thermo scientific

Release notes PerGeos Software Version 2021.1

3D data visualization and analysis

The aim of this document is to inform you about the most important new features, improvements and changes in this version of Thermo Scientific™ PerGeos™ Software.

Please read these Release Notes carefully.

We would appreciate your feedback regarding this version. If you encounter any problems or have any suggestions for improvement, please do not hesitate to contact us at FRBOR.3d_hotline@thermofisher.com.

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New Features

Deep Learning Training

The Deep Learning Training tool has been substantially reworked, with the following new features:

- Support for multi-class segmentation.
- Different types of networks and U-Net backbones are proposed: a generic UNet model with configurable number of layers or feature map size, and different classical backbones such as VGG and RESNET.
- More Loss and Metric functions, such as Dice, Jaccard, and Intersection over Union.
- More controls for configuring the training batches.
- A new Plugin mechanism to enable custom network architectures, loss or metric functions, so they can be used within the tool. This is described in a new documentation page, which is referenced in the documentation of the tool as well as in the updated tutorial.

Deep Learning Prediction

The Deep Learning Prediction tool has been improved as follows:

- The default behavior of the tool is now to generate a label map, instead of probability maps, when applied on a model trained with the Deep Learning Training tool.
- An automatic algorithm estimates the GPU memory required to apply the Deep Learning Prediction tool, depending on the architecture of the network. This allows the software to propose an Automatic Tiling mode. It remains possible to use the manual mode, which may be required for some custom architectures.
- The weights files and .py file are automatically selected when indicating the architecture file, provided they have the same file names. It is possible to manually select different files if relevant.
- The pre- and post-processing functions (.py file associated with the trained model) have been revisited. A new method has been proposed to allow custom post-processing at each tile, and to control the type of the output dataset.

The Deep Learning tutorial, and related Xtras have been updated to reflect these new features.

Refer to the Xtra Recipe Library and Compatibility Notes sections of this document.

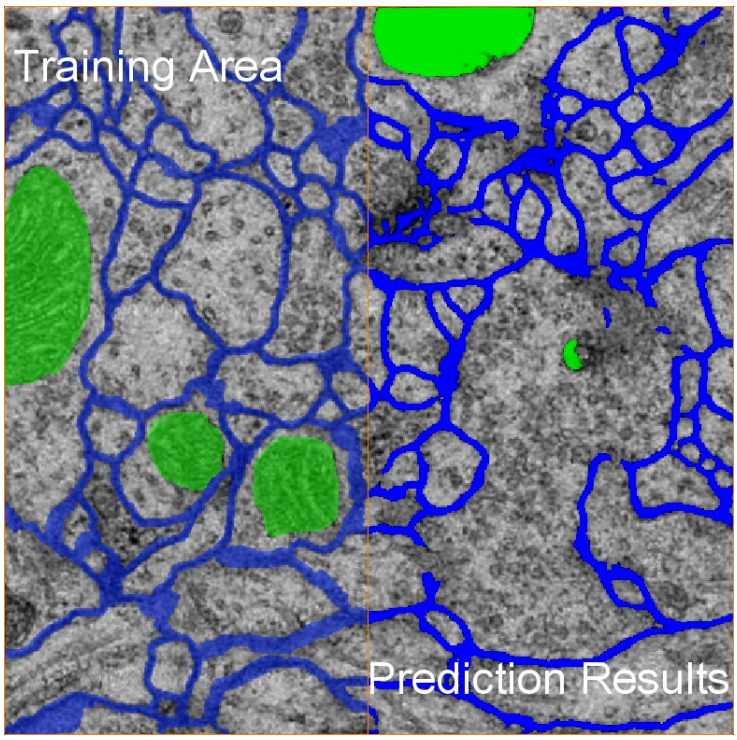

Figure 1: The Deep Learning Training tool is now able to learn multi-class segmentation models, and Deep Learning Prediction can directly generate a label field as output.

Ridge Enhancement Filter

The Ridge Enhancement Filter tool has been upgraded by the addition of a new "Planeness Tensor Voting" option. This option allows you to significantly improve the detection quality of surface like structures (for example, cell membranes) present in a 3D uniform scalar field (available only for Windows operating system). The previously available "Planenss Tensor Voting" option has been renamed to "Partial Planeness Tensor Voting".

