MAVI kit

MAVIkit for Tool IP

Tool IP goes 3D

If you have used ToolIP to solve your complex image analysis tasks or you plan to do so and 3D images are within the scope of problems, then complete ToolIP with the MAVIkit toolbox.

MAVIkit offers ToolIP plugins dedicated to processing and analysis of 3D image data as generated by tomographic or serial sectioning methods like computed tomography or FIB-SEM. All MAVIkit plugins work truly in three dimensions.

MAVIkit's algorithms are developed for volume images of microstructures and focus on the analysis of complex spatial geometries.

MAVI's functionality customized

If you like the 3D image processing and geometric analysis functionality of MAVI but you missed scripting or would like to combine it with your own solutions, then MAVIkit for ToolIP is worth a trial.

MAVIkit provides MAVI's volume image processing and analysis algorithms as plugins for the graphical algorithm development tool ToolIP. This allows rapid prototyping of complex customized solutions for your 3D image analysis task.

Through ToolIP's SDK, you can easily integrate your own algorithms or third party libraries. Finally, the graphically designed algorithm can be applied in batch mode or be called from your program, too.

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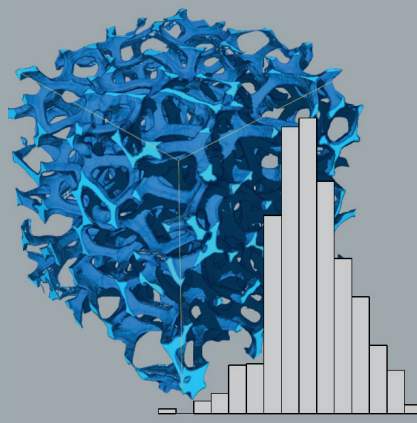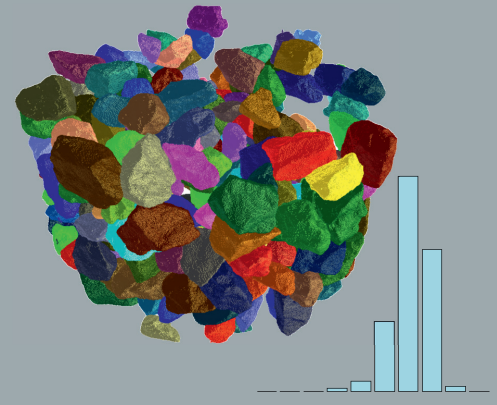**www.itwm.fraunhofer.de**

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1 *ToolIP graph with MAVI-kit nodes for image analytic reconstruction of the cell system of an open foam*

2 *Open cell chrome-nickel foam, histogram of cell sizes*

3 *Glass fiber reinforced polymer, diagonal entries of the 2nd order orientation tensor*

4 *Grit particle bed sphericity*

Functionality

MAVIkit is the 3D image analysis tool box for ToolIP. MAVIkit provides a wide range of algorithms for processing and analysis of volume image data, as generated for instance by computed tomography, for using them within the ToolIP framework. The algorithms can be applied to 2D images, too. Currently, MAVIkit contains the following modules:

- Load/write 3D image data
- Linear filter
- Segmentation (global and local adaptive thresholding watershed transform, labelling)
- Transformation (simple and complex morphological transforms, distance transforms)
- Arithmetic (unary and binary point operations)
- Utilities, type conversion, etc.
- Analysis (FieldFeatures, ObjectFeatures, SubfieldFiberDirections)
- Data handling
- Complex analysis functions
  - SubfieldFiberDirections (local fiber orientation analysis, orientation tensors)
  - CellReconstruction (tessellation of the pore space of foams)

Combined with the ObjectFeatures, the CellReconstruction allows to determine empirical distributions of geometric characteristics of foam cells.

Extension

The 3D image processing tool box can be extended on user's demand.

PointFieldStatistics

offers, based on the Object Features, additional functions for analyzing the spatial arrangement of the found objects. Various summary statistics for random point fields from spatial statistics are computed for the object centers.

MeshExport

offers for segmented binary (black-and-white) images surface meshing, mesh simplification, and export in one step.

MeshVis

adds interactive visualization to the functionality of MeshExport.

ParticleFeatures

adds for label images analysis options for image objects exceeding the range of functionality of MAVIkit's ObjectFeatures. ParticleFeatures includes for instance length, width, and thickness derived from the minimal volume bounding cuboid, maximal Feret diameter, maximal local thickness, elongation and elongation index.

Application scenarios

MAVIkit is intended to add support for 3D images to ToolIP's algorithm tool box and enable automatic processing of large amounts of volume data using a custom tailored complex algorithm.