



CHAIR FOR BIOINFORMATICS
AND INFORMATION MINING

Open Source Tool Blending: Image Analysis in KNIME

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Image Processing and Analysis

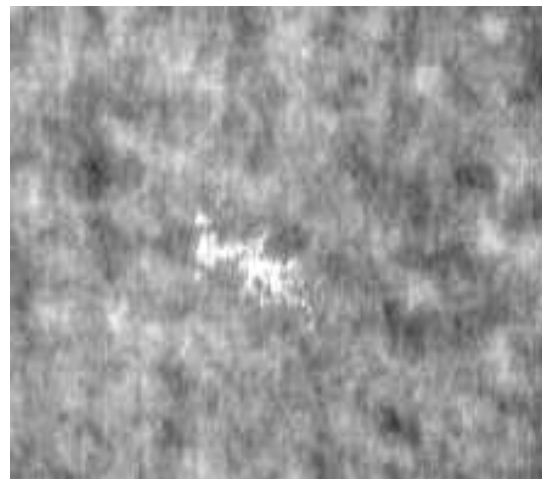
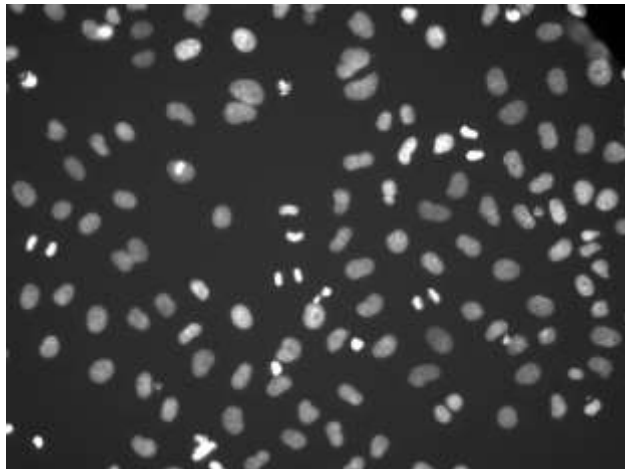
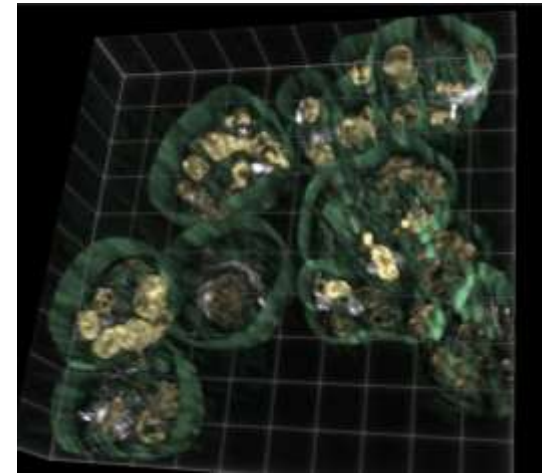
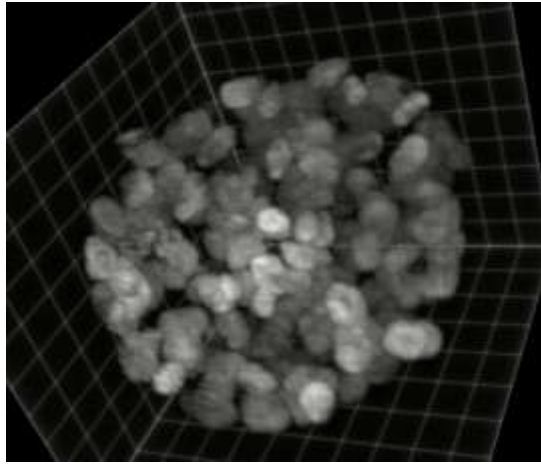




Image Processing and Analysis

Instagram: 95M photos a day (~60PB/year)

Facebook: 300M photos a day (~180PB/year)

