The KNIME Image Processing Plugin

Image Processing with KNIME – The Current State

Available Image Processing Nodes

The Image Data Model (ImgLib)

Biological Image Processing with JAVA – An Outlook

Image Processing Nodes

Contributors: Martin Horn, Christian Dietz, Felix Schönberger

Image Reader

Image Writer

OMERO DB Reader

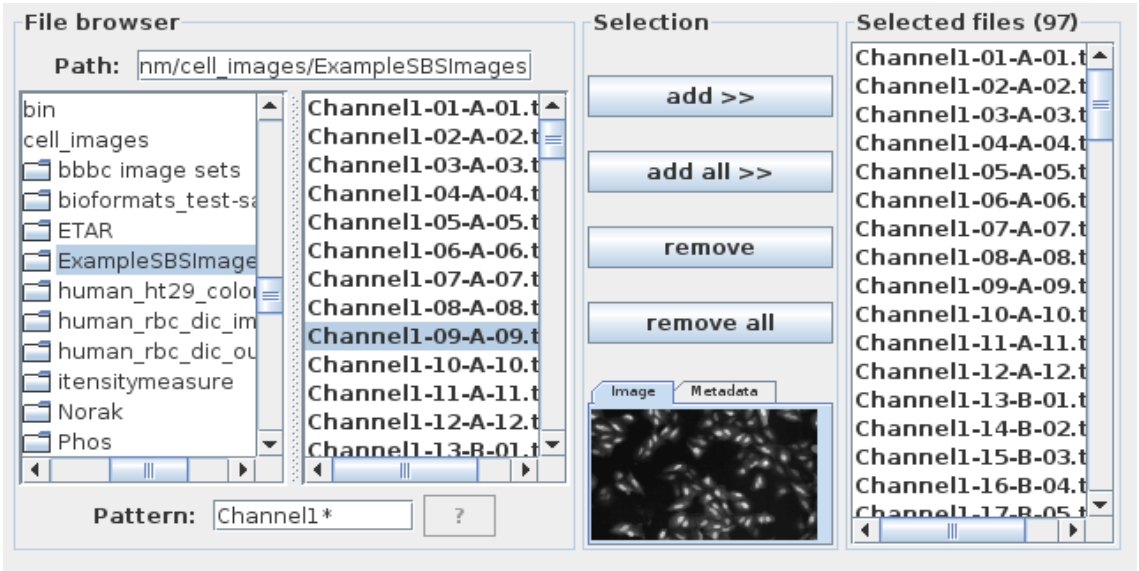
• • •

I/O

