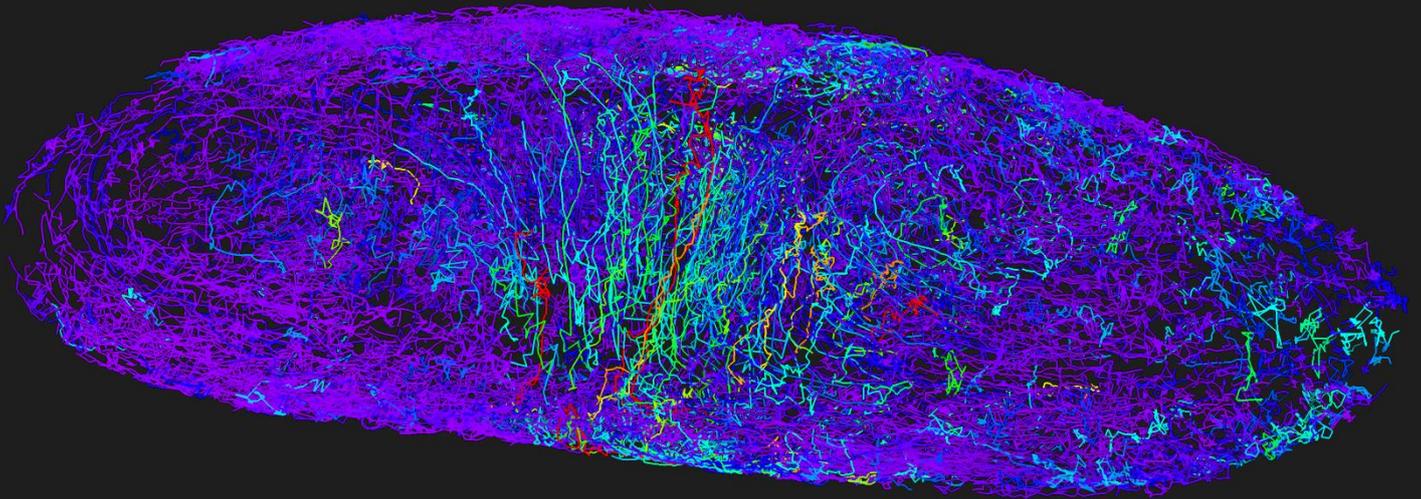


What's new in arivis Vision4D 3.1

Datasheet



Cell Tracks of a developing fly embryo

Image courtesy of Celia Smits, Stanislav Y. Shvartsman, Department of Molecular Biology, Princeton University

arivis Vision4D is a modular software for working with multi-channel 2D, 3D and 4D images of almost unlimited size independent of available RAM.

The strength of arivis Vision4D is its capability to segment, analyze and track cells or biological structures in various multi-dimensional data sets. Therefore, arivis Vision4D provides a robust and fast tool for processing and analysis for large 2D, 3D or 4D image data in Life Sciences.

A. arivis Vision4D 3.1 Release Notes

New Machine Learning workflow

The arivis Analysis Module now offers a new Machine Learning workflow which fully integrates in the arivis Analysis Pipeline.

With a new UI this version focuses on ease of use and fast creation of optimal and reproducible results in a few steps. Just train the software once and add it to the pipeline to segment one or a batch of images automatically. In addition, probability maps from the Machine Learning Training can be integrated into a segmentation pipeline to combine them, e.g. with the Blob Finder or Membrane Segmentation.

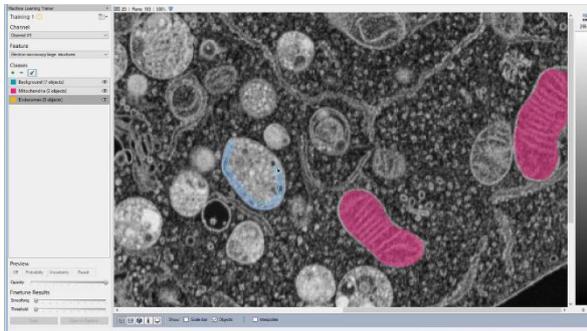


Figure 1: Machine Learning Trainer allows to classify and label typical structures of interest

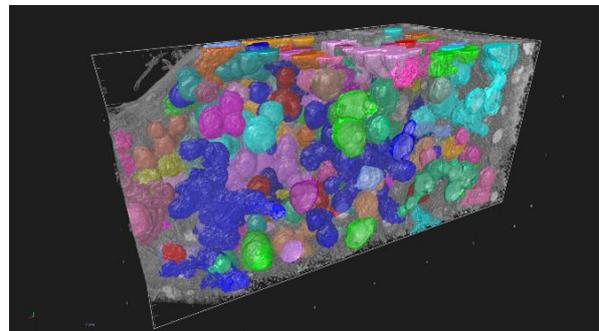


Figure 2: The Machine Learning segmenter creates 3D objects for further measurements or analysis

This solution needs no expert knowledge in image analysis and may be combined with any operator in our Analysis Pipeline for more demanding workflows.