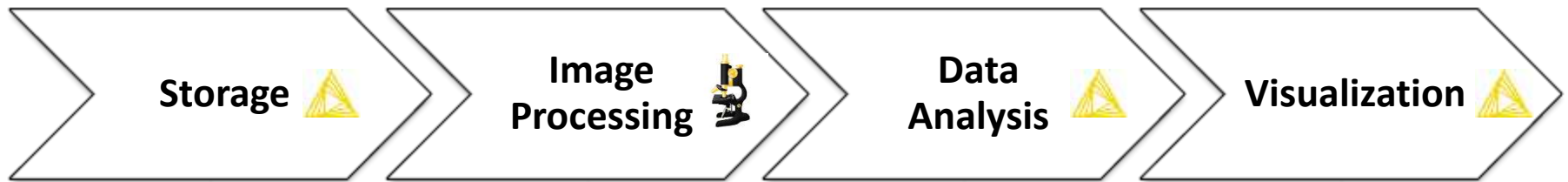
Surveillance Cameras: 1000PB / year

Bio-Imaging: TB/2s



Image Analysis

Tool Blending and Integration



Run somewhere on many images
Accessible for non-experts



ImageJ2



KNIME Image Processing – ImageJ2 Integrations



KNIME Image Processing

- Set of KNIME extensions to process and analyze images
- Approx. 100 nodes for IO, Preprocessing, Manipulation, Segmentation, Tracking, Feature Extraction, Visualization, ...
- Based on ImgLib2, SciJava, SCIFIO, BioFormats, ...

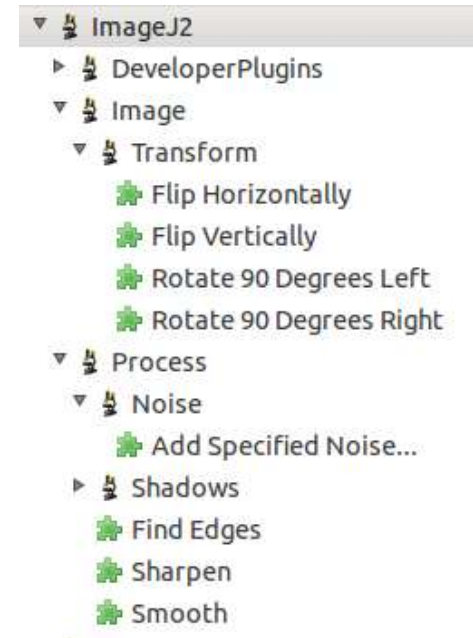




ImageJ2 Integration

ImageJ2 in KNIME

- “Write once, run anywhere”
- Automatic node generation from ImageJ2 plugins
- Add own ImageJ2 Plugins via installer
- Shared algorithm repository (ImageJ-Ops)
- From scripts to nodes*