Image Reader

Image Writer

OMERO DB Reader



In: 106 formats
Out: 10 formats

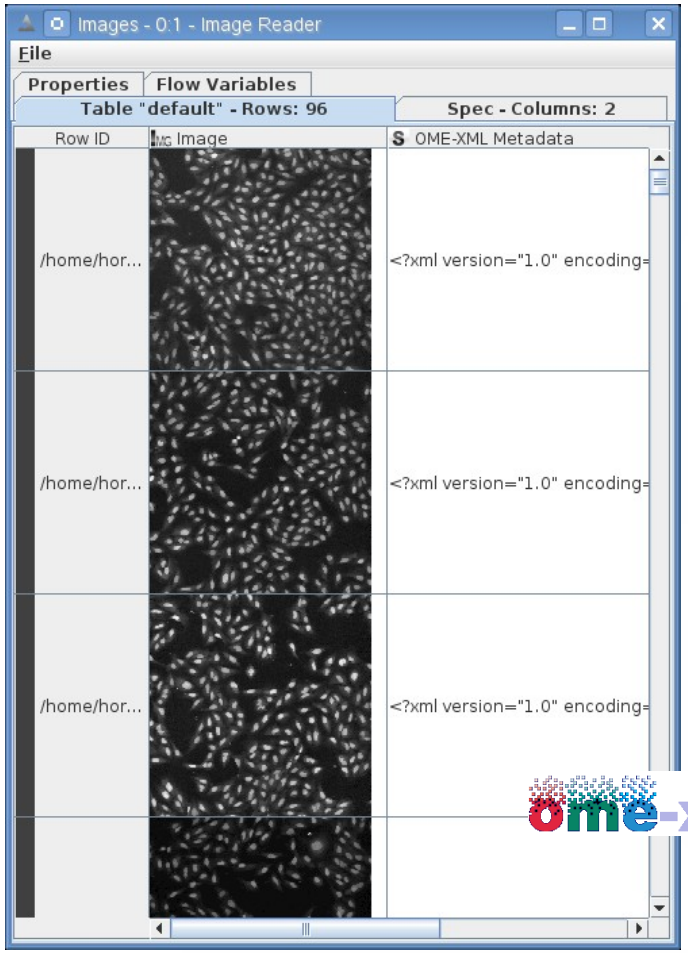
I/O

Image Reader

Im

Image Writer

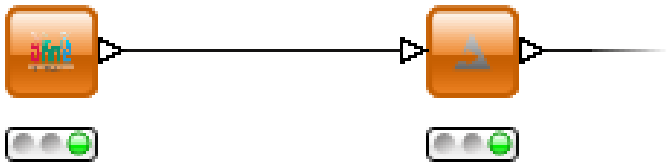
OMERO DB Reader



I/O

OMERO DB Reader

Image Importer



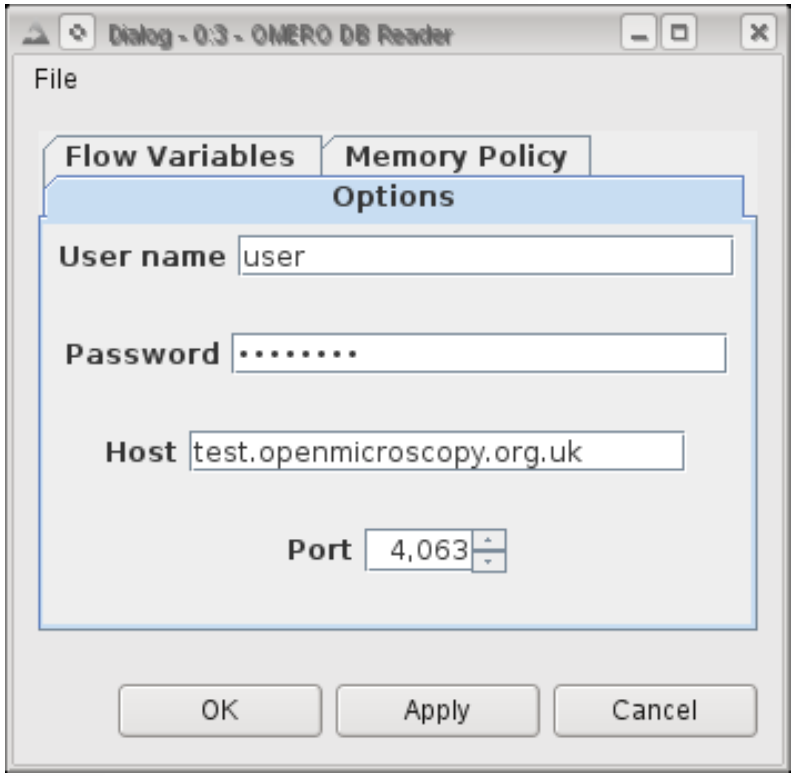


Image Writer

OMERO DB Reader

I/O

Image Reader
Image Writer
OMERO DB Reader
I/O