Segment Tracking and Lineage

New Tracking Parameters

Lineage functionality has been added to our Segment Tracking Module. These lineage features allow tracking of cells or particles in cells, organoids or tissues adding new parameters such as divisions/fusions, conal angle, weighting by features and option to continue tracks

New Feature

The new Manual Track Tool allows track creation interactively in the viewer by placing spots using spheres, marker or Magic Wand.

Enhancement to Track Editor

The significantly enhanced Track Editor offers much improved handling for free segments sorted by distance to a track and improved keyboard navigation. Sorting or filtering of tracks is synchronized with the interactive objects dialog and segments are now colored by track by default.

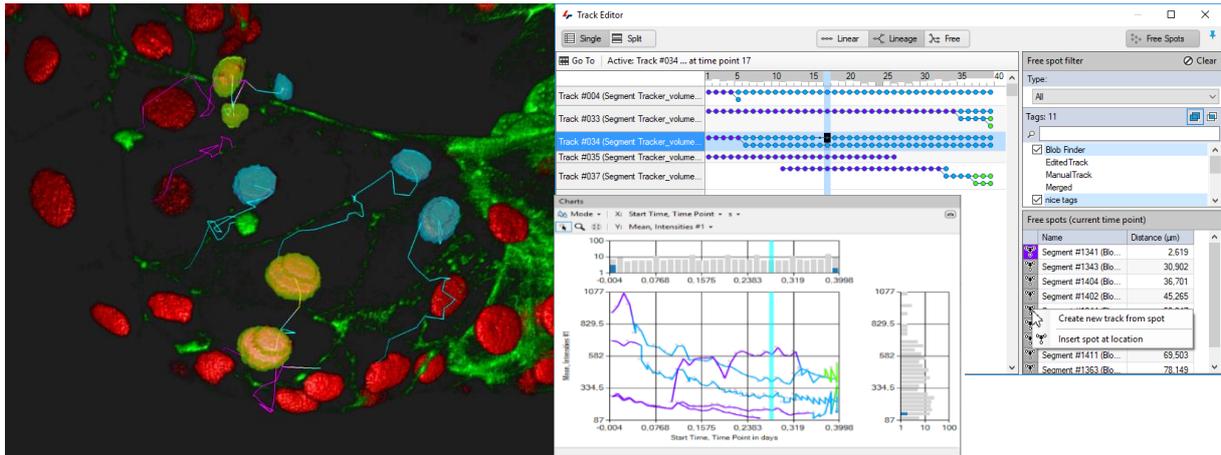


Figure 3: Object measurements along a track and Track Editor sorting free segments by distance to a track

Enhancement to Track Visualization

Tracks can now be visualized in several different ways showing the centroids as Spots, adjustable Dragon Tail or Dragon Head and Vectors with full length or depending on the Dragon Tail length.

New track related features

Several new features have been added including the measurements of several parameters of cell division for lineage analysis:

- * Number of generations, divisions, successors, branches
- * Generation time
- * Time since last division
- * Displacement by time point and overall
- * Instantaneous, average speed and acceleration
- * Velocity
- * Further custom measurements based on any feature available (also imported features)

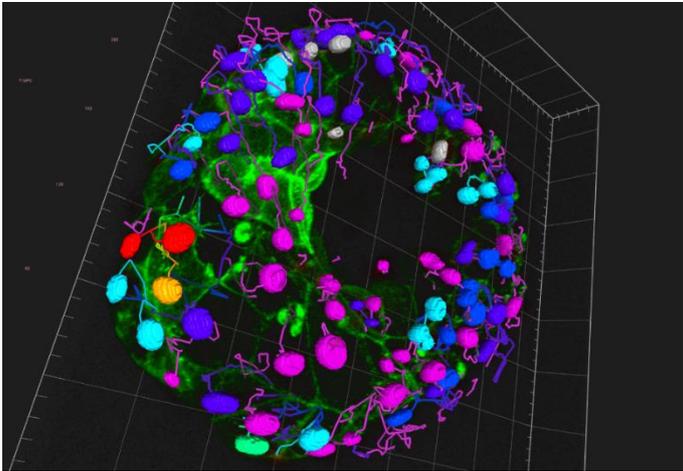


Figure 4: Dividing cells color coded by generation



By adding the InViewR Module you can use Virtual Reality to proof read and correct automatically created results much more efficiently than ever before.