Test Command



Node 4

script:myjython.py



Node 2

script:test.clj



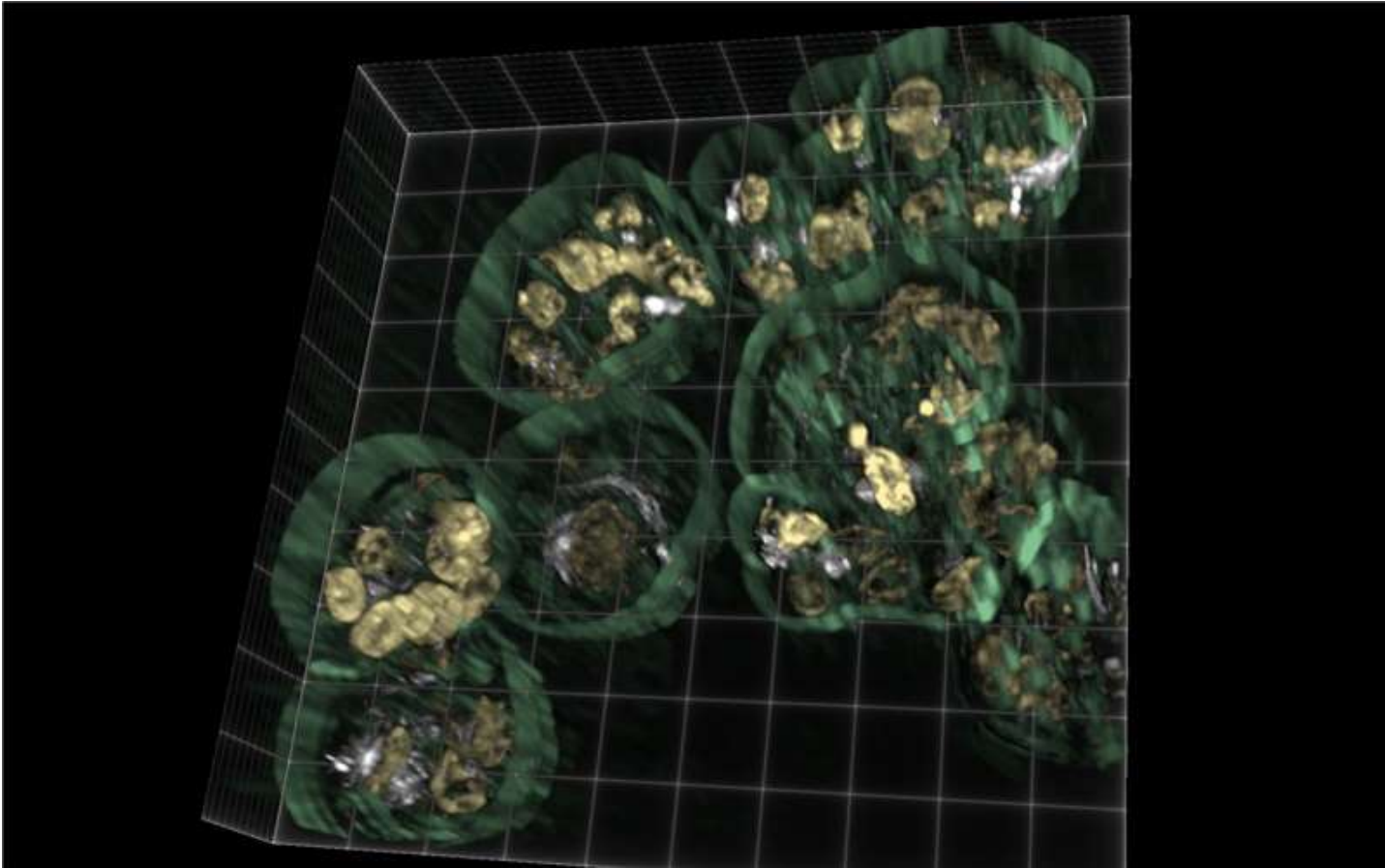
Node 3



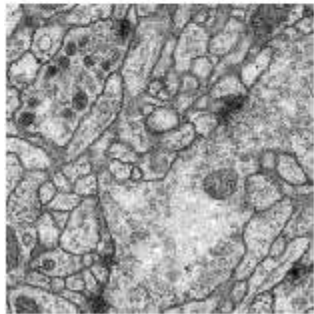
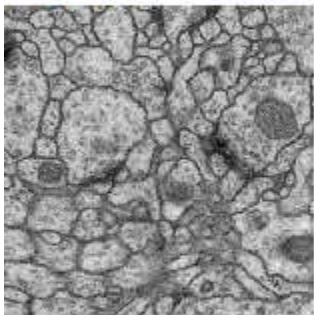
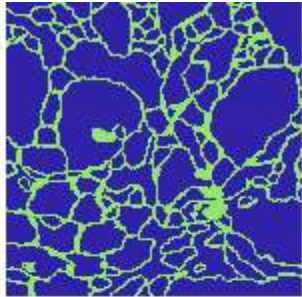
Clear Volume



CBG
Max Planck Institute
of Molecular Cell Biology
and Genetics



SUISE



Groundtruth Labels



labels

Joiner



queued

Pixel Classification Model



queued

Train images

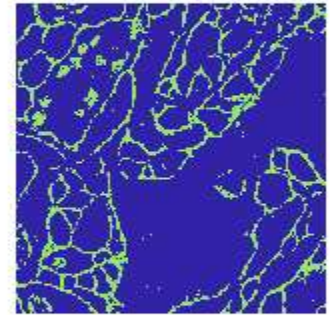


Pixel Classification Apply



queued

Test images





BigDataViewer*



CBG
Max Planck Institute
of Molecular Cell Biology
and Genetics

Image Viewer - 2:5 - Image Viewer

File Hilite

KNIPCombinedView BetaBigDataViewer

tbd t = 0
Value at Mouse = 100.0 104.0 (875.6, 437.0, 54.5)

Img 1 [Meta] -
1 is current is active

Img 2 [Meta] -
1 is current is active

Grid Mode Fused Mode

Renderer Selection Apply to all

[Info]
Min:
Max:
Min: 131 Max: 527

Projector: Default Projector

Grouping

Back to Table Expand Table View

Column [Image] (1/2) Row [MMStack_Pos1] (1/1)

Click on a cell or drag and select multiple cells to continue ...