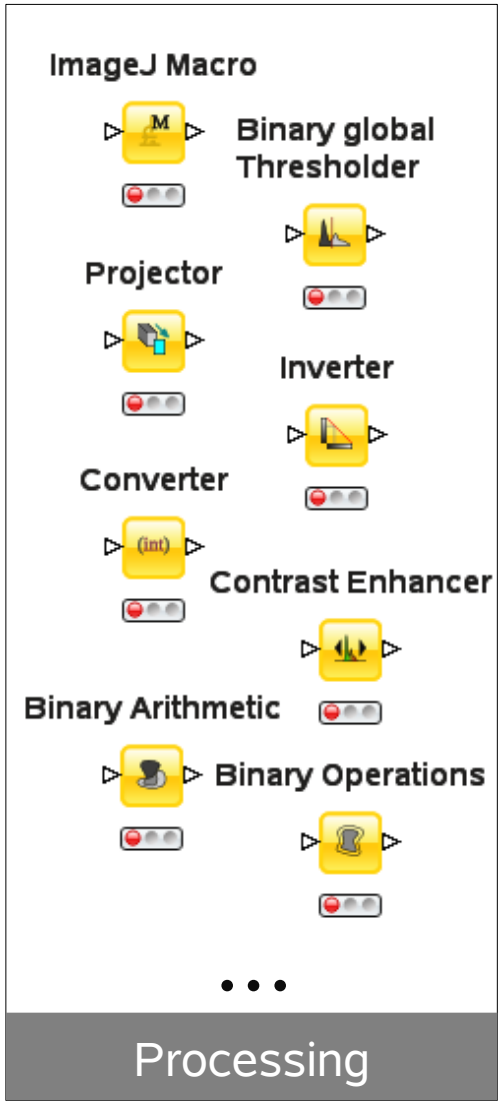
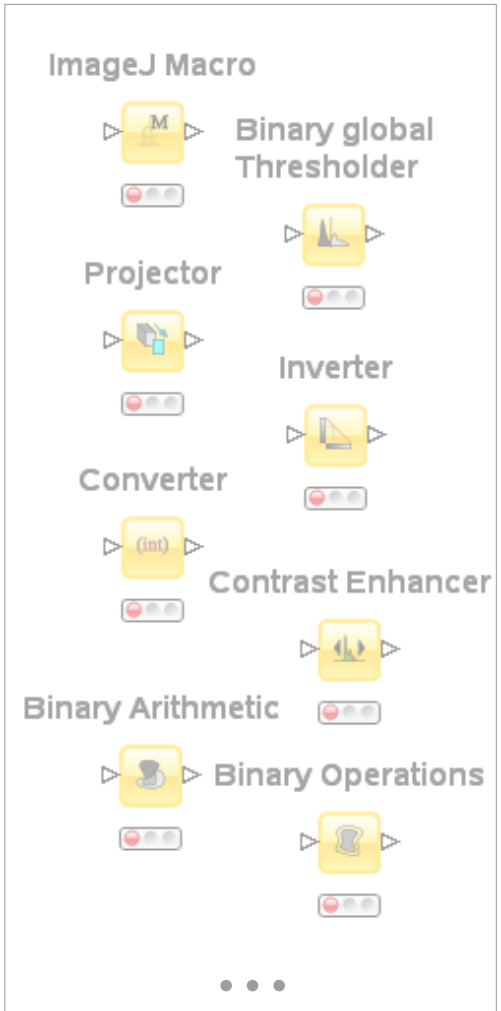

ImageJ Macro
Binary global Thresholder
Projector
Inverter
Converter
(int)
Contrast Enhancer
Binary Arithmetic
Binary Operations
Processing

Image Reader
Image Writer
OMERO DB Reader
I/O


ImageJ Macro
Binary global Thresholder
Projector
Inverter
Converter
Contrast Enhancer
Binary Arithmetic
Binary Operations
Processing

