ZEISS - Open software ecosystem for data-centric model development

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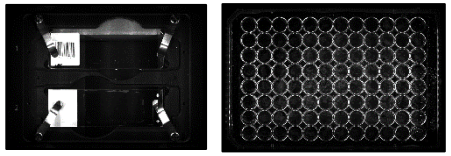
AI solutions @ZEISS microscopy

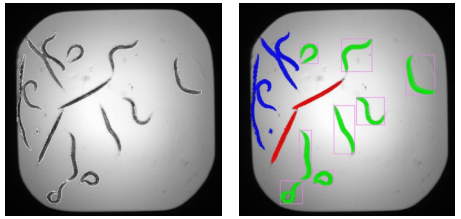
Image Analysis and Processing

Classification

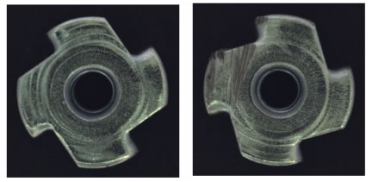
Classifying an entire image or individual objects



Recognize a Sample Carrier



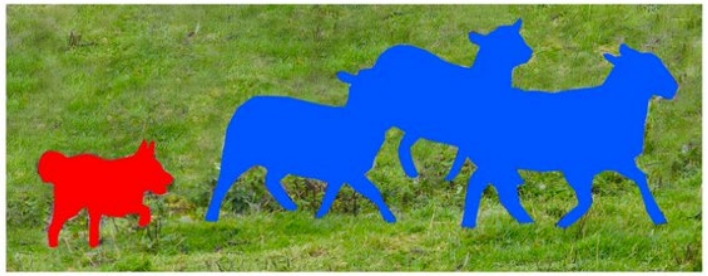
Classify objects in analyzed images



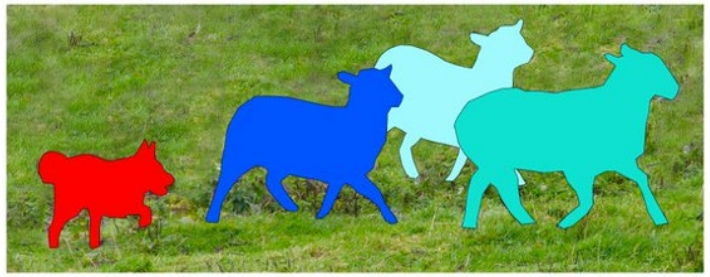
"Good" part vs "Anomaly"

Segmentation

Refers to classifying at a pixel level



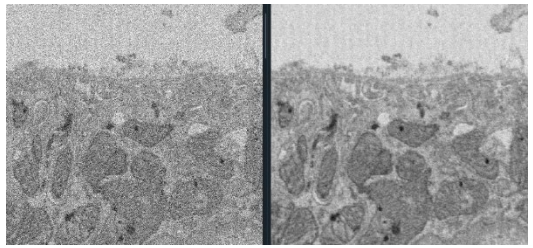
Semantic Segmentation



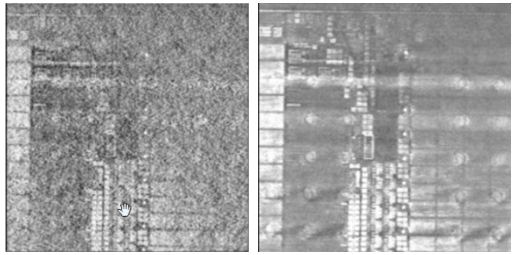
Instance Segmentation

Processing

Image corrections and enhancements



Denoising & Image2Image



Reconstruction

Mission Statement for AI @ZEISS

Our mission statement for AI @ZEISS Microscopy could be described as:

"Put the scientist back into the driver seat for Deep Learning"

The of our **core message** when it comes to Image Analysis & AI solutions is:

"Better data beat better models"

Align Requirements from Academia and Industry with Business Model

- Academia wants open and flexible solutions and does not like to be locked in
- Industry often wants “Streamlined and Integrated” tools and “one-Button-Solutions” for a specific task
- Various of open-source software (OSS) tools that offer specific solutions → What is our business model?
- “cloud-computing” is trending, but some users / customers do not want / are not allowed use cloud yet
- What tools should a we use? Should we develop our own (build or buy)

