

# From Images to Knowledge with ImageJ & Friends

virtual conference

**Nov 30 - Dec 2, 2020**

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## Modern Insights from Microscopy Images: An Introduction to Web-based Methodologies

**Tutors:** Matthew McCormick ([matt.mccormick@kitware.com](mailto:matt.mccormick@kitware.com))

**Session 1:** 2020-11-30 13:00 UTC – 2020-11-30 17:00 UTC

**Session 2:** 2020-11-30 18:00 UTC – 2020-11-30 22:00 UTC

From Images to Knowledge with ImageJ & Friends Virtual Conference Tutorial  
November 30th - December 2nd, 2020

Instructor: Matt McCormick, PhD, Kitware

Title: Modern Insights from Microscopy Images: An Introduction to Web-based Methodologies

Abstract: Technological evolution poises modern, web-based methods as the future of bioimage analysis. Moreover, web-based methods are better suited to solve challenges such as extremely large images and reproducibility. In this tutorial, we will introduce the concepts, approaches, and tools for modern, web-based open source bioimage analysis. An introduction to the fundamentals of web-based imaging is covered through the topics of web-based image visualization, image data storage for the web, distributed image processing in the cloud, asynchronous programming, and re-usable deep learning components on the web. Content will be presented in Jupyter notebook modules consisting of oral presentations, interactive material, and hands-on exercises.

Technical Requirements:

Students are required to have a laptop or a workstation, Chrome web browser, and a [GitHub](#) account. Students should install [miniconda](#) or [anaconda](#) to obtain the conda package manager.

Outline:

1. Introduction to Modern, Web-based Methodologies (20min)

*Learning objectives:*

- What are modern, web-based image analysis methods?
- Why are web-based methods relevant for large images and reproducibility? - How does open source software fit into the computational ecosystem?

2. Student Introductions (50min)

*Learning objectives:*

- Connect students to collaborate on shared challenges - Gain an understanding of peer needs

3. Web-based Image Visualization (30min)

*Learning objectives:*

- Understand the capabilities and limitations of img, canvas, WebGL, WebAssembly, and WebGPU browser technologies
- Identify the trade-offs in server-side and client-rendering
- Become familiar with open source web visualization tools: itk-vtk-viewer, itkwidgets, kaibu, imagej.js, matplotlib, ipympl, neuroglancer, and the web-based capabilities of paraview, napari

#### 4. Image Data Storage for the Web (30min)

*Learning objectives:*

- Become familiar with the design of modern, blob-based storage systems and network-storage properties
- Gain experience with the zarr and n5 formats
- Understand the relationship between chunked, compressed, blob storage and parallel processing and multi-scale visualization

#### 5. Distributed Image Processing in the Cloud (30min)

*Learning objectives:*

- Become familiar with lazy, distributed Python image processing with Dask
- Learn how to start and interact with a Coiled.io cloud cluster
- Understand why consistent software environments are required and how to

create them

#### 6. Asynchronous Programming (30min)

*Learning objectives:*

- Compare asynchronous, event-based systems with procedural thread parallelism traditionally used in imaging
- Understand how to use async/await in JavaScript and Python
- Understand how to interface asynchronous and synchronous programs

#### 7. Open, Re-usable Deep Learning Components on the Web (30min)

*Learning objectives:*

- Use ImJoy web-based imaging components - Create a JavaScript-based ImJoy plugin
- Create a Python-based ImJoy plugin

#### 8. Summary and Questions (50min)