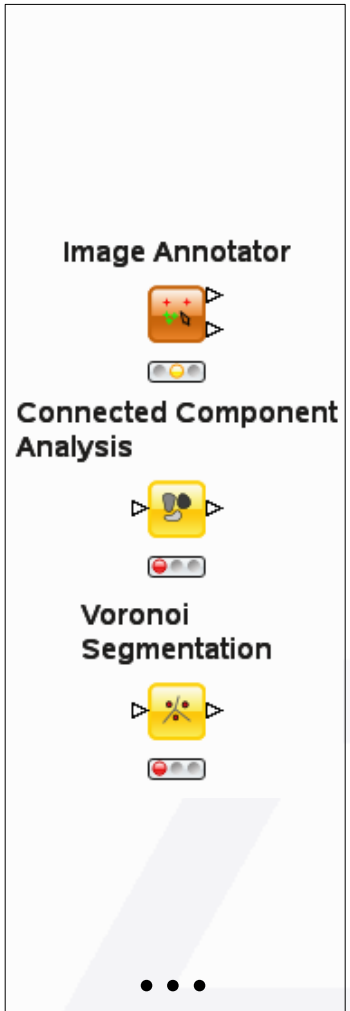


Image Annotator
Connected Component Analysis
Voronoi Segmentation
Segmentation

Voronoi Segmentation

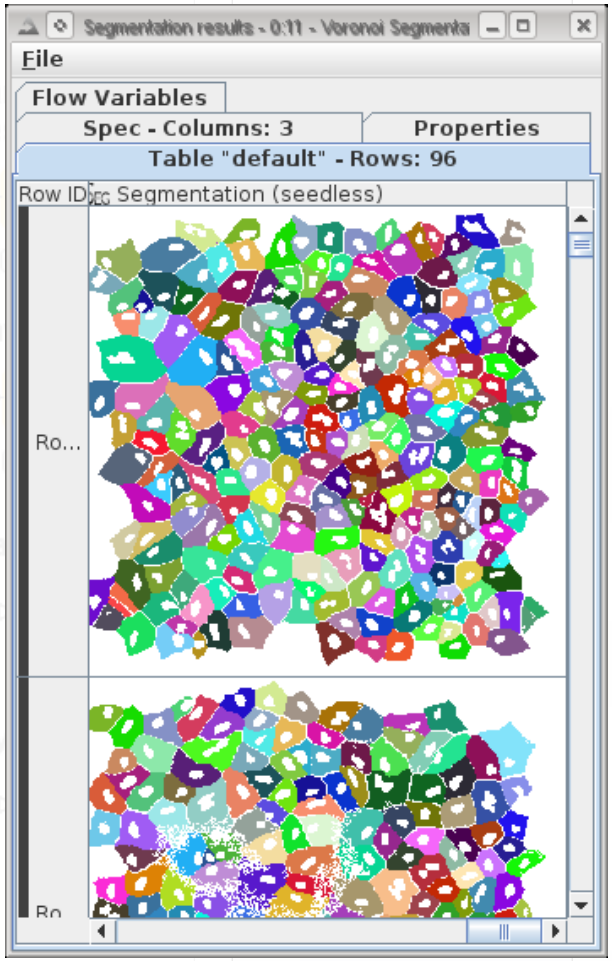
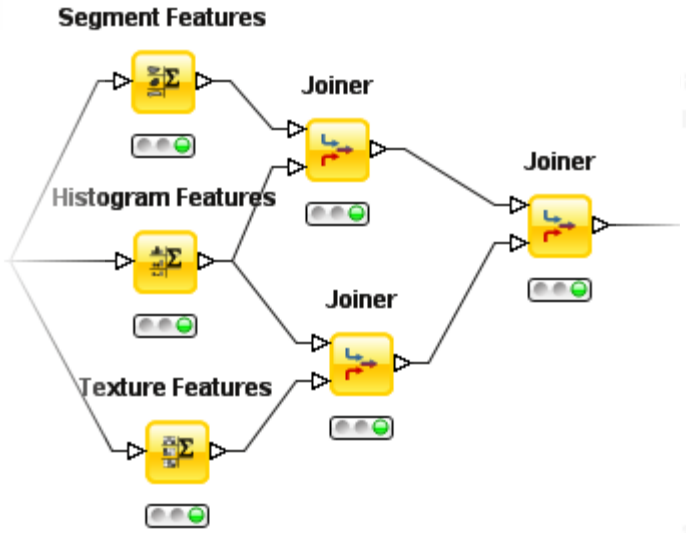


Image Reader
Image Writer
OMERO DB Reader
I/O
ImageJ Macro
Binary global Thresholder
Projector
Inverter
Converter
Contrast Enhancer
Binary Arithmetic
Binary Operations
Processing
Image Annotator
Connected Component Analysis
Voronoi Segmentation
Segmentation
Histogram Features
Segment Features
Texture Features
Zernike Features
Feature Calc.



