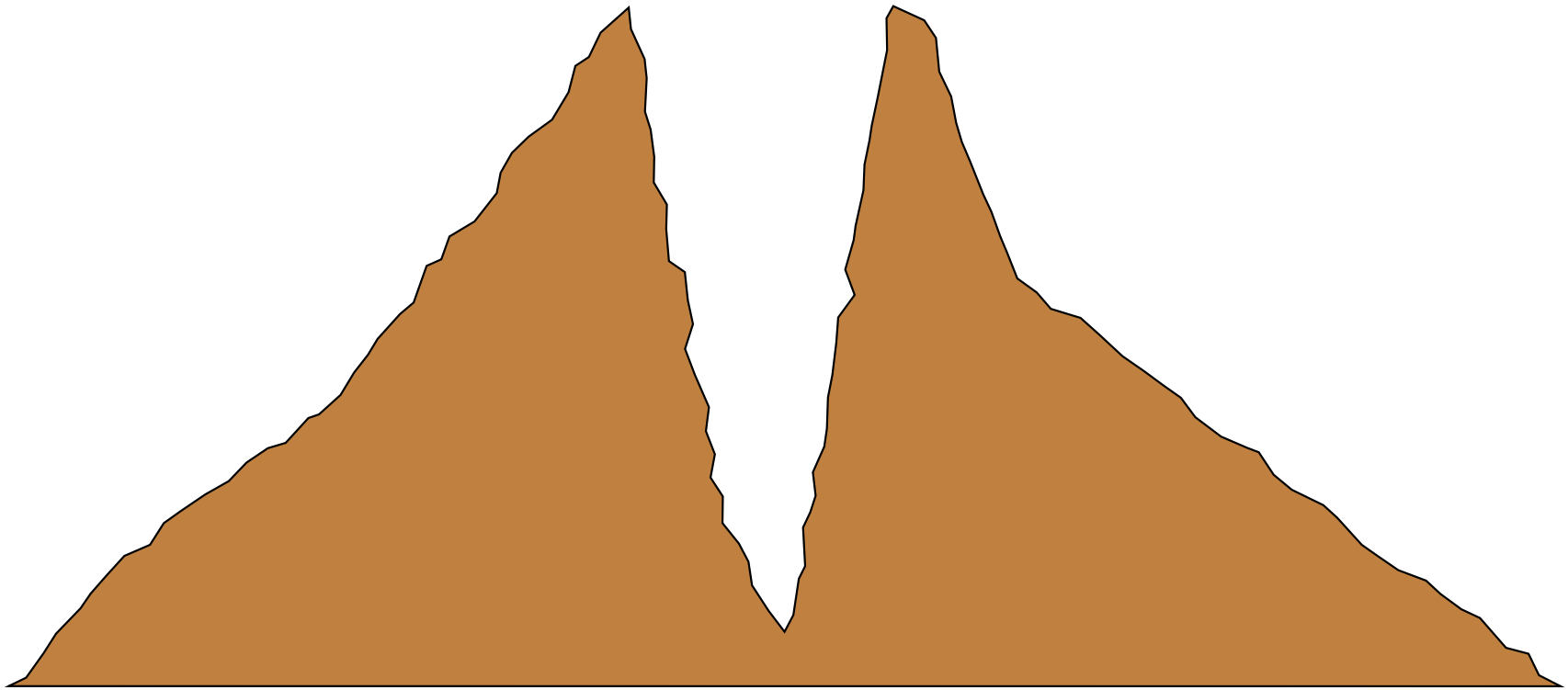