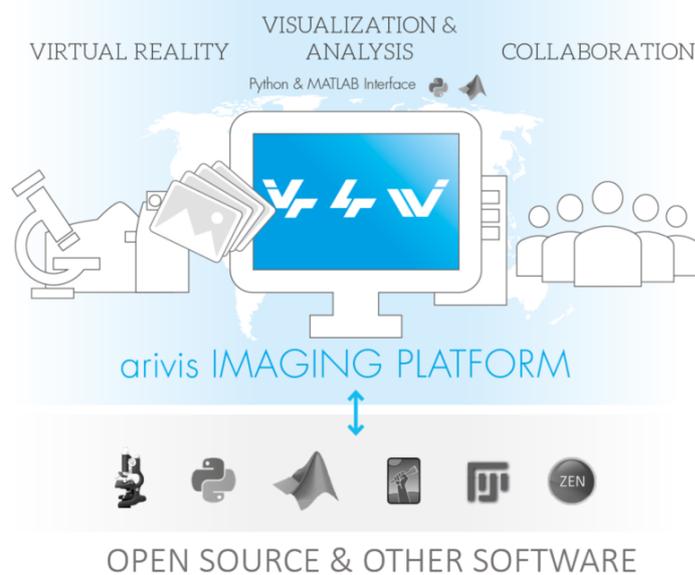
Enhanced Distance Measurements and Grouping

New operators for Distance Measurements, Compartmentalization and Grouping have been added to the Analysis Pipeline replacing the Colocalization operator.

Distances (centroid to centroid and surface to surface) are now calculated and displayed in the Objects Table. This allows color coding or grouping of objects according to distances and object-grouping in compartments, or in any other way for interactive inspection in the 4D Viewer or in Virtual Reality with the InViewR Module.

Exchange of Objects with Open Source and other software

New module **Exchange Objects from Open Source** offers an integrated solution to imaging facilities and PIs to connect with open source workflows and any other software which is capable of exporting/importing labelled images.



Easily interface with your specific workflows whenever you are using segmentation functions in open source such as Fiji, ImageJ, Ilastik and Python or in commercial solutions such as MATLAB or Carl Zeiss ZEN Blue.

Just import your resulting objects, e.g. from Fiji or any other software in a single step into Vision4D and visualize the segmentation in 3D, create impressive movies with our Vision4D storyboard or explore and edit them with InViewR in Virtual Reality. Alternatively, you can also integrate the results from Open Source in your arivis Analysis Pipeline and do further processing, Tracking, Classification with our flexible Analysis Pipeline.

A new operator in the Analysis Pipeline also allows export of objects as labeled or binary images for subsequent processing in other software.



Volume Fusion

The Volume Fusion functionality has been significantly enhanced by adding the option to preview and modify transformation parameters for fusing two data sets into one data set. You can now use landmarks and/or the free movement, rotation and scaling of a surface representation to get the transformation values automatically. The volumes may now be merged as separate channels for multimodal imaging. This allows easy analysis of the complete sample in one dataset. The resulting volume may also be explored in Virtual Reality with an upgrade to InViewR.

With all these enhancements Volume Fusion is no longer available as a free public preview and requires a separate license.

Vision4D-UI

New feature: Improved UI for viewer linking and split views for ease use.

New feature: Improved UI for the info panel which allows selective viewing of information of interest. The last used setting is saved for convenience.

New feature: "Switch to InViewR" is a new menu entry and available if arivis InViewR application is installed.

Import & Data Handling

New feature: In the Tile Sorter the source files can be automatically deleted after stitching.

New feature: The import scenario "As Channels" now allows import and combining of multi-channel-datasets more easily

4D Viewer

New Feature: Selected objects are now highlighted with a bright halo for easy visualization

New Feature: Surfaces from surface extraction or from objects may be copied & pasted into the same or other image sets. Surfaces may be subsequently transformed by translation, scaling or rotation.

