Data Management of high-content screening data using OMERO
Case studies at the UFZ, Leipzig

Riccardo Massei
Data Steward at NFDI4BIOIMAGE

From Paper to Pixels: Navigation Through Your Research Data - Dresden

05.06.2024

Scientific background and motivation

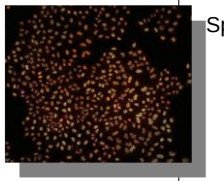
Challanges in high-content screening (HCS) bioimaging

High-content screening (HCS) bioimaging approaches are powerful techniques consisting of the automated imaging and analysis of a large numbers of biological samples

A single experiment can easily generate thousand and up to hundred thousand images for acquisition

Due to the amount of data, processed such as data management and analysis has a particular need for **automatization**

High content genome-wide siRNA



Spinning disk confocal microscopy

83 plates (384 well plate)

230000 images

Müller et al., 2021 (Nature)

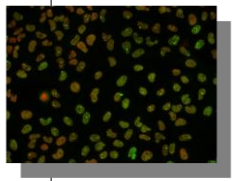
RNAi high content genes screening

Fluorescence Microscopy

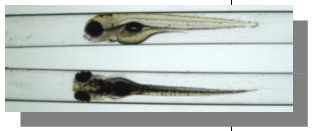
148 plates (384 well plate)

56000 images

Doil et al., 2009 (Cell)



Vascular distruption in zebrafish embryos



Bright Field Microscopy

50 plates (96 well plate)

5500 images

Nöth et al., 2024 (Archieves of Toxicology)

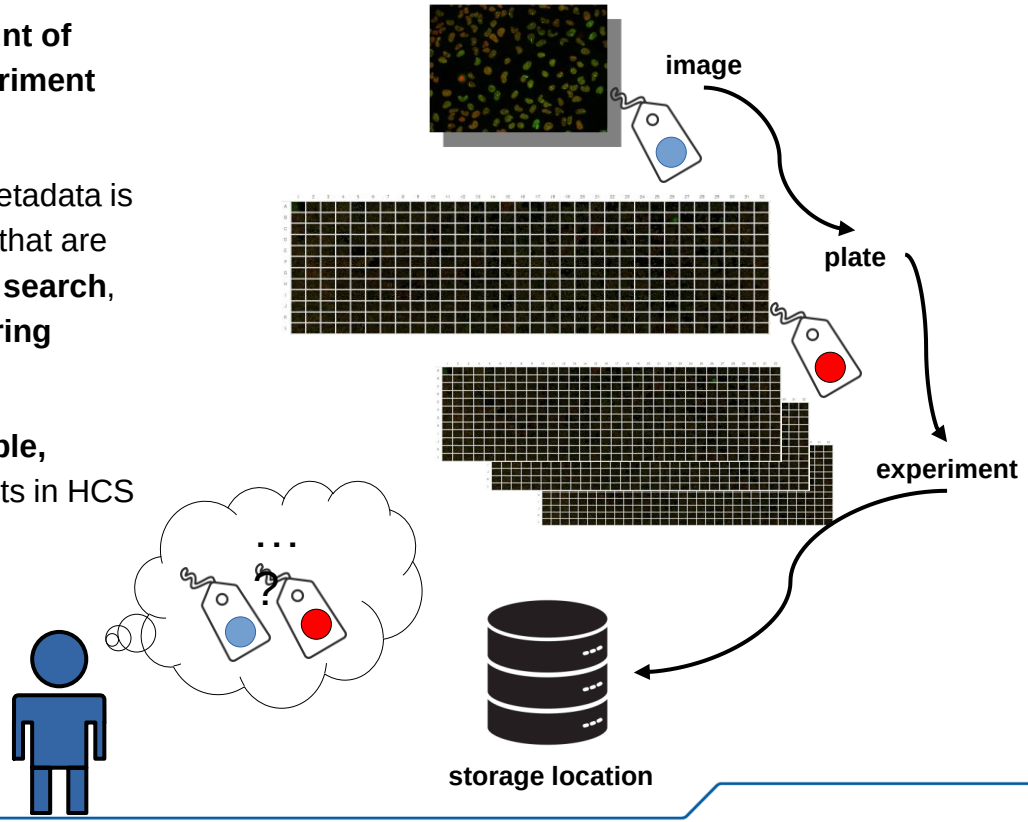
Scientific background and motivation

Metadata and FAIR principles in high-content screening (HCS) bioimaging

HCS experiments generate a huge amount of information and metadata in each experiment