Concept: Train models “anywhere”

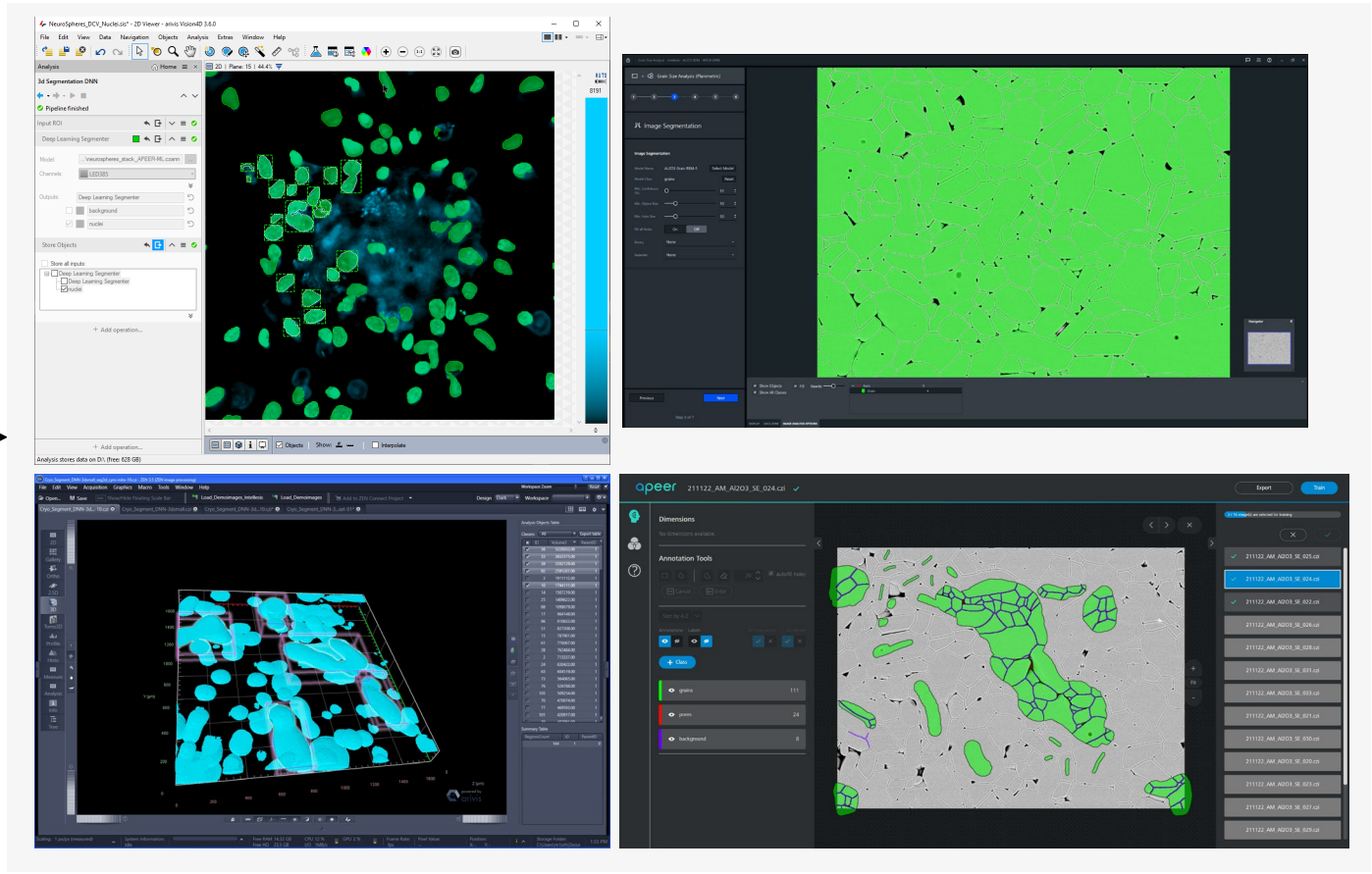
Train a model
In the cloud

Train a model
where you like

Train a model
directly on your
