OMERO guide MATLAB Documentation

Release 0.1.0

Open Microscopy Environment

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Contents

This section shows how to install and use the OMERO MATLAB toolbox. Various exercises demonstrate how to analyze data and stored the results back to server.

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CHAPTER 1

Analyze OMERO data using MATLAB

Matlab is a powerful programming platform. We show here you can analyze data stored in OMERO using Matlab.

We will use https://docs.openmicroscopy.org/latest/omero/developers/Matlab.html as a reference.

1.1 Description

Here we demonstrate how to analyze a batch of images associated with the paper Subdiffraction imaging of centrosomes reveals higher-order organizational features of pericentriolar material.

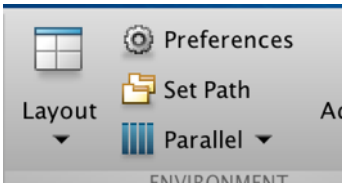
We will show:

- How to connect to OMERO using MATLAB.
- How to load data (dataset, channels information, binary data).
- How to analyze images. The channel's name will be used to determine the channel to analyze.
- How to save the generated ROIs to OMERO.
- How to save the results stored in a CSV file locally back to the OMERO.server as a FileAnnotation.
- How to convert the CSV file into an OMERO.table.

1.2 Setup

1. The OMERO.matlab toolbox and the Image Processing toolbox have been installed.
    - To install the OMERO.matlab toolbox https://www.openmicroscopy.org/omero/downloads/
    - The Image Processing toolbox is only necessary for the image analysis. This is a convenient toolbox for analysis purpose. You do not need to install that toolbox to integrate OMERO and MATLAB.
    - Make sure that the OMERO.matlab toolbox is on the MATLAB path. To add it to the path, you can
    - Launch MATLAB.

- Under the *HOME* tab, click on *Set Path* (middle of the top task bar).



- A *Set Path* dialog pops up.
- Click on the button *Add with Subfolders...*
- Select the OMERO.matlab toolbox, Click *Open*.
- Close the *Set Path* dialog, you can either save the path for future use or not.

1.3 Resources

We will use:

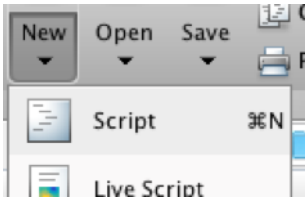
- Data from Image Data Resource (IDR) https://idr.openmicroscopy.org/webclient/?show=project-51

For convenience, the IDR data have been imported into the training OMERO.server. This is only because we cannot save results back to IDR which is a read-only OMERO.server.

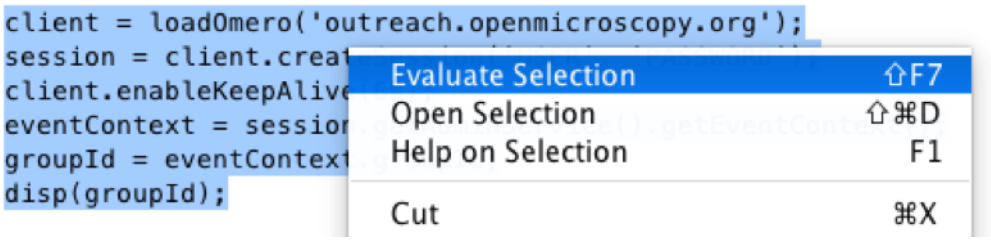
1.4 Step-by-Step

The script used in this document is `idr0021_steps.m`.

1. In the *EDITOR* tab create a new script:

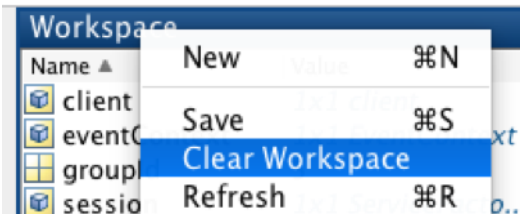


2. Copy the code for the exercises from `idr0021_steps.m`
3. Paste it into the new file and save the script under whatever name you like. **DO NOT RUN** the whole script.
4. To follow along the exercises only select the code block of each exercise and run it with "Evaluate Selection":



5. Later exercises cannot be run unless the previous exercises have been executed successfully.

6. If **you get stuck**, right-click on the *Workspace* tab, clear the workspace and start again from the beginning:



1.4.1 Exercise 1

Objectives: Connect to OMERO and print out your group ID.

Steps:

- Replace the USER and PASSWORD placeholders with your assigned credentials.
- Select the code block of **Exercise 1**
- Run it with "Evaluate Selection".

1.4.2 Exercise 2

Objectives: Load dataset and list the images contained in the dataset.

Steps:

- In OMERO.web find the dataset 'matlab-dataset' (in Project 'matlab-project')
- Copy its ID
- In the matlab code replace DATASET_ID with this ID
- Run the code block.

1.4.3 Exercise 3

Objectives: Read metadata; in particular find out which protein is the target in the images by looking through the image's map annotations (key-value pairs). It is the same protein for all four sample images.

Steps:

- Select one image from the dataset
- Load the map annotation linked to the image
- Select the entry whose key is 'Antibody Target'

1.4.4 Exercise 4

Objectives: Find out in which channels the target protein is stained.

Steps:

- Iterate through the dataset
- For each Image

  - Find the channel's name using the LogicalChannel
  - Determine the index of the channel whose name matches the value found in the previous exercise

1.4.5 Exercise 5

Objectives: Perform a simple image segmentation on one image and display the result.

Steps:

- Iterate through the dataset
- Analyze the image whose name is *siControl_N20_Cep215_I_20110411_Mon-1509_0_SIR_PRJ.dv*
- Retrieve the plane with `z=0, t=0, c=channel-1`. Indexes start at *0* in OMERO.
- Determine the mean, the standard deviation.

1.4.6 Exercise 6

Objectives: Perform the image segmentation on the whole dataset and save the results as ROIs and CSV file. The CSV file is saved as a FileAnnotation

1.4.7 Exercise 7

Objectives: Save the results as OMERO.table. This shows how to convert the CSV file into an OMERO.table

Steps:

- Run the code
- Go back to OMERO.web
- Select an image from the evaluated dataset
- Expand the *Tables* harmonica. You should see the results there.
- Double-click on the thumbnail of the image and inspect the ROIs in OMERO.iviewer.
- Note: You can also use OMERO.parade on the OMERO.table data created in this manner. As OMERO.parade works only on Projects, in OMERO.web
  - Create a new Project
  - Put the analyzed Dataset into that Project
  - Attach the OMERO.table created in **Exercise 7** to the Project
  - Now you can use OMERO.parade on the Project