The efficient and accurate treatment of image metadata is of great importance, as it provides insights that are essential for effective image **management**, **search**, **organisation**,**interpretation**, and **sharing**

It is vital to implement **Findable, Accessible, Interoperable and Reusable (FAIR)** concepts in HCS bioimaging



Goal of the UFZ in NFDI4BIOIMAGE

Develop automatic pipelines for HCS image data management

In the frame of **NFDI4BIOIMAGE**, the UFZ develop solution and analysis pipelines for storing, processing, analysing, and sharing HCS data with the public and other scientists

In particular, we work on the **development of guidelines** and **workflows** to make findable and machine-readable metadata using (semi)automatic tools

Image source: https://www.nlm.nih.gov/oet/ed/cde/tutorial/02-200.html

Tools – Data Management, metadata handling and sharing

OMERO – Open Microscopy Environment Remote Object

omero.intranet.ufz.de

OMERO (Open Microscopy Environment Remote Object) is an open source client/server system for visualizing, managing, and annotating microscope images and metadata

Upload
More than 140 file format are supported

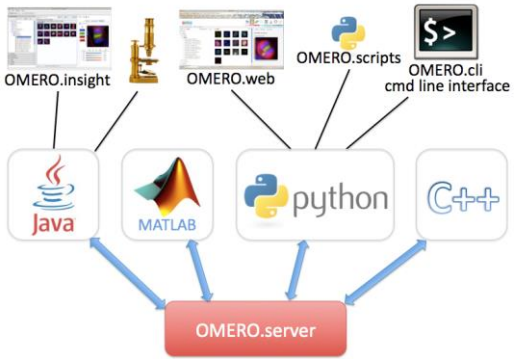
Sharing
Share and collaborate with colleagues

Managing
Metadata, annotation, filtering

Analyze
Access and save images

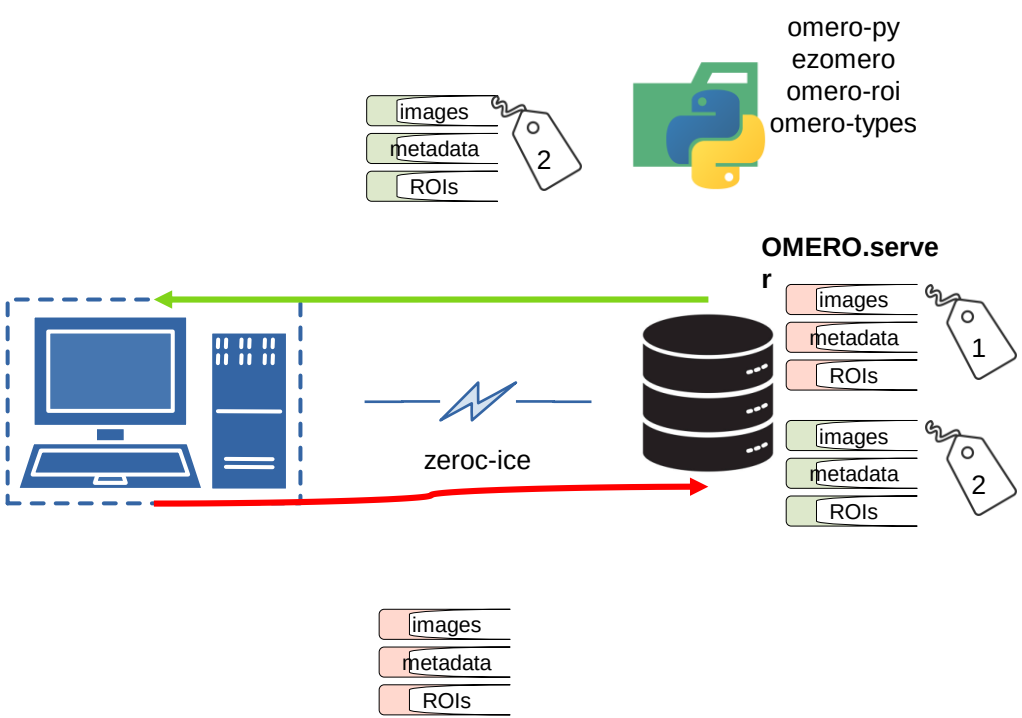
Viewing
Up to 5-dimensional viewing in supported