This new module is a complete implementation of the TomoMemSegTV algorithm described by A. Martinez-Sanchez, I. Garcia, S. Asano, V. Lucic, and J.-J. Fernandez,"Robust membrane detection based on tensor voting for electron tomography", Journal of Structural Biology, vol.186, issue.1, pp.49-61, 2014.

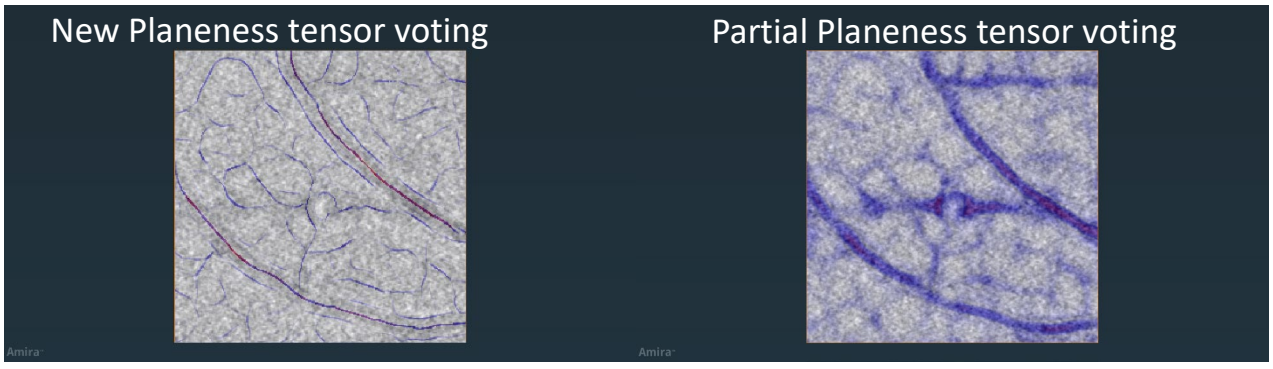

Figure 2: Comparing results of Planeness and Partial Planeness tensor voting (images courtesy of the Cell and Tissue Imaging (PICT-IBiSA), Institut Curie, member of the French National Research Infrastructure France-BioImaging (ANR10-INBS-04)). Tool's result image in ColorWash clearly shows improvements in structure enhancements along membranes' ridges.

Enhancements

Python 3.6.12 and Python environments upgrade

PerGeos Python interpreter has been updated to version 3.6.12. Python package distribution with both the embedded and the custom Deep Learning Python environments have been updated to the most recent versions available with this interpreter. In particular, TensorFlow version 2.2.2 and NumPy 1.17.4 are now available in PerGeos.

Normalize Grayscale

Normalize Grayscale now offers an option to allow manual selection of the pixel type of the output dataset.

This new option can save an unnecessary additional step, for instance when wanting to convert a 16-bit dataset to 8-bit. However, the default behavior is preserved, and the output dataset will have the same type as the input.

Optimization of Morphological Binary Operators

The Erosion, Dilation, Closing, Opening modules have been optimized when processing binary images with large square or cube structure element.

When the structure element size is larger than a threshold (which depends on the hardware configuration and XY or 3D interpretation), the module switches to a time-independent algorithm based on a distance map. The results remain identical to previous versions.