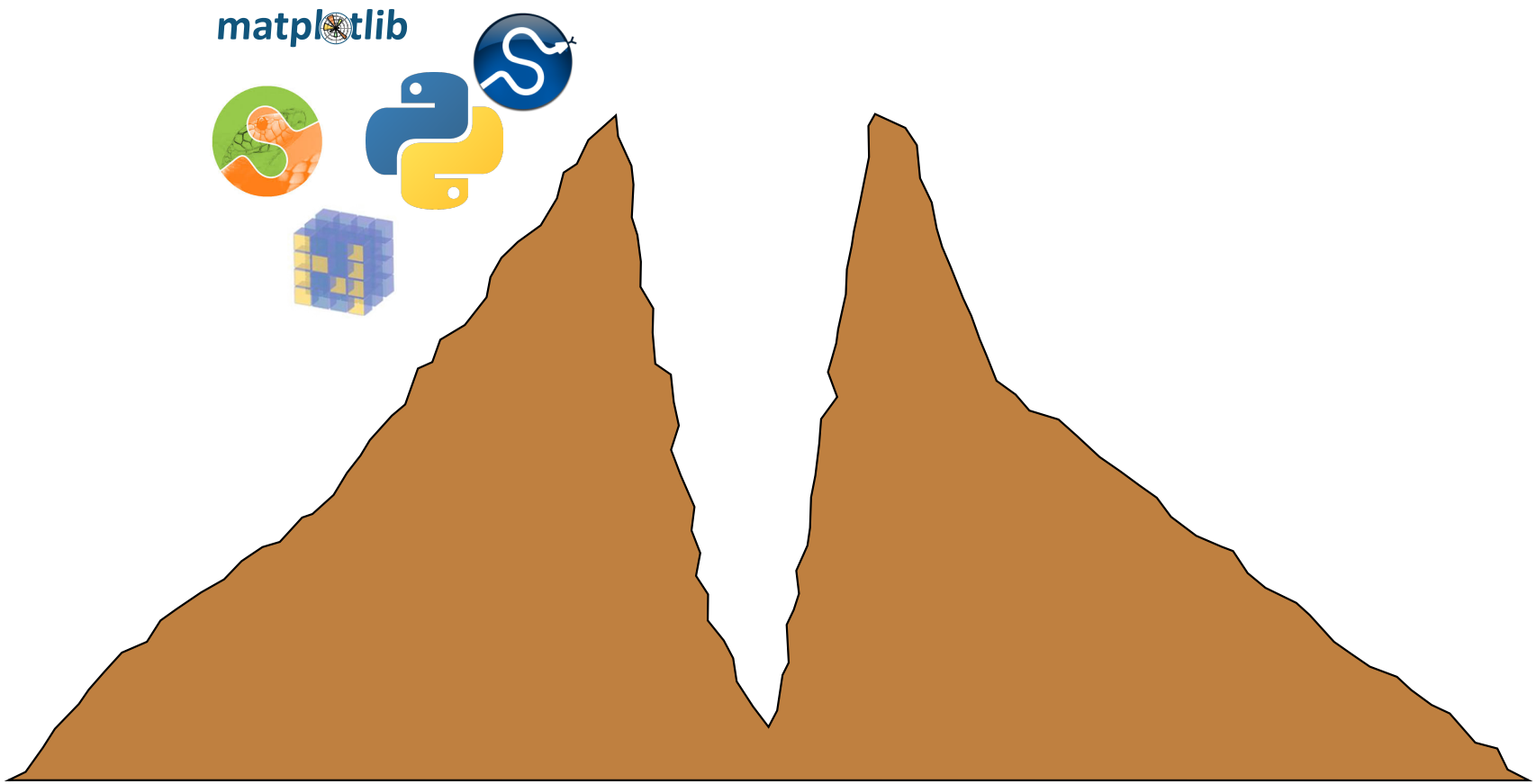
hhmi | janelia
Research Campus

