

Before the tutorial

To get the most out of this tutorial, you may want to work along with us on your own laptop. If you do, we highly recommend that you:

1. Download and install the following:

- **Anaconda** 5.2 for python 3.6 - <https://www.anaconda.com/download/>
- **Pycroscopy** - <https://pycroscopy.github.io/pycroscopy/install.html>
- **HDFview** - <https://support.hdfgroup.org/products/java/release/download.html>

2. Familiarize yourself with basics concepts. Links to quick and helpful tutorials are available here - https://pycroscopy.github.io/pyUSID/external_guides.html . Topics include:

- Basic **python** usage
- **Jupyter notebooks** for running code
- **Numpy** for numeric operations

If you have any trouble or questions with installations etc., please go to:

<https://groups.google.com/forum/#!forum/pycroscopy>

Other Useful Links:

Pycroscopy

- Python software package
- Open source and free
- Written by and for scientists
- Instrument agnostic algorithms
- Workflows in Jupyter notebooks
- Uses USID and pyUSID

USID

- Universal Spectroscopy and Imaging Data
- Any instrument, modality, size, dimensionality, complexity, data precision

pyUSID

- Free, open, python package
- Underlying engineering tools that power pycroscopy

Looking for pycroscopy?

Google: “pycroscopy documentation”

Or go to: <https://pycroscopy.github.io/pycroscopy/about.html>

Want to learn the basic data tools that power pycroscopy (pyUSID)?

Go to: https://pycroscopy.github.io/pyUSID/auto_examples/index.html

How to install Pycroscopy?

Go to: <https://pycroscopy.github.io/pycroscopy/install.html>

How to get help for Pycroscopy?

Go to: <https://groups.google.com/forum/#!forum/pycroscopy>

What is a Jupyter notebook?

Go to: <http://jupyter.org/>

Where to get our Jupyter notebooks for this workshop?

https://github.com/pycroscopy/MM_2018_Workshop

Where to get our Jupyter notebooks associated with recent papers?

<https://github.com/pycroscopy/papers>

Want to visualize contents of pycroscopy data files?

Use HDFView: <https://support.hdfgroup.org/products/java/hdfview/>

Schedule

Time	Topics
8:30 - 9:15 AM	Software set up Crash course on basic python, Jupyter notebooks and numpy
9:15 – 10:30 AM	Introduction to the Universal Spectroscopy and Imaging Data (USID) Using USIDatasets, slicing, and interactive visualization of multidimensional datasets
10:30 – 10:45 AM	Coffee Break
10:45 – 11:45 AM	Spectral decomposition and unmixing – <ol style="list-style-type: none"> 1. Singular Value Decomposition (SVD) 2. Independent Component Analysis (ICA) 3. Non-negative matrix factorization (NMF) 4. K-Means Clustering
11:45 AM – 12:45 PM	Lunch break
12:45 – 1:45 PM	Image denoising, feature extraction and atom-finding applied to atomically resolved images
1:45 – 2:15 PM	Extracting invisible trends in 4D Scanning Transmission Electron Microscopy datasets
2:15 – 2:45 PM	Clustering positions of identified atoms
2:45 – 3:00 PM	Coffee Break
3:00 – 3:30 PM	Image alignment and registration
3:30 – 5:00 PM	Deep learning – <ol style="list-style-type: none"> 1. Logistical regression as shallow neural networks (NN) 2. Deep neural networks (DNN) 3. Convolutional neural networks (CNN) 4. Applications to microscopy images