Publish and Export



Tools - Analysis and data transfer pipelines

OMERO Python API



GitLab

Scripts and guidelines

Manual pipeline

- Jupyter Notebook
- KNIME workflows
- OMERO.web scripts

Automatic pipelines

- CLI using omero-py

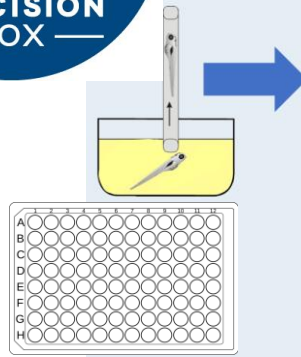
cron

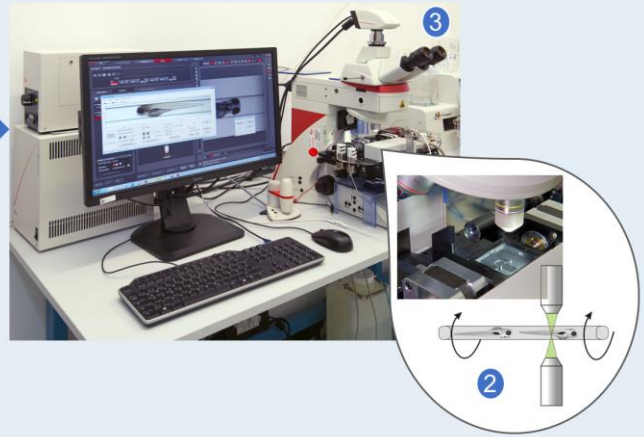
UFZ Case Studies

Toxicology and Human Health – HCS with zebrafish embryos

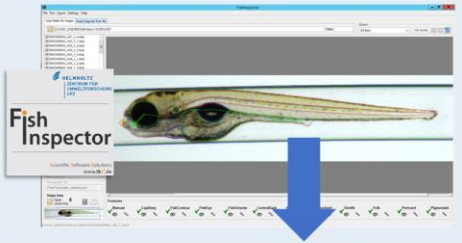
Project leader: Dr Stefan Scholz

Vertebrate Automated Screening Technology

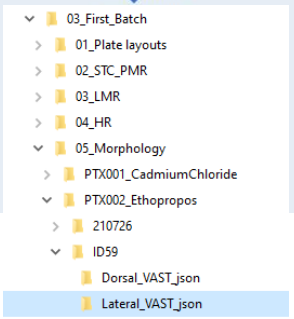




FishInspector



ROI saved in a json file

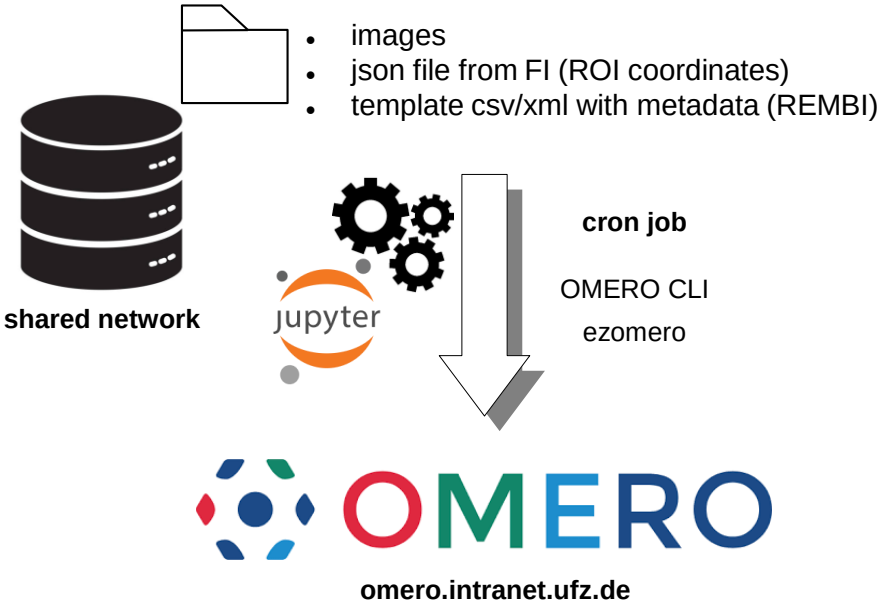


shared network

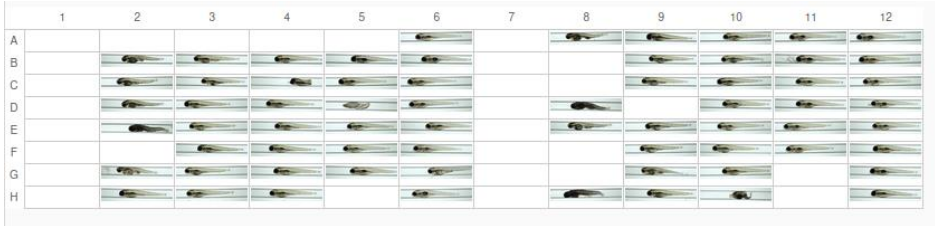
Required automatization: Image transfer, metadata and ROI annotation in OMERO

UFZ Case Studies

Toxicology and Human Health – HCS with zebrafish embryos

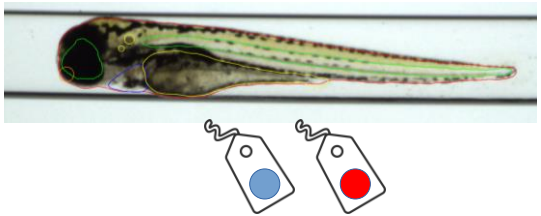


Data Management in OMERO



BIOTOX_Image_Metadata
Added by: Riccardo Massei

Study type	HCS Assay
Experimenter	Riccardo Massei
Instrument	VAST
Chemical Tested	Acrylamide
IUPAC Name	prop-2-enamide