ImageJ2 Plugin Scripting*



Image Reader



Node 1

Scripting



Node 2

Dialog - 0:16 - Scripting(Apply Net)

Script Editor

Language: java

```
1 import net.imagej.ImgPlus;
2 import net.imglib2.Cursor;
3 import net.imglib2.Img;
4 import net.imglib2.type.numeric.RealType;
5
6 import org.scijava.Items;
7 import org.scijava.command.Command;
8 import org.scijava.plugin.Parameter;
9
10 public class MyClass<T> extends RealType<T> implements Command {
11
12     @Parameter(type = Items.INPUT)
13     private ImgPlus<T> in_img;
14
15     @Parameter(type = Items.OUTPUT)
16     private ImgPlus<T> out_img;
17
18     public void run() {
19
20         Img<T> in = in_img.getImg();
21         T t = in.cursor().next();
22         .
23         // create output image with same dimensions
24         Img<T> img = in.factory().create(in, t);
25
26         Cursor<T> cin = in.cursor();
27         Cursor<T> cout = img.cursor();
28
29         int count = 0; // cur index
30
31         // set every other pixel to black
32         while (cout.hasNext() && cin.hasNext()) {
33             // set pixel of cout to pixel in
34             cout.next().setReal(cin.next().getRealDouble() * (count & 1));
35
36             count++;
37         }
38
39         out_img = new ImgPlus<T>(img);
40         return;
41     }
42 }
43
```

Column/Input Matchings:

Column	Active	Input
image	in_img	

OK Apply Cancel



KNIME Image Processing – More Integrations



CellProfiler



The image shows a CellProfiler Pipeline Executor dialog box and a KNIME Table with Measurements window. The dialog box is titled "Dialog - 0:5 - CellProfiler Pipeline Executor" and has tabs for "Config", "Flow Variables", and "Memory Policy". The "Config" tab is active, showing the "Pipeline file" set to "/home/dietzc/Desktop/ExampleHumanIm" and three "Orig" channels: "OrigBlue" (AS_09125_050116030001_D03f00d0.tif), "OrigGreen" (AS_09125_050116030001_D03f00d1.tif), and "OrigRed" (AS_09125_050116030001_D03f00d2.tif). The KNIME Table window is titled "KNIME Table with Measurements" and shows a table with 38 rows and 62 columns. The table is titled "Table 'default' - Rows: 38 Spec - Columns: 62 Prop". The table has columns for "Row ID", "D Locati...", "D Locati...", "D Intens...", and "D Intens...". The rows are labeled "Image#0" through "Image#30".

Below the dialog box, a workflow diagram shows the following nodes:

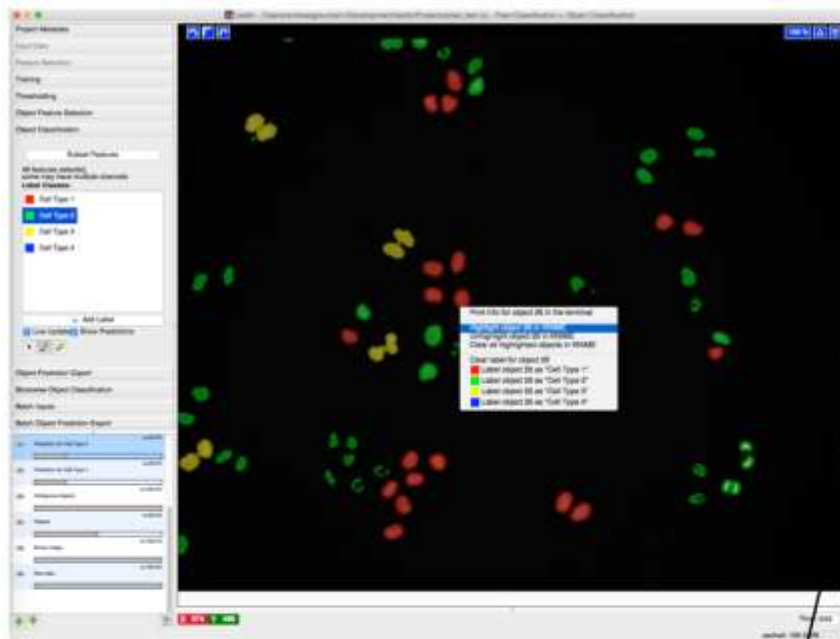
- Image Reader (Node 1)
- Transpose (Node 4)
- CellProfiler Pipeline Executor (Node 5)
- CellProfiler Measurements To Table (Node 3)