local machine

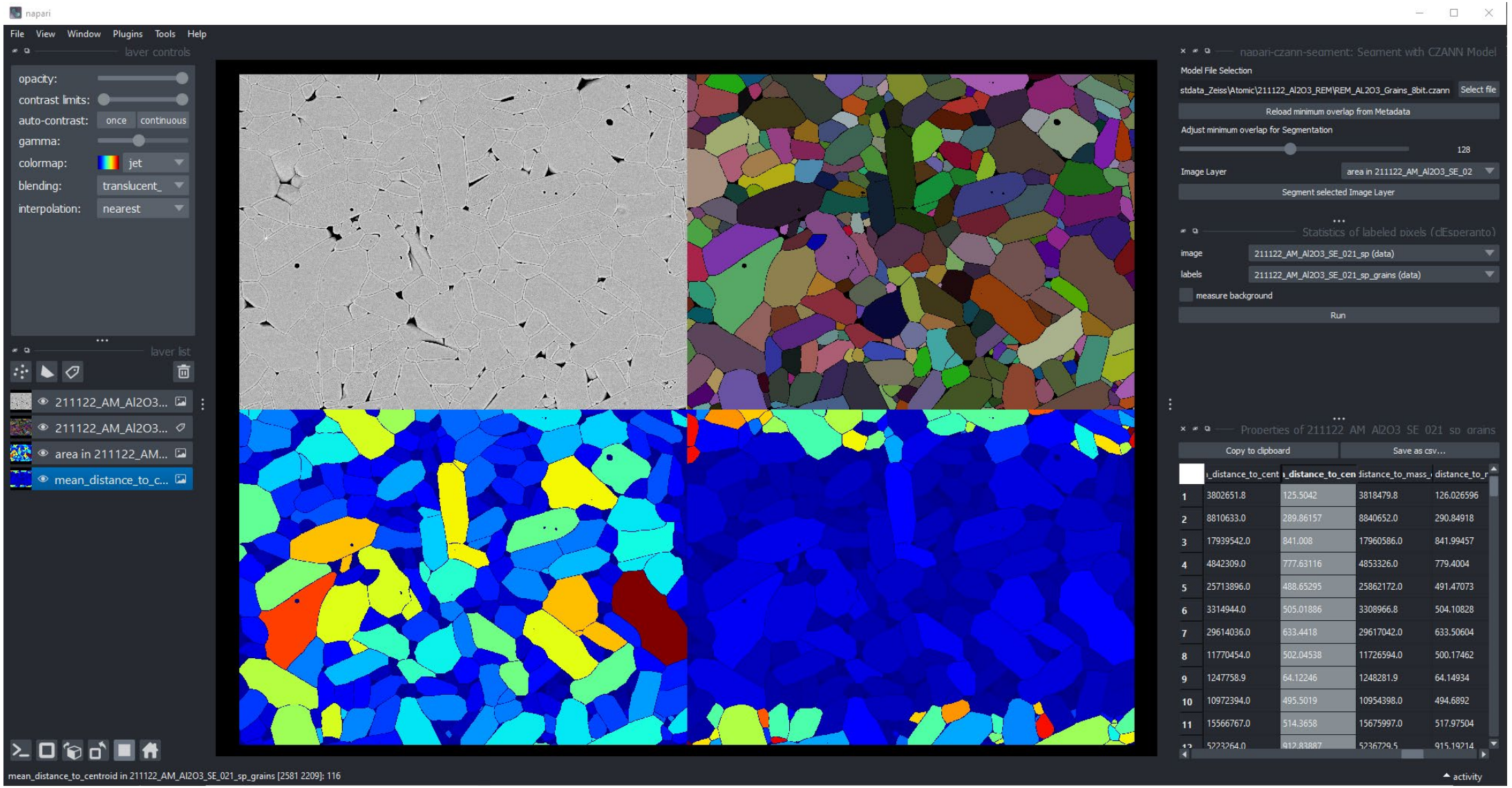
Trained Model

**Get labelling and
training a model
as a paid service**

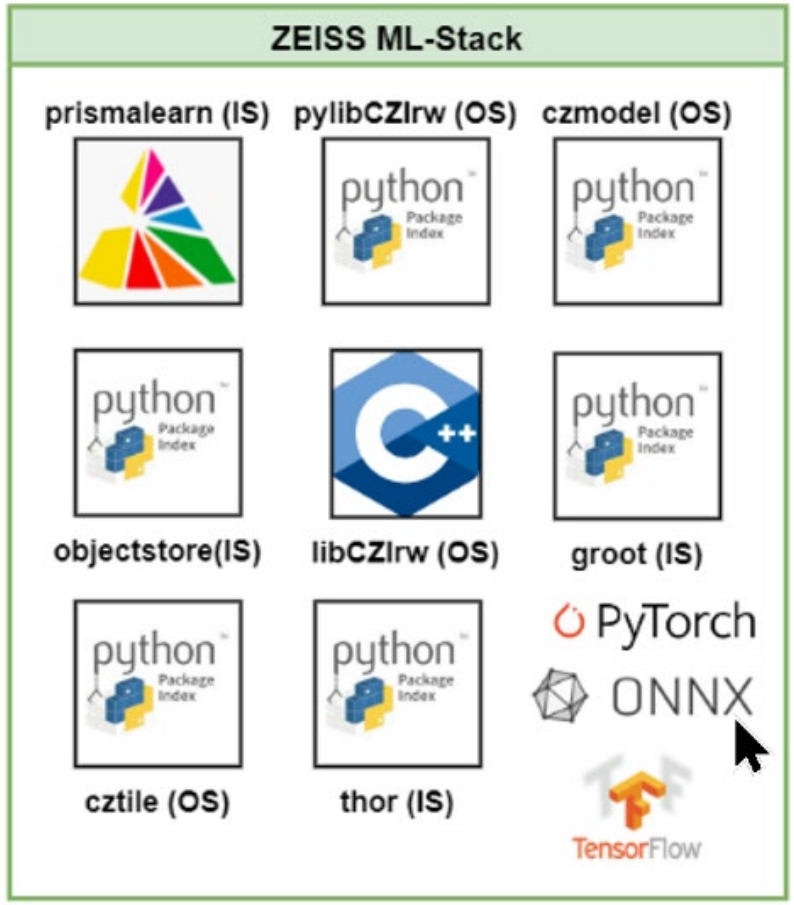


ZEN blue, ZEN core, vision4D and APEER

Open really means open – it also works inside “community software”
*.czann trained on APEER executed inside Napari



