

From Images to Knowledge with ImageJ & Friends

virtual conference

Nov 30 - Dec 2, 2020

Stephan Preibisch, Stephan Saalfeld, Anna Kreshuk,
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ImJoying Interactive Bioimage Analysis with Deep Learning, ImageJ.JS & Friends

Tutors: Wei Ouyang (wei.ouyang@scilifelab.se)

Session 1: 2020-12-01 12:00 UTC – 2020-12-01 16:00 UTC

Session 2: 2020-12-02 08:00 UTC – 2020-12-02 12:00 UTC

Session 1: Dec. 1st 12:00-16:00 UTC

Session 2: Dec. 2nd 8:00-12:00 UTC

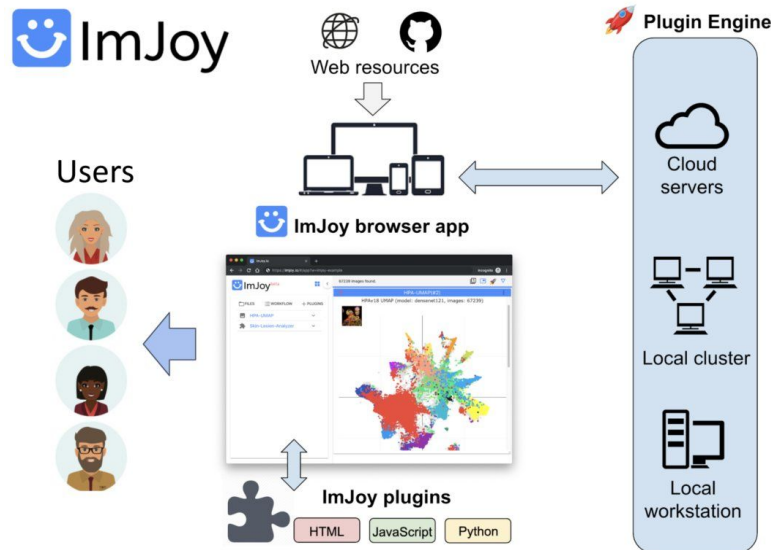
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About the tutor

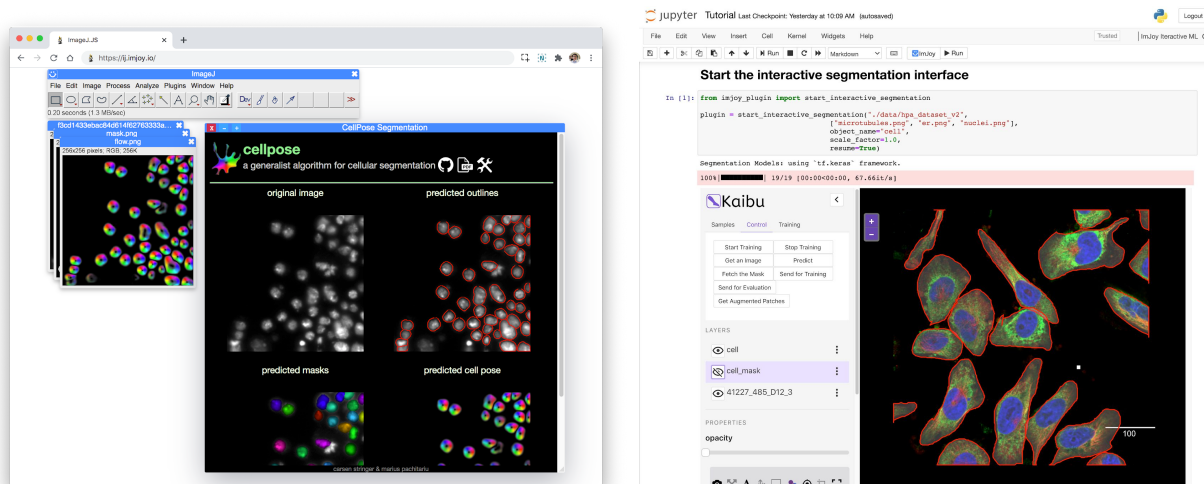
Wei OUYANG is a postdoctoral researcher in Prof. Lundberg's group at the Science for Life Laboratory and KTH Royal Institute of Technology in Stockholm. He has a diverse background across several different fields including material science, computer science and advanced microscopy imaging. Dr. Ouyang obtained his PhD in computational image analysis at Institut Pasteur, Paris where he mainly focuses on applying deep learning for super-resolution microscopy. During this period, he developed a deep learning method called [ANNA-PALM](#) which massively accelerates super-resolution localization microscopy by 100x. To address the challenges in the dissemination of AI tools, he developed an open-source computational platform, [ImJoy](#), which makes deep learning tools easier to build and more accessible to the user. He is actively involved in consortiums and community activities for promoting more open, scalable, accessible and reproducible scientific tools. Dr Ouyang is mainly interested in AI augmented microscopy imaging and data-driven whole cell modeling.