Joined table - 0:30 - Joiner

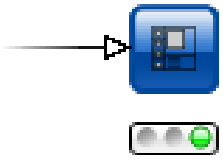
File

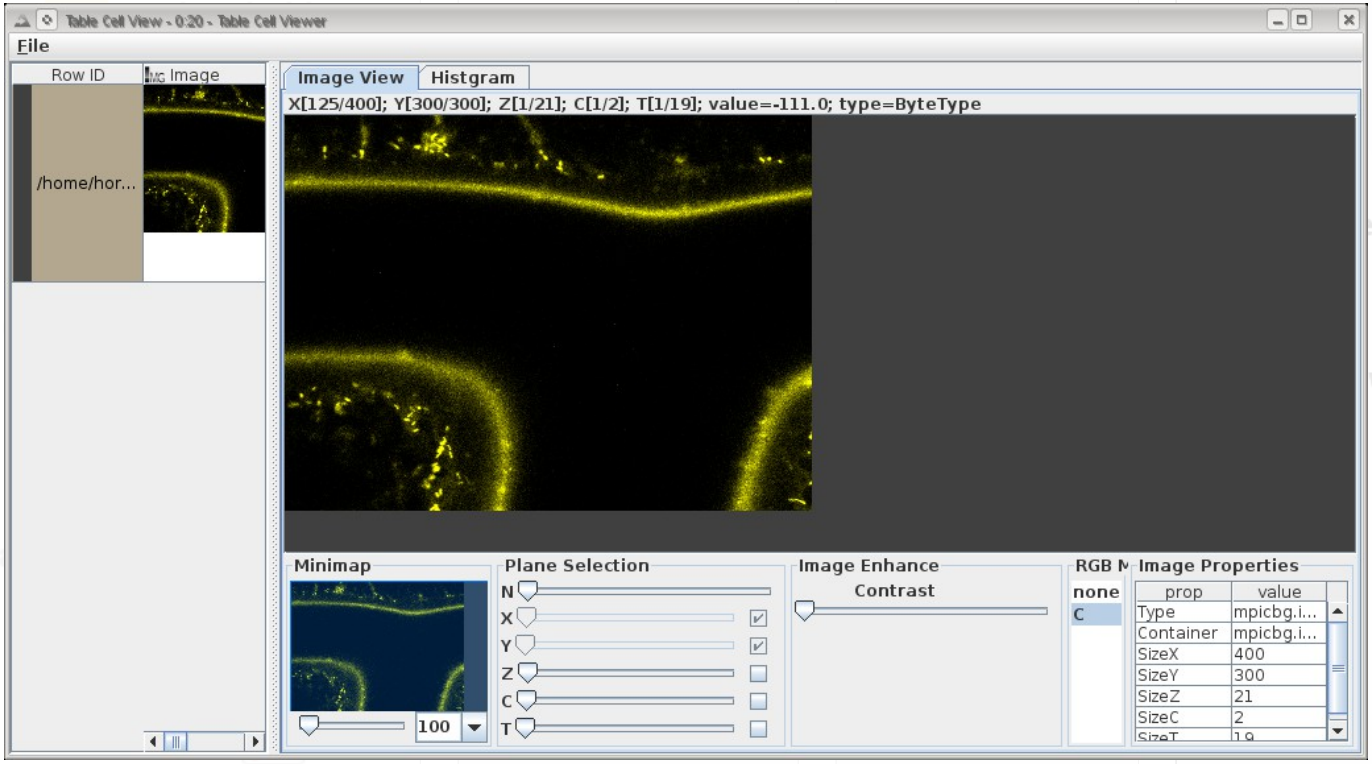
Table "default" - Rows: 14370 | Spec - Columns: 35 | Properties | Flow Variables

Row ID	Segme...	Num Pix	Min	Max	Mean	Sum	Squar...	Std Dev	Variance	Skewn...
Ro...	1	1,513	-124	-35	-105.318	-195,680	21,484,278	21.716	471.589	1.507
Ro...	2	1,326	-123	17	-100.816	-158,685	17,447,855	30.359	921.682	2.038
Ro...	3	783	-123	-12	-101.436	-98,799	10,762,363	27.588	761.103	1.582
Ro...	4	694	-125	-17	-99.006	-91,878	10,092,478	32.778	1,074.393	1.281
Ro...	5	927	-122	44	-91.601	-104,975	11,923,823	44.897	2,015.707	1.793
Ro...	6	704	-125	-48	-106.156	-89,914	9,904,684	20.622	425.281	1.53
Ro...	7	1,268	-124	14	-105.557	-156,224	17,955,168	31.469	990.311	2.179
Ro...	8	1,004	-124	-30	-108.951	-123,332	14,026,694	22.832	521.315	2.174
Ro...	9	1,349	-124	-23	-105.201	-168,638	18,848,958	26.299	691.628	1.762
Ro...	10	1,208	-124	-8	-105.519	-149,943	16,959,097	28.299	800.851	2.013
Ro...	11	873	-125	-48	-109.474	-112,101	12,669,227	19.703	388.195	1.771
Ro...	12	1,669	-124	-41	-109.201	-209,229	23,591,947	19.71	388.482	1.942
Ro...	13	2	-86	-79	-82.333	-247	20,361	3.512	12.333	-0.423
Ro...	14	2,725	-124	-24	-114.236	-333,682	39,137,486	18.682	349.022	3.245
Ro...	15	1,706	-125	-34	-109.541	-218,754	25,060,570	23.454	550.085	1.904
Ro...	17	1,148	-124	-49	-110.179	-145,326	16,503,628	19.316	373.115	1.877
Ro...	16	1,351	-123	14	-103.217	-163,806	18,454,018	31.225	975.025	2.14
Ro...	19	1,445	-123	-28	-109.381	-180,370	20,574,318	22.646	512.856	2.21
Ro...	18	2,161	-124	-27	-115.289	-267,010	31,549,490	18.191	330.927	3.291
Ro...	21	974	-124	-55	-110.908	-123,551	14,005,071	16.481	271.638	1.841
Ro...	20	730	-123	-33	-105.077	-93,729	10,403,017	24.94	622.022	1.582
Ro...	23	1,234	-124	-46	-112.105	-157,171	18,067,109	17.872	319.399	2.11
Ro...	22	1,890	-125	-26	-112.705	-233,300	27,158,322	20.437	417.676	2.768
Ro...	25	1,538	-124	-11	-107.475	-188,511	21,531,507	26.93	725.216	2.324
Ro...	24	832	-124	-51	-109.718	-105,549	11,957,245	19.796	391.872	1.848
Ro...	27	1,586	-125	-49	-115.298	-199,927	23,477,945	15.692	246.238	2.51
Ro...	26	1,154	-124	-47	-103.725	-152,476	16,452,178	20.817	433.342	1.296