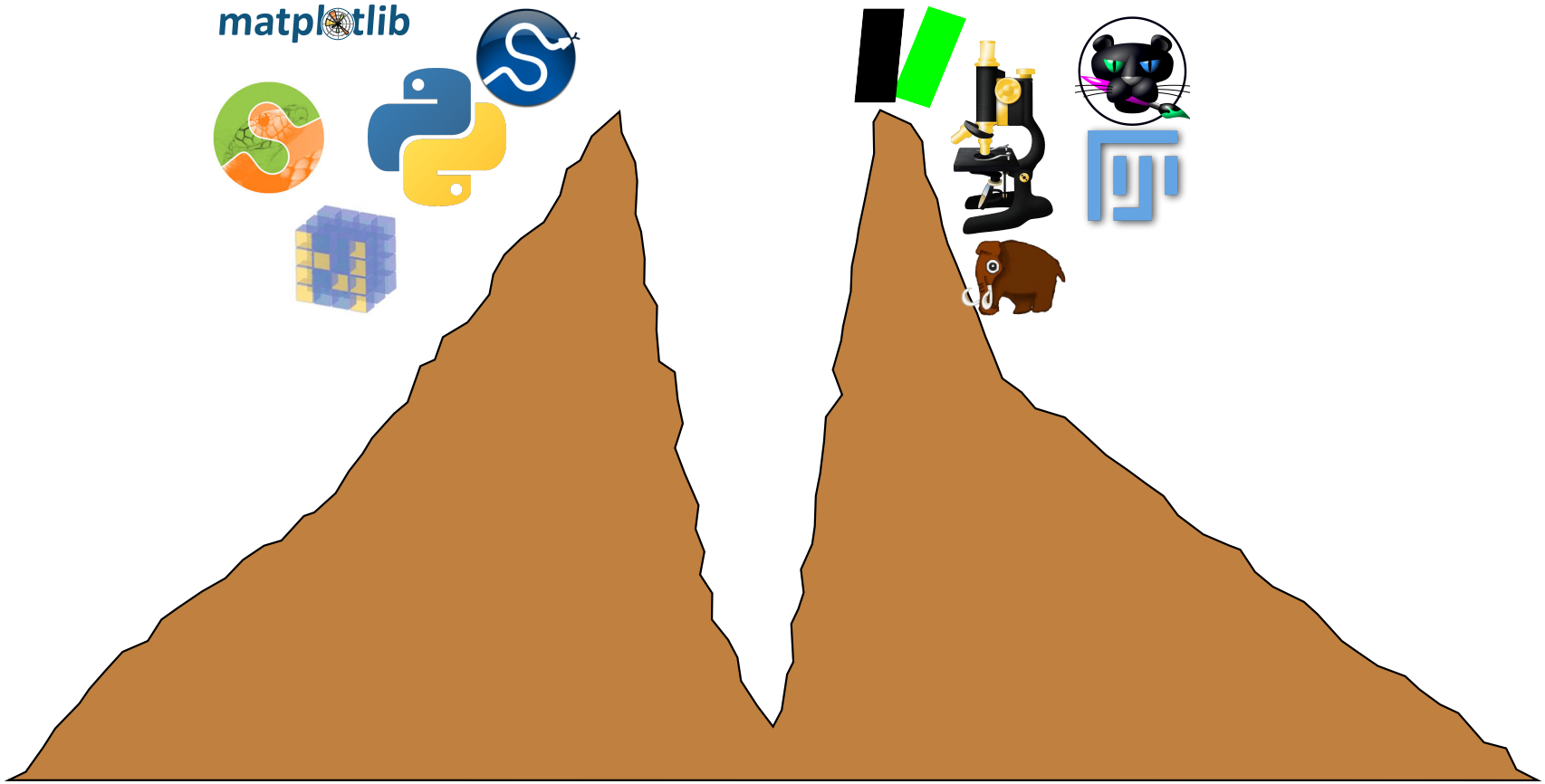
Philipp Hanslovsky

imglyb

Bridging The Chasm Between ImageJ and NumPy




matplotlib


matplotlib

What is Python?

- Interpreted language with dynamic typing.
- Access to native memory.
- Efficient software through C/C++ extensions.
- Interactive shell and notebooks.