Analysis Pipeline

New Feature: A pipeline may be duplicated easily to make changes and may be saved with a new name within the document.

New Feature: The pipelines will be stored automatically with the document without the need to confirm when the analysis panel is closed.

New Feature: The new pipeline operator "Segment Modification" allows modification of objects within a pipeline run to improve analysis results (e.g. erosion or dilation). It also allows to re-use this functionality for other data sets and in batch analysis.

New Feature: The new pipeline operator "Merge Segments" allows merging of touching segments within a pipeline run to improve analysis results. It allows reuse of this functionality for other data sets and in batch analysis.



New Feature: The option to maintain the original color range after the Background Correction Operator was added to avoid unwanted automatic correction of the color range for subsequent Voxel operations.

New Feature: GZip compression may now be enabled for new analysis documents.

New Feature: The Tag filter in the Imported Document Objects Operator now supports wildcards allowing specification of tags more efficiently.

New Feature: The Import Document Objects operation now offers a selection to keep or clear tags for imported document objects.

New Feature: The Store Objects Operator now allows removal of tags for unselected inputs. This function is set by default.

New Feature: It is now possible to add the opposite filter functionality (tag negative). This is an advanced analysis function which can be added via preferences.

Enhanced Usability: A streamlined pipeline menu allows easier interaction and supports more efficient workflows.

Enhanced Performance: The segment generation performance (Intensity Threshold, Blob Finder, etc.) has been improved.

Enhanced Performance: Meshing of object surfaces has been significantly improved and is enabled by default during the segment generation in the Analysis Pipeline run. This default setting may be changed in the Preferences/Analysis section.

Objects

New Feature: There is a new summary for quick statistics in the object table available with a single click.

New Feature: Any features from pipeline calculations (such as distances) may be stored and integrated in the objects table. External measurements also may be imported via Python scripting and integrated into the objects table. This allows users to interactively visualize, select, sort or color code any features or measurements in the object table and in the 4D Viewer.

New Feature: Parent & Children features are now providing name and ID each.

Enhanced Usability: Group statistics may be created directly and more efficiently in a context menu at any feature cell.

Enhanced Usability: 2D Viewer supports centroid or bounding box visualization for objects like in the 4D Viewer.

Enhanced Performance: The object loading performance has been enhanced.

Scripting

The Script Editor has been improved with auto-completion and now highlights matching braces. The script API has been enhanced for e.g. coloring, story board and 4D camera. The Scripting documentation has been improved and the sample script documentation has been specified in more detail.



Personal WebView

A new Personal WebView component for easy access and usability has been created and a new state-of-the-art HTML frontend is now used. The sharing setup of the shared views has been simplified. Histogram and color settings panels have been added. Full support for multi-plane segment objects is now available. Channels can now be turned off and on for web view independently from Vision4D. The handling of many objects has been improved by loading segments by plane.

B. arivis Vision4D 3.1 Smaller Changes and Fixes

General

- * fix: potential problems with color bar visualization for 32bit data
- * fix: small problems with the color gradient management
- * fix: prevent invalid path settings for temporary files

Import & Data Handling

- * new: support for IMS files written by Andor Dragonfly microscopes
- * fix: avoid slowing down by histogram calculations during import
- * fix: potential CZI import problems
- * fix: combine channels if importing image data as tiles (CZI & TIFF)
- * fix: problem with wrong pixel type after importing data as a new image set
- * fix: support for importing 'Binary-Only' OME-Tiffs
- * fix: better support for single channel mosaic LaVision OME-Tiffs
- * fix: read time stamps from LIF-file

4D Viewer

- * fix: potential problems with data offsets or ROI clipping

Analysis

- * improved: handling for different voxel sizes or image offsets in all voxel filter operations
- * improved: Membrane Enhancement Operator
- * fixed: potential problem with the Particle Enhancement Operator
- * fixed: potential out of memory problem with Matlab scripting
- * fixed: more robust cancellation of Magic Wand calculation jobs

Objects

- * improved: filtering within the feature tree
- * improved: object menu structure
- * improved: restructured Object Settings panel
- * improved: unit support with custom features
- * fixed: crash when creating custom channel features
- * fixed: a track's segment Ids feature will be shown sorted by time point
- * fixed: incorrect abort during dilation of objects

Scripting

- * fix: Sys.Path handling
- * fix: open import dialog from script
- * fix: get_object performance