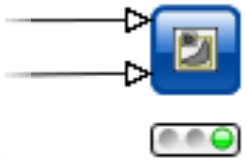
Image Reader
Image Writer
OMERO DB Reader
I/O
ImageJ Macro
Binary global Thresholder
Projector
Inverter
Converter
Contrast Enhancer
Binary Arithmetic
Binary Operations
Processing
Image Annotator
Connected Component Analysis
Voronoi Segmentation
Segmentation
Histogram Features
Segment Features
Texture Features
Zernike Features
Feature Calc.
Table Cell Viewer
Segment Viewer
Views

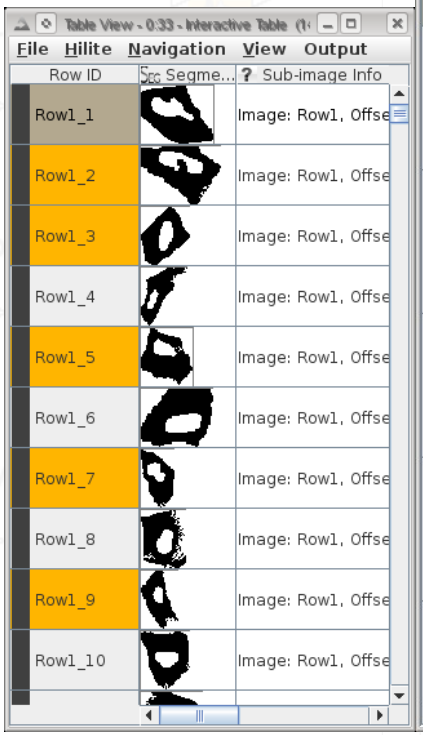
Table Cell Viewer





Segment Viewer





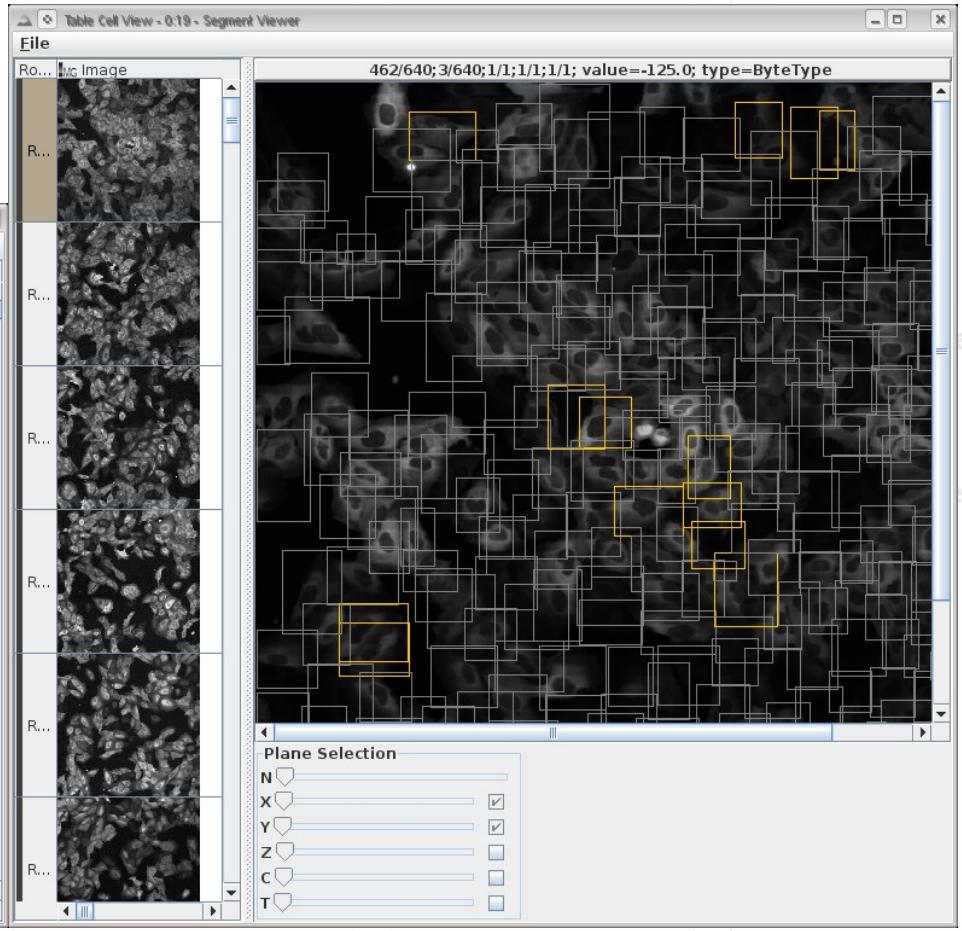
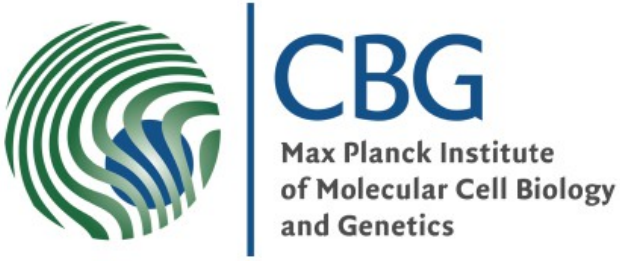