The CellProfiler Pipeline Executor node is connected to the CellProfiler Measurements To Table node.

Row ID	D Locati...	D Locati...	D Intens...	D Intens...
Image#0	8.864	80.617	0.045	0.02
Image#1	14.894	58.586	0.057	0.056
Image#2	15.295	104.783	0.05	0.081
Image#3	16.014	175.548	0.064	0.024
Image#4	21.441	154.88	0.034	0.028
Image#5	18.698	134.106	0.053	0.117
Image#6	27.522	31.063	0.062	0.02
Image#7	31.974	84.363	0.066	0.02
Image#8	31.605	48.441	0.076	0.081
Image#9	34.479	65.338	0.053	0.052
Image#10	48.609	44.287	0.062	0.089
Image#11	51.603	148.386	0.045	0.016
Image#12	45.208	107.915	0.044	0.02
Image#13	51.293	173.417	0.043	0.016
Image#14	50.1	129.839	0.193	0.198
Image#15	57.727	82.748	0.049	0.02
Image#16	63.901	123.046	0.054	0.218
Image#17	71.799	49.112	0.044	0.016
Image#18	82.485	166.69	0.046	0.016
Image#19	83.812	76.623	0.045	0.016
Image#20	85.619	110.551	0.046	0.109
Image#21	86.518	127.509	0.163	0.04
Image#22	103.538	53.838	0.039	0.016
Image#23	106.397	136.336	0.043	0.036
Image#24	108.679	95.909	0.066	0.02
Image#25	108.933	75.214	0.054	0.028
Image#26	114.23	113.537	0.072	0.02
Image#27	114.594	37.085	0.057	0.016
Image#28	114.96	165.203	0.045	0.016
Image#29	126.906	77.37	0.05	0.028
Image#30	133.975	125.74	0.059	0.028



Ilastik



Ilastik Integration

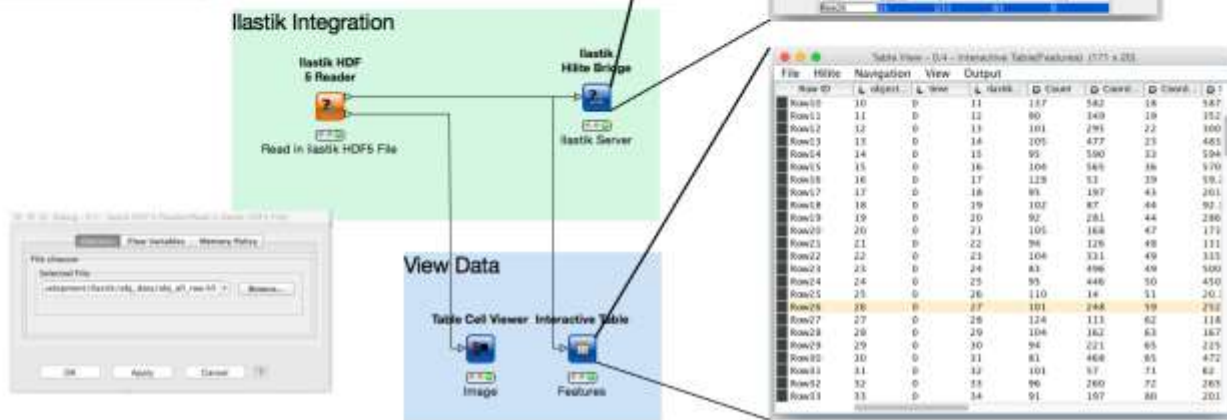


Table View - 0.14 - Interactive Table/Features (175 x 201)