What is Java?

- Statically typed language that compiles into byte code.
- Byte code is executed within a virtual machine (JVM).
- No access to native memory through Java language API.

Why are they hard to combine?

- Native vs JVM
- Java Array $\neq$ C-Array

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- Python and JVM in the same process:
  - ✓ Shared memory possible.
  - ✓ Avoids unnecessary copies of data.

Two options

- Java implementation of Python: Jython

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  - ✓ Access native CPython extensions through Jython Native Interface
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- Start Java within a CPython process

Way out!

- ✓ Start JVM from Python process.

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  `https://github.com/imglib/imglib2-imglyb`

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✓ Make ImgLib2 and NumPy understand each other.

`https://github.com/imglib/imglib2-unsafe`
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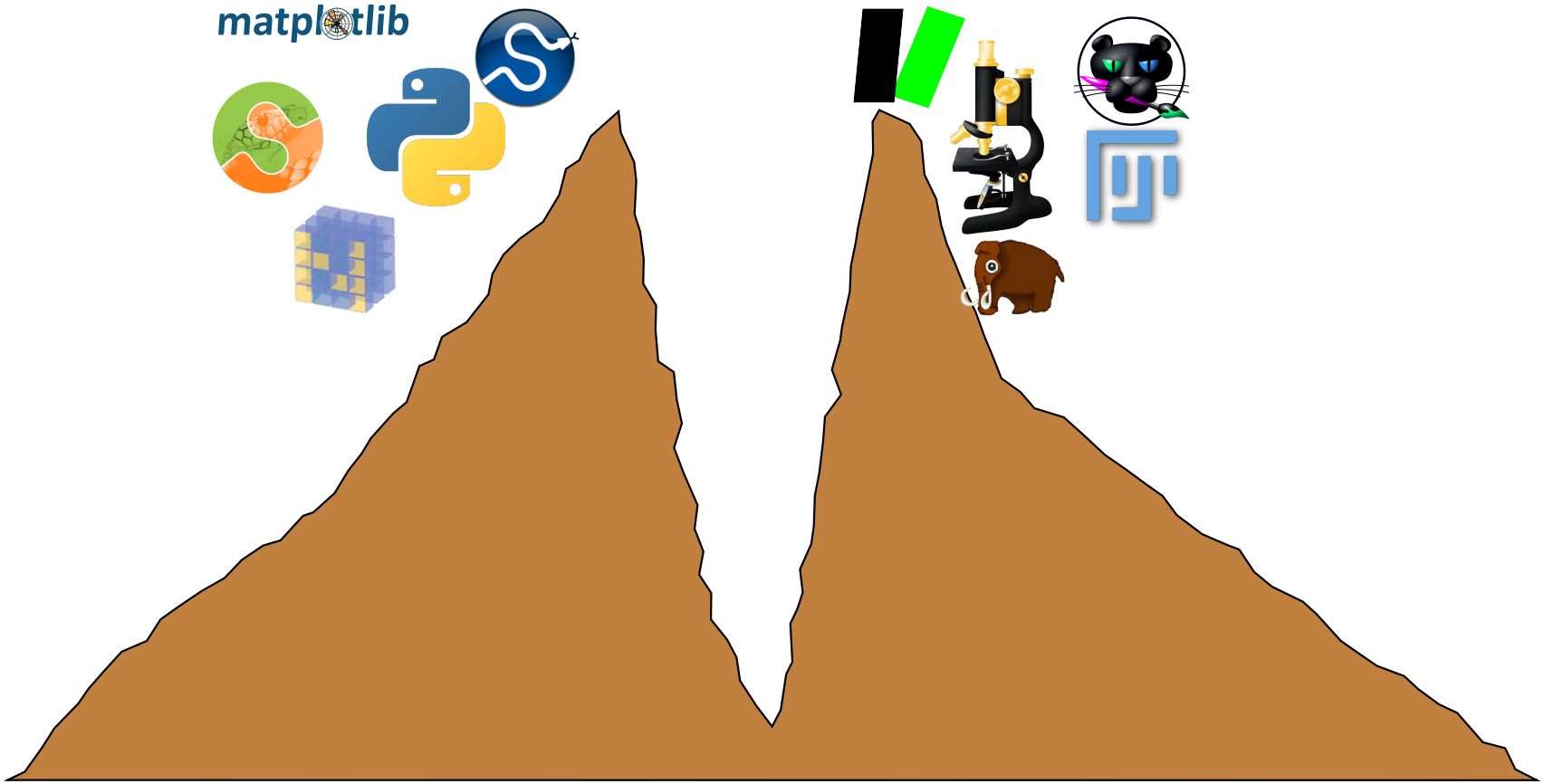
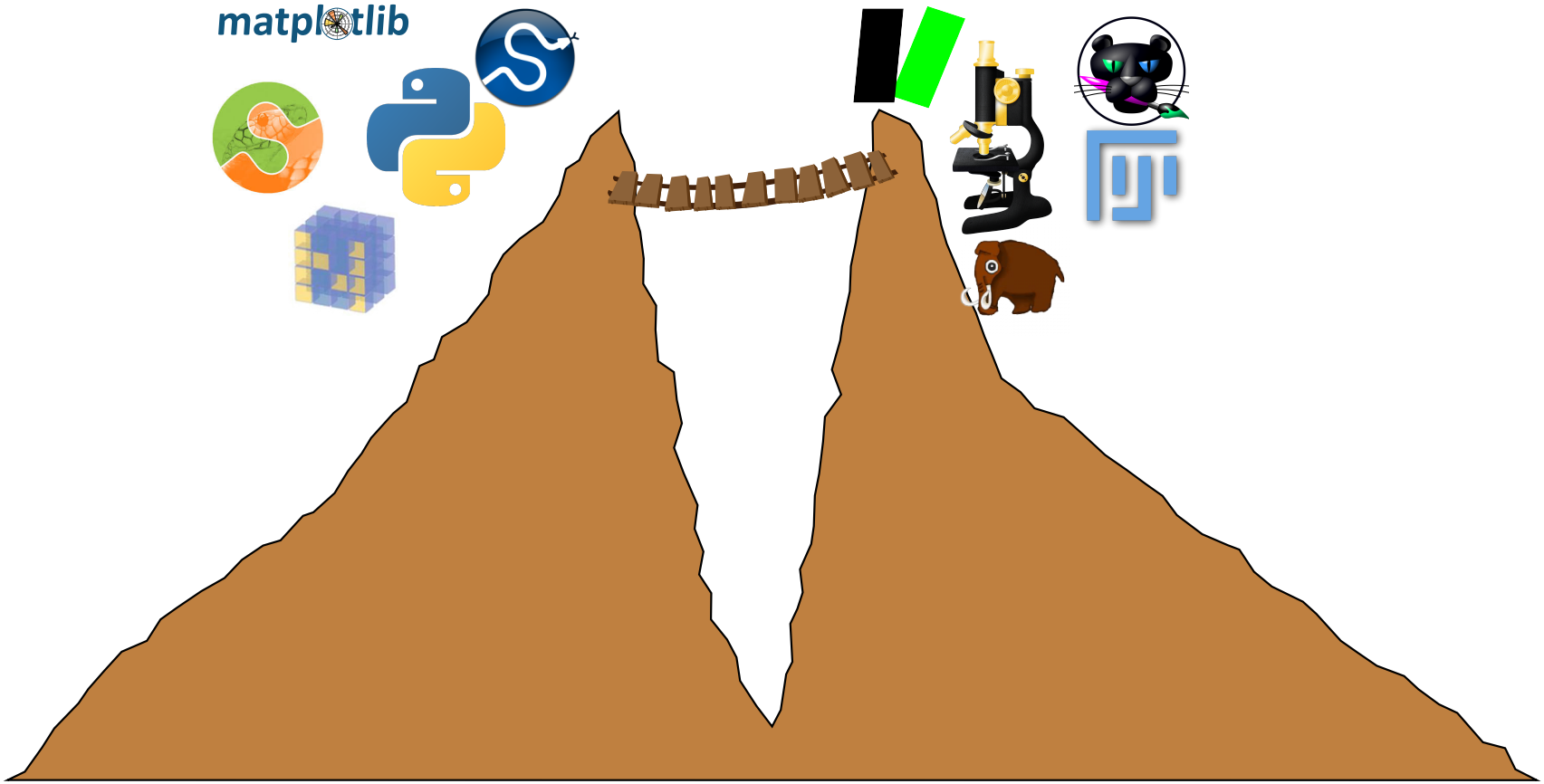
`https://github.com/imglib/imglyb`