PubChem Link	https://pubchem.ncbi.nlm.nih.gov/compound/6579
Biological entity	Eleuteroembryos
Start Exposure (hours)	2
End Exposure (hours)	96
Vessel	96-well-plate
Exposure Temperature	28
Organism	Danio rerio
Strain	WIK/OBI
NCBI accession number	https://www.ncbi.nlm.nih.gov/datasets/taxonomy/7955/
NCBI Taxonomy ID	7955
Experimental status	Finalized
inTOB link	https://web-intern.app.ufz.de/intob-db/experiment/204/details?tab=meta
inTOB id	204



RDM Research Data Management

UFZ

RDM at UFZ:
https://www.ufz.de/index.php?en=45348

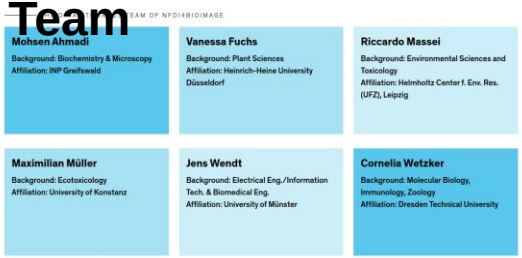
RDM Guidelines:
https://rdm.pages.ufz.de/guidelines/

Personal GitHub:
https://github.com/rmassei

Helmholtz Codebase – GitLab:
Coming soon

NFDI 4 BIOIMAGE

DaSt Team



Consult our Help Desk!

https://nfdi4bioimage.de/help-desk

helpdesk@nfdi4bioimage.de

Image Source:

High content genome-wide siRNA – IDR 93
https://idr.openmicroscopy.org/webclient/?show=screen-2751

RNAi high content genes screening - IDR10
https://idr.openmicroscopy.org/webclient/?show=screen-1351

Vascular distruption in zebrafish embryos - S-BIAD954

IDR

BioImage Archive