Image Data Structure

ImgLib – Generic Image Processing in Java

Stephan Preibisch & Stephan Saalfeld
Tomancak Group



ImgLib

Why?

- Generic programming – Write it once!
- More algorithm-like programming
- Easier to understand code
- Smaller source code
- Easier exchange of code
- …

ImgLib

How?

Abstract implementation of algorithm independent from the …

… Dimensions (if possible):
- 2d, 3d, …

… Storage
- in memory (as one or multiple arrays, planes, sparse …)
- paged on disc
- distributed over the net

… Type
- 8 bit, 16 bit, float, complex, labels

ImgLib

How?

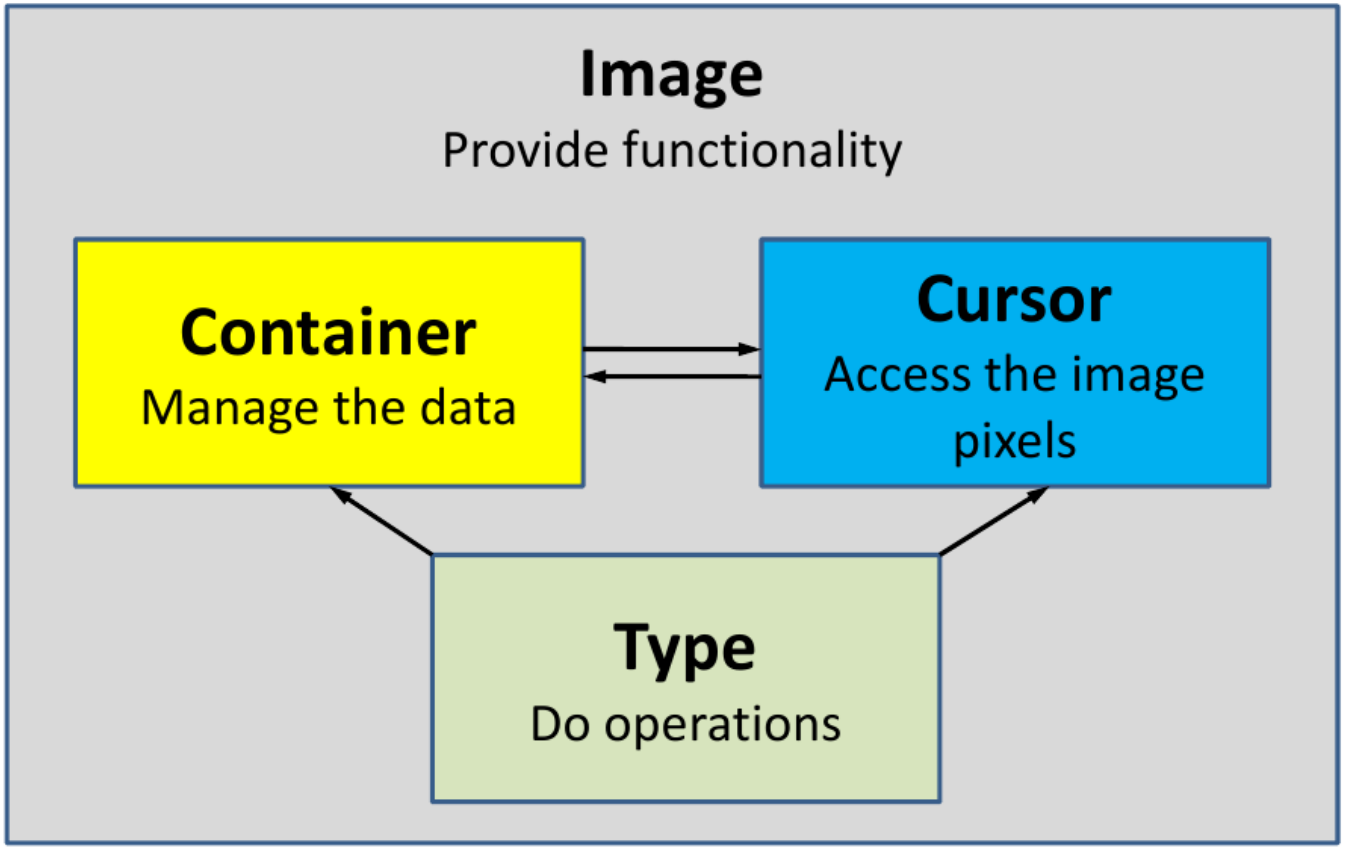


Image
Provide functionality
Container
Manage the data
Cursor
Access the image pixels
Type
Do operations

ImgLib

Example!

```
public static <T extends Type<T>> void fill(Image<T> img, T val) {
        Cursor<T> c = img.createCursor();
        while (c.hasNext()) {
            c.fwd();
            c.getType().set(val);
        }
        c.close();
    }

 public static void main(String[] args) {
        Image<ByteType> img = new ImageFactory<ByteType>(new ByteType(),
                new ArrayContainerFactory()).createImage(new int[]
                { 500, 500, 10 });
        fill(img, new ByteType((byte) 10));
    }
```

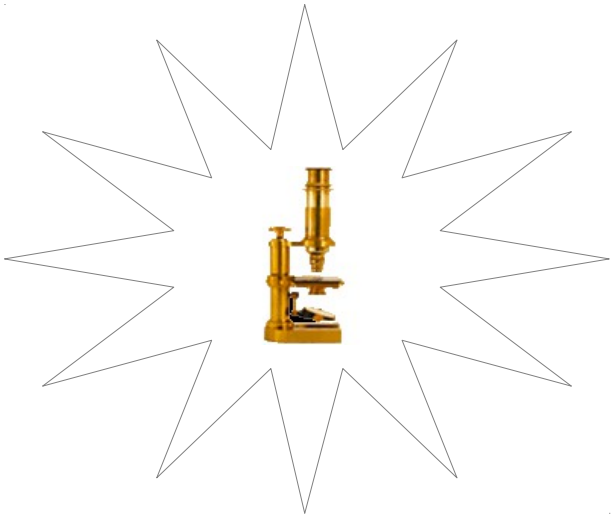