File	H5file	Navigation	View	Output					
Row ID	X	Y	Z	Channel	ID	Class	ID	Class	ID
Row00	10	0	11	117	582	18	587		
Row01	11	0	12	80	149	19	152		
Row02	12	0	13	101	295	22	300		
Row03	13	0	14	105	437	23	443		
Row04	14	0	15	95	580	22	584		
Row05	15	0	16	104	545	18	550		
Row06	16	0	17	128	53	29	59.1		
Row07	17	0	18	85	197	43	201		
Row08	18	0	19	102	87	44	92.1		
Row09	19	0	20	92	281	44	286		
Row10	20	0	21	105	168	47	173		
Row11	21	0	22	94	126	48	131		
Row12	22	0	23	104	331	49	333		
Row13	23	0	24	83	496	48	500		
Row14	24	0	25	93	448	50	450		
Row15	25	0	26	110	14	51	20.1		
Row16	26	0	27	101	244	59	250		
Row17	27	0	28	124	113	62	118		
Row18	28	0	29	104	162	63	167		
Row19	29	0	30	94	221	65	225		
Row20	30	0	31	81	468	65	472		
Row21	31	0	32	101	57	71	62		
Row22	32	0	33	96	260	72	265		
Row23	33	0	34	91	167	80	201		



DeepLearning4J



DL4J Model

Initializer

Convolution Layer

Pooling Layer

Convolution Layer

Pooling Layer

Dense Layer



LeNet

AlexNet





And More ...

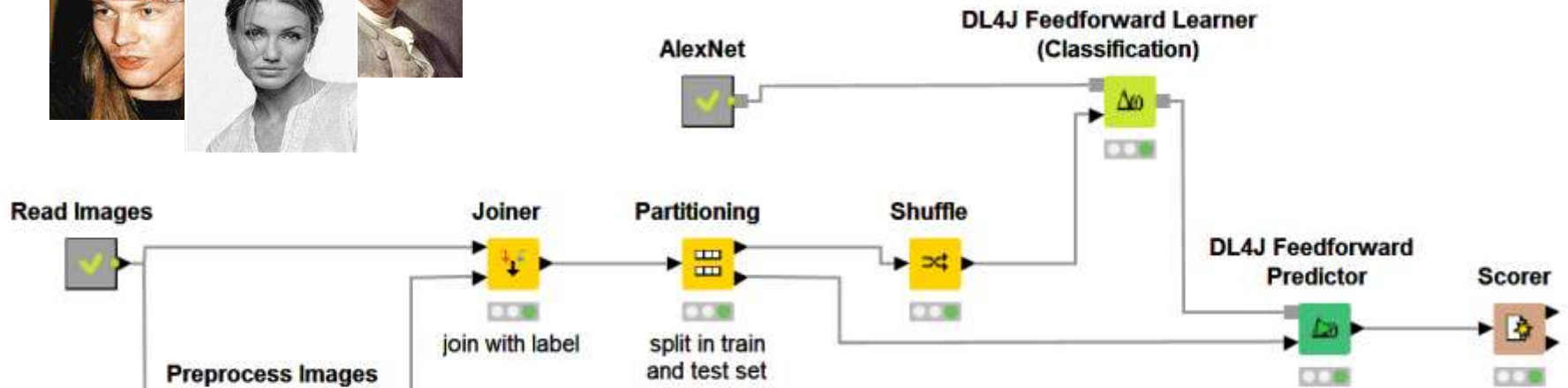
- OMERO
- Tess4J
- Python Extensions
- TrackMate
- ImageJ1-Macro
- ...



Use-Cases



Celebrity Recognition



Cameron Diaz



Cell Classification & Tracking

The screenshot displays a software interface for cell classification and tracking. The main window shows a microscopy image of cells with various colored masks (red, blue, yellow, purple) overlaid. The interface includes a top menu bar, a central image area, and a right-hand control panel with various settings like 'Image Enhancement', 'Renderer Selection', and 'Color Options'.

