result is approx. 19.2 times faster inference time(*1) and approx. 93% reduction(*2) in power consumption.



About Conditions and Measured Values

[Conditions]

- "SoftNeuro" is used for 3D-Unet inference on Fugaku.
- Comparison of inference speed using TensorFlow (available as standard on Fugaku) and using "SoftNeuro" optimized for Fugaku.
- Each Fugaku uses 1 node (48 cores).

[Measured Values]

◆ Average elapsed time

Using "SoftNeuro" optimized for "Fugaku": approx. 19.2 times faster (*1)

Inference Engine	Inference Time（ms）
TensorFlow	2820
"SoftNeuro"	147

◆Average power consumption
Using "SoftNeuro" optimized for "Fugaku": approx. 93% reduction in power consumption (*2)

Inference Engine	Power Consumption（W*s）
TensorFlow	130.0
“SoftNeuro”	8.6

*1, 2: Executed one at a time (each execution calls the inference function only once.) five times. The average of the measured values across five executions is the result.

“SoftNeuro” supports major deep learning frameworks and performs faster processing in various edge-device environments. Since it is a general-purpose inference engine, it can be used not only for image recognition but also for speech recognition and text analysis. Morpho has proposed and provided “SoftNeuro” for multi-platform and high-speed inference for various detection applications based on image data.

Morpho will support further acceleration of 3D simulations (galaxy formation simulations) using deep learning on Fugaku through the project and collaboration. In addition, Morpho will continue to further improve the convenience and technical capabilities of “SoftNeuro” and develop technology on a global level to realize a fruitful culture through the provision of various services and solutions.

- “SoftNeuro” product page: https://www.morphoinc.com/en/technology/sie

Comments from Morpho’s President
“The results of this project show that SoftNeuro can significantly improve the calculation speed and reduce power consumption not only on edge devices but also on supercomputers. This indicates that SoftNeuro contributes to the development of science and technology, and also helps to realize the SDGs world through its power-saving performance. Based on these results, we will further promote the technological development of SoftNeuro and expand its range of applications to contribute to the development of our business and society”
(Masaki Hilaga, Dr. Sc. President, Morpho, Inc.)

About the Project
The project is to accelerate highly resolved galaxy formation simulations.
We have developed the 3D-CNN-based deep learning model that predicts anisotropic shell expansion of supernova (SN) explosions and identifies particles with small timesteps. Our model is based on Memory-In-Memory Network (Wang et al. 2018), which consists of 2D-CNNs and predicts future images. The research appears in "3D-Spatiotemporal Forecasting the Expansion of Supernova Shells Using Deep Learning toward High-Resolution Galaxy Simulations.
Source: https://arxiv.org/abs/2302.00026

Related Press Release
2022/12/05
Morpho Provides “SoftNeuro” to Highly Resolved Galaxy Simulations Project for Universities: Supporting 3D Simulation with Supercomputer Fugaku
https://www.morphoinc.com/en/news/20221205-epr-sn

Related Information
Program for Promoting Research on the Supercomputer Fugaku
https://www.r-ccs.riken.jp/en/fugaku/org-relations/promoting-research/

Toward a unified view of the universe: from large scale structures to planets
(Junichiro Makino, Kobe University)
https://jicfus.jp/fugaku_ap/en/

Sub-project A: Revealing the Formation History of the Universe with Large-scale Simulations and Astronomical Big Data
(Michiko S. Fujii, the University of Tokyo)
https://jicfus.jp/fugaku_ap/en/research/subtask/subtaska/

Galaxy formation simulation using ASURA-FDPS
(Takayuki R. Saitoh, Kobe University)
https://www.asj.or.jp/nenkai/archive/2021a/pdf/Z307a.pdf

Abstracts of the Autumn Meeting 2022 of the Astronomical Society of Japan
Accelerating Predicting the Expansion of Supernova Shells for Highly Resolved Galaxy Simulations Using Deep Learning
https://www.asj.or.jp/nenkai/archive/2022b/pdf/X52a.pdf

About Morpho, Inc.
Established in 2004, Morpho is a research and development-led company in image processing technology. It has globally expanded its advanced image processing technology as embedded software, for domestic and overseas customers centered on the smartphone market, broadcasting stations and content providers. It has also provided image recognition technology utilizing Artificial Intelligence (AI), collecting image information captured by cameras into devices and clouds and analyzing it, for fields such as automotive devices, factory automation, and medical care. Morpho will provide broad support, making a wide range of innovations happen with its imaging technology and Deep Learning technology. For more information, visit https://www.morphoinc.com/en or contact m-info-pr@morphoinc.com.

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