Our ecosystem - ZEISS Machine Learning Stack

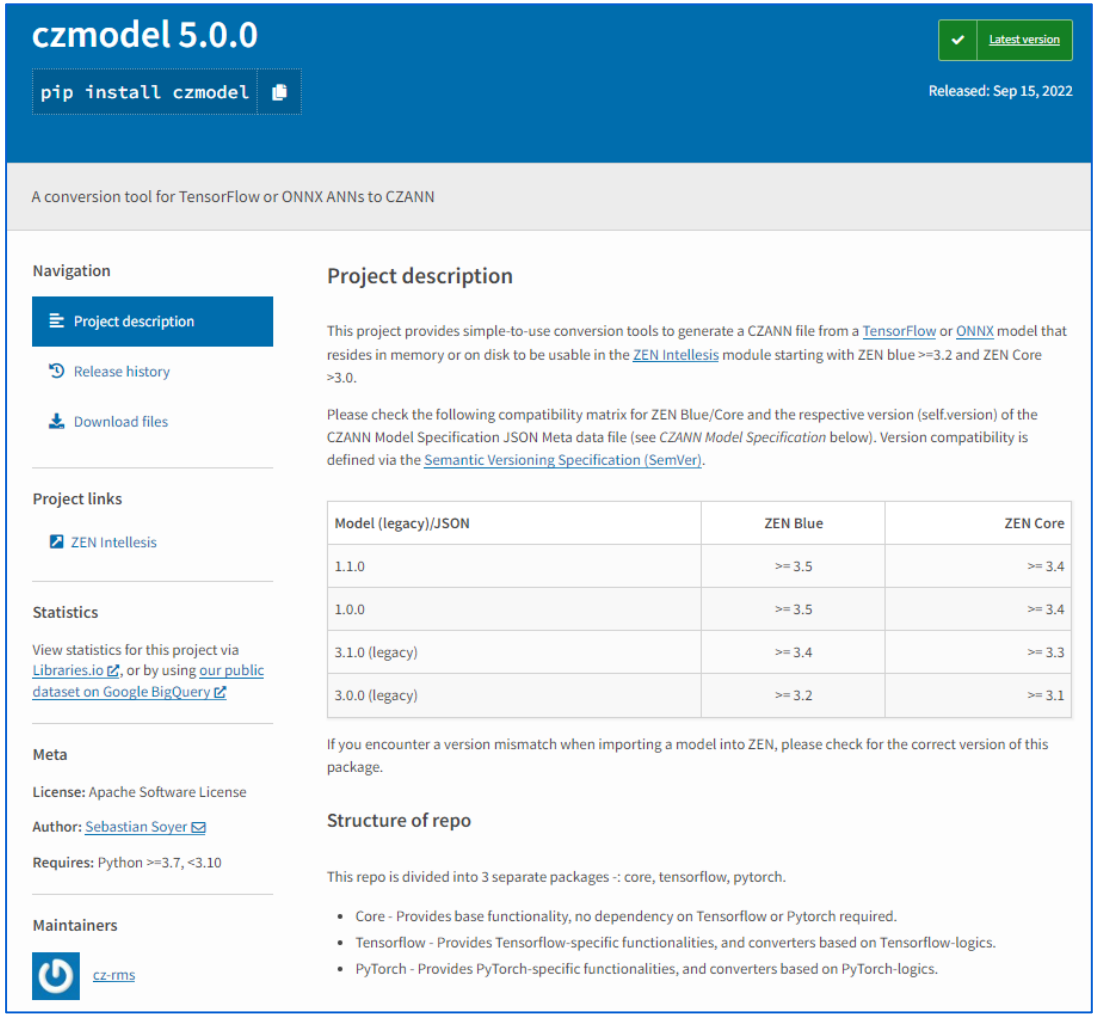


ZEISS ML Stack

- mainly Python-based internal (IS) and open-source (OS) packages
- easy to deploy & use in different development teams @ZEISS
- clear rules that those packages must the 1st choice when starting new projects
- test coverage and code-quality standards cannot be just be “nice thing to have” but are crucial

ANACONDA.
python
PyTorch
ONNX
TensorFlow
Keras
DASK
scikit-learn

Open-Source python package czmodel
Store model along with metadata



czmodel 5.0.0

Latest version

```
pip install czmodel
```

Released: Sep 15, 2022

A conversion tool for TensorFlow or ONNX ANNs to CZANN

Navigation

- Project description
- Release history
- Download files

Project links

- ZEN Intellesis

Statistics

View statistics for this project via Libraries.io, or by using our public dataset on Google BigQuery

Meta

License: Apache Software License

Author: Sebastian Soyer

Requires: Python >=3.7, <3.10

Maintainers

cz-rms

Project description

This project provides simple-to-use conversion tools to generate a CZANN file from a TensorFlow or ONNX model that resides in memory or on disk to be usable in the ZEN Intellesis module starting with ZEN blue >=3.2 and ZEN Core >3.0.

Please check the following compatibility matrix for ZEN Blue/Core and the respective version (self.version) of the CZANN Model Specification JSON Meta data file (see *CZANN Model Specification* below). Version compatibility is defined via the Semantic Versioning Specification (SemVer).

Model (legacy)/JSON	ZEN Blue	ZEN Core
1.1.0	>= 3.5	>= 3.4
1.0.0	>= 3.5	>= 3.4
3.1.0 (legacy)	>= 3.4	>= 3.3
3.0.0 (legacy)	>= 3.2	>= 3.1

If you encounter a version mismatch when importing a model into ZEN, please check for the correct version of this package.

Structure of repo

This repo is divided into 3 separate packages -: core, tensorflow, pytorch.