My contribution 

imglyb



imglyb



Installation & Usage

- Install imglyb from conda

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conda install -c conda-forge imglyb
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- Notebooks available on

  https://github.com/hanslovsky/imglyb-learnathon

How to use?

Import `imglyb`

```
# import imglyb before jnius
import imglyb
from imglyb import util
# import from jnius what you need
from jnius import autoclass, cast, PythonJavaClass, java_method
```

Wrap NumPy arrays in ImgLib2

```
import imglyb
from imglyb import util

import numpy as np

img = np.random.rand( 300, 200, 100 ) * 2**16
wrapped = util.to_imglib( img )
util.BdvFunctions.show( wrapped, "wrapped image" )

rgba = np.random.randint(
    2**32, size = ( 300, 200, 100 ),
    dtype=np.uint32 )
wrapped_rgba = util.to_imglib_argb( rgba )
util.BdvFunctions.show( wrapped_rgba, "wrapped rgba image" )
```

Examples

Available in the imglyb-examples package:

```
imglyb-examples.bdv-hello-world
imglyb-examples.bdv-painter
imglyb-examples.butterfly
imglyb-examples.qt-awt
imglyb-examples.views-stack
```

Known Issues

- Java awt and Swing require wrapper script on macOS
- Dask Arrays cannot be wrapped as ImgLib2 data structures yet

Example 1 — BigDataViewer


T. Pietzsch

BigDataViewer (BDV) is a Java viewer for arbitrarily large multi-view 3D images and 3D image sequences developed by Tobias Pietzsch.

https://imagej.net/BigDataViewer
https://github.com/hanslovsky/imglyb-learnathon/blob/master/notebooks/bdv/show-numpy-array-in-bdv.ipynb

Example 2 — BigDataViewer

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Example 3 — BigWarp

J. Bogovic

BigWarp is a tool for interactive manual alignment of 2D or 3D images developed by John Bogovic.

https://imagej.net/BigWarp
https://github.com/hanslovsky/imglyb-learnathon/blob/master/notebooks/bigwarp/bigwarp.ipynb

Example 4 — Paintera

Paintera is a tool for the efficient generation of dense ground truth annotations and proof-reading 3D EM connectomics with 3D visualization and mesh generation on the fly.

https://github.com/saalfeldlab/paintera
https://github.com/hanslovsky/imglyb-learnathon/blob/master/notebooks/paintera/paintera-mesh-generation-on-the-fly.ipynb

Resources


https://www.python.org


https://www.numpy.org


https://scipy.org


https://scikit-image.org


https://matplotlib.org


https://imagej.net/ImageJ2


https://imagej.net/ImgLib2


https://github.com/saalfeldlab/paintera


https://fiji.sc/


https://imagej.net/MaMuT


https://openclipart.org/detail/209218/firebog-bridge

Thank You!

https://github.com/hanslovsky/scipy-2019

Link to Slides

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