Summary

ImJoy is a computing platform for developing and deploying advanced data analysis tools (<https://imjoy.io>). It provides a minimal and flexible framework for building scalable and easy-to-use data analysis tools. While cloud resources can be connected to the standalone ImJoy application, ImJoy can also utilize modern web browser features such as WebAssembly and WebGPU to build interactive computing tools. With a large variety of existing libraries from the web and scientific computing community, users can easily develop rich and interactive data analysis plugins in ImJoy. It enables sharing data and tools in one click, interactively processing massive dataset, training AI models and performing browser and cloud based hybrid computing.



Our recent efforts aimed to ease the integration of ImJoy with existing bioimage analysis tools and online databases. Now, ImJoy is integrated with a web version ImageJ (<https://ij.imjoy.io>). ImJoy plugins can also be developed and run directly in Jupyter Notebooks, JupyterLab and Google Colab. We demonstrate this cross-compatibility with new plugins developed for image visualization, annotation and microscopy control.



Outline

In this tutorial, we will cover the following topics:

- 1) **Introduction to web based image analysis and ImJoy (20min)**
 - a) Challenges of data analysis in the deep learning era
 - b) Modern browser and cloud based image analysis
 - c) Basic design of ImJoy and its plugin, workflow, and remote procedure calls

- 2) Introduction of each student (50min)**
- 3) Practical work 1: Building your own ImJoy plugins (45 min)**
 - a) Get familiar with web programming (HTML/CSS/Javascript)
 - b) Learn asynchronous programming and remote procedure calls
 - c) Build ImJoy plugins in Javascript and Python
 - d) Deploy your plugin to Github/Gist and Sharing it with others
- 4) Practical work 2: Interactive Image Analysis with ImJoy and Jupyter Notebooks (45 min)**
 - a) Develop ImJoy plugin in Jupyter notebooks (JupyterLab and Google Colab)
 - b) Scalable high dimensional image visualization with [itk-vtk-viewer](#), [Kaibu](#) and [vizarr](#)
 - c) Build your own image viewer plugin with itk-vtk-viewer
- 5) Practical work 3: Building ImJoy plugins for deep learning based image analysis (45min)**
 - a) Build a UNet for image restoration and segmentation in Python
 - b) Extend your image viewer plugin for interactive training and prediction
 - c) Contribute your models and plugins to [BioImage.IO](#)
- 6) Summary and questions (1h)**

Most parts of the tutorial will be interactive and involve hands-on experiments on your own laptop. We can also adapt the topic to the audience.

Requirements

To join this tutorial, the students will need a laptop or PC with [Chrome browser](#), [miniconda](#) or [anaconda](#) installed, a GitHub account and a Google account (for Colab access). For the deep learning part, a workstation with GPU will be helpful but it is not mandatory for this tutorial.

Looking forward to meeting you, ImJoying and having fun together!