Image Info
X:194.1392; Y:174.1048; Time:215; value=img; [S] Labeling: [EmptyLabel]
Visible Rectangle: [0; 0; 1083; 348]
Image

Image Info
Label: P0037_700190_Crfp_Z1_51.tif
Type: LabelingType

Minimap
200

Image Enhancement
 Normalize
Saturation (dB): 0.0%

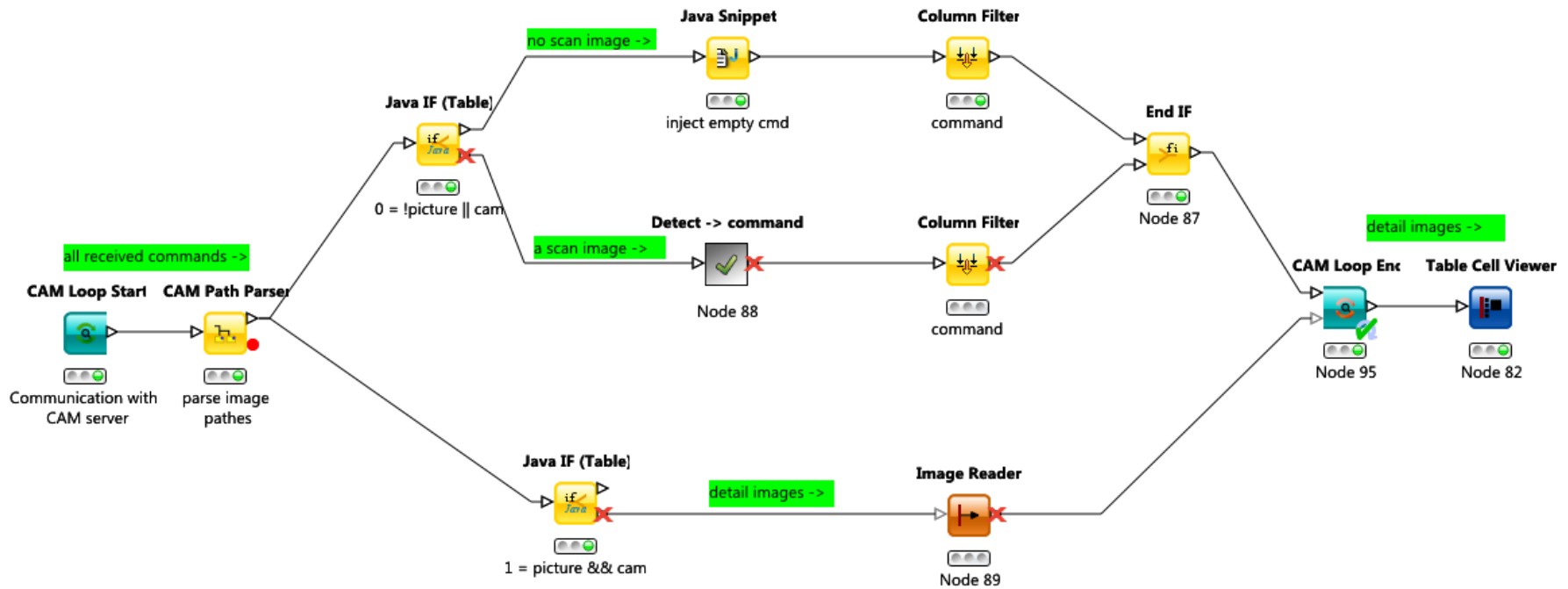
Renderer Selection
Random Color Labeling Renderer
Bounding Box Renderer
Bounding Box Color Labeling Renderer

Color Options
Transparency: 0%
Set Bounding Box Color: [Color Picker]
Change Random Label...: [Color Picker]
Show Bounding Box B...: [Color Picker]

Label Filter



Smart Microscopy





And more ...

BioImaging

- Image Classification in Histopathology
- Learning of Segmentation
- Object Classification
- Simple Task Workflows (Counting, Measurements,...)
- Multi-View Reconstruction (SPIM)*
- ...

Classical Image Analysis

- Large Scale Object Recognition
- Face Recognition
- Car Counting
- Pedestrian Tracking*
- ...

... Check our example workflows!



Why KNIME & ImageJ?

- Joined Efforts of two Leading Communities
- Big Image Processing and Analysis
- Exploration and Prototyping
- Scaling and Automation
- Bridging Domains



Get Involved!

- Update Site
- Installation Details, News, Wiki, GitHub
- Forum
- Contact Information
- Example Workflows/Tutorials/Videos...

<http://knime.imagej.net>

<http://imagej.net>



Questions?



Open for Innovation
KNIME