Biological Image Processing with JAVA - An Outlook

The next generation of ImageJ

ImageJX

http://www.imagejdev.org

The next generation of ImageJ



National Institutes of Health

Wayne Rasband (ImageJ)

The next generation of ImageJ

Laboratory for Optical and Computation (LOCI) at UW-Madison

Bioformats

OME / OMERO

VisBIO

The next generation of ImageJ

Max Planck Institute of Molecular Cell Biology and Genetics (MPI-CBG) at Dresden

Fiji (Fiji is just ImageJ)

ImgLib2

CBG
Max Planck Institute
of Molecular Cell Biology
and Genetics

The next generation of ImageJ

Broad Institute of MIT and Harvard

Cell Profiler

BROAD INSTITUTE

The next generation of ImageJ

The next generation of ImageJ

ImageJX

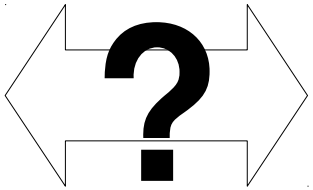
Aims:

Improve the ImageJ core architecture
- separate the data model from the user interface
- extension framework for algorithms
- broaden the image data model

Interfacing ImageJ with existing open-source programs
- e.g. CellProfiler, VisBio

...

The next generation of ImageJ



Resources

http://tech.knime.org/community-image
- KNIME Image Processing Plugin

http://pacific.mpi-cbg.de/wiki/index.php/Imglib
- ImgLib

http://imagejdev.org/
- next generation of ImageJ

http://www.openmicroscopy.org
- BioFormats, OME-XML, Omero