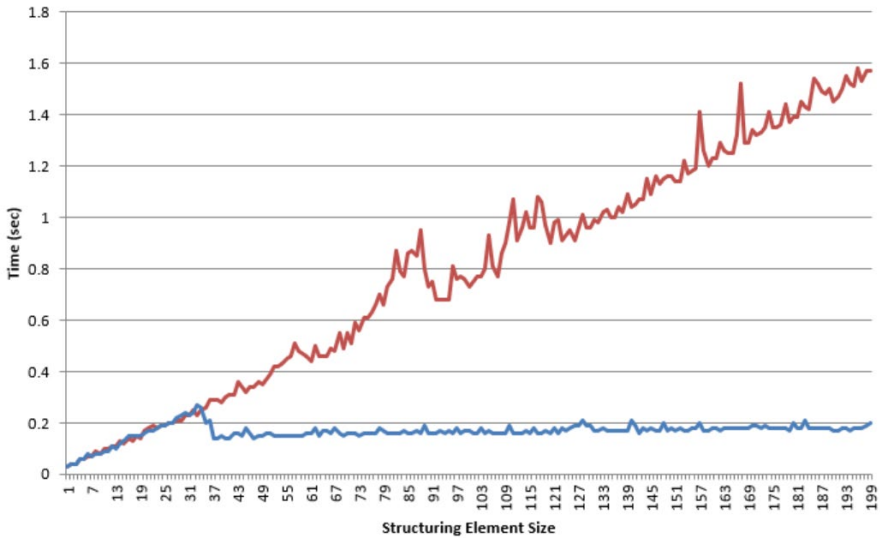

Figure 3: Comparison of computation time for a binary Opening of a 4096x4096 image with increasing size of a square structuring element. (red: with 2020.3, blue: with 2021.1)

Xtra Recipe Library

The following Xtras have been published or updated since the previous release notes. Please pay attention to the product, license and OS requirements, as well as the installation instructions. Have a look, and do not hesitate to send us your feedback.

- Getting Started with Deep Learning Training (Update)

- BSE SEM denoiser – Deep Learning Model (Update)
- Image Segmentation Evaluation Using Standard Metrics
- Large Data Visualization
- Patch Extraction Tools for Deep Learning data preparation
- How to install non-Standard Python Package

Compatibility notes

Deep Learning Training

The previous version of the Deep Learning Training tool is now deprecated. You can still load projects created with earlier versions, but it is highly recommended to switch to the new tool. All features from the previous tool can be found in the new tool.

The previous model architecture is not proposed, but a close equivalent is available with the GenericUnet Model Type and its default parameters. As a consequence, models weights trained with previous versions of the software cannot be used to initialize a new training.

Deep Learning Prediction

The syntax for the .py file associated with a trained model has been modified. To maintain a full compatibility when using these models with the Deep Learning Prediction tool, replace the original .py file associated with your models with the Compatibility_DL_Before_2021.1.py file provided in this Xtra: Getting Started with Deep Learning Training.

Otherwise, the intended post-processing would no longer apply. Instead of a probability map on 8-bits with values in [0,255], you would now obtain the raw prediction from Keras which is the same probability map but using the 32-bit float type and values in [0,1].

Operating systems

PerGeos Software version 2021.1 runs on:

- Microsoft Windows 10 (64-bit).
- Linux x86 64 (64-bit). Supported 64-bit architecture is Intel64/AMD64 architecture. Supported Linux distribution is CentOS 7.

To add custom extensions with PerGeos XPand extension, you will need:

- Microsoft Visual Studio 2013 (VC12) Update 4 on Windows
- gcc 4.8.x on Linux CentOS 7

Solved issues

3D registration	AA-24331	Metrics computations from SearchSlice script module are now fully available.
Auto Thresholding	AA-23112	Saving and reloading a project after Type port update now works as expected: result keeps its connection to the module.
Breadth3D	AA-23175	Breadth3D values are now available up to 65535 labels.

Label Analysis	AA-22328	The Mean and the Max values of the Width Orientation Theta are now in the appropriate range (-180;180).
Marker-based Watershed	AA-23273	The out-of-core data can now be processed by the marker-based watershed module.
ROI Box	AA-16870	It is now possible to associate a ROI Box to any LDA display module or Volume Rendering on a Multi-Channel-Field data. No artifact occurs when updating the ROI Box.
Propagation Distance	AA-21998	In the binary case, abnormal big numbers in some areas at the starting level have been corrected.
Remove small spots	AA-23995	Remove small spots is now working for large data.
Brush tool	AA-24015	Brush tool (from ROI Editor and Interactive Brush Tool) is now aligned with cursor position for 4k screen resolution.
Non-Local Means Filter	AA-23845	GPU Standard in 3D interpretation is now deprecated. By adapting the filter's parameters it can be replaced by Standard CPU 3D interpretation that is providing the same performance. Compatibility is maintained for old projects.
Object Naming	AA-22421	The rule for automatically renaming modules in case of name conflicts has been updated. The increment number is now added inside parenthesis at the end of the object name. This new rule only applies to new projects. Projects saved with earlier versions are not impacted.
Licensing	AA-25314	It is now possible to launch the product on Linux without error, even if no license has been activated.