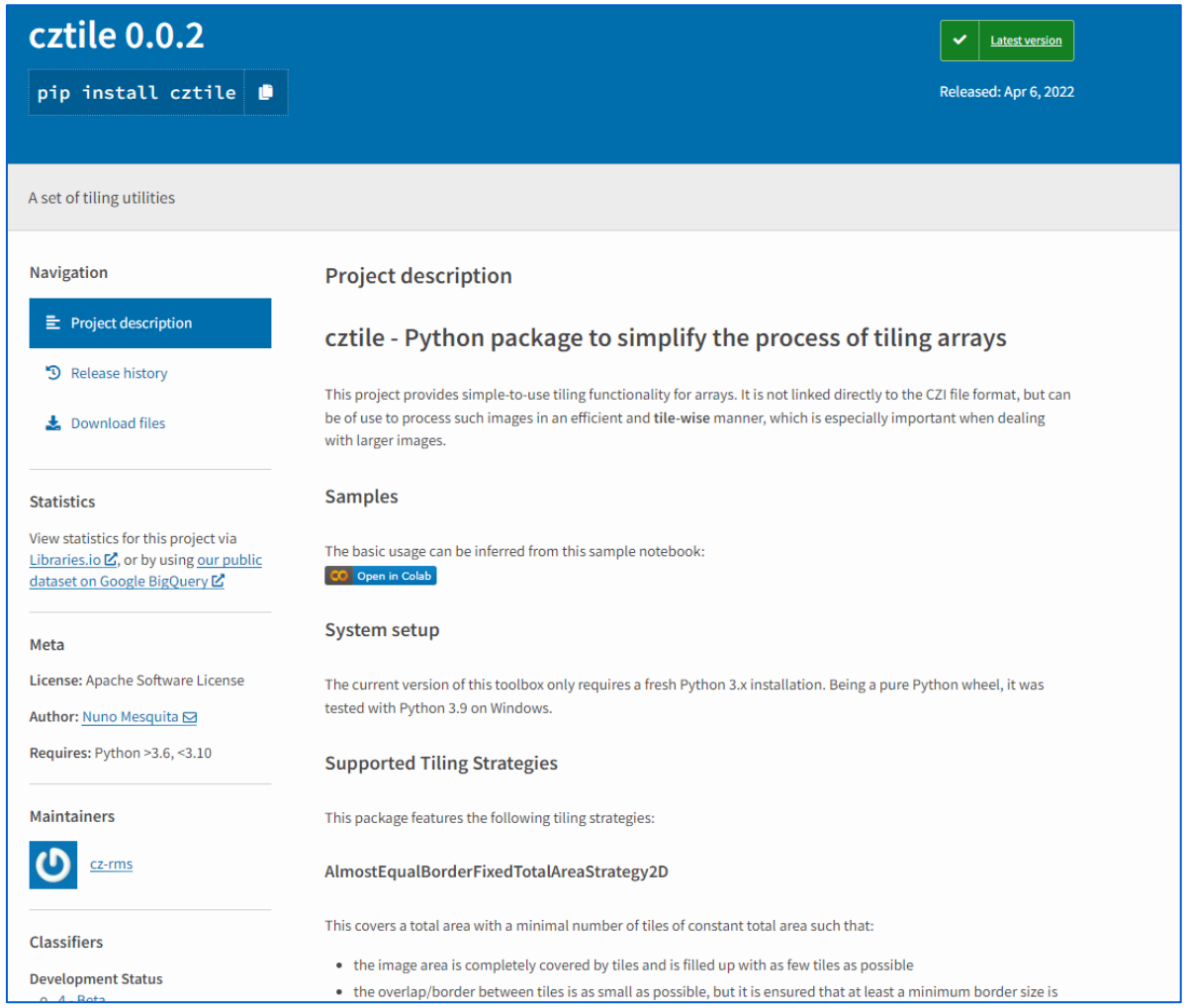
- Core - Provides base functionality, no dependency on Tensorflow or Pytorch required.
- Tensorflow - Provides Tensorflow-specific functionalities, and converters based on Tensorflow-logics.
- PyTorch - Provides PyTorch-specific functionalities, and converters based on PyTorch-logics.

- Open and standardized “container” to store ML models and metadata
- is the “glue” between SW tools for Machine-Learning at ZEISS
- no new model format
- support for TF2.SavedModels (legacy) and ONNX models
- used by ZEN blue, ZEN core, APEER-ML and vision4D
- **allows external data scientists to integrate their own models our tools**

Open-Source python package pylibCZIrw
Read and write CZI images format in your python environment

- easily read and write CZIs from Python using a simple API
- based on libCZIrw (C++) library (to be published soon)
- focus on the real application code and not an DataIO … ☺
- allows reading and writing parts of an CZI image
- ensure that the output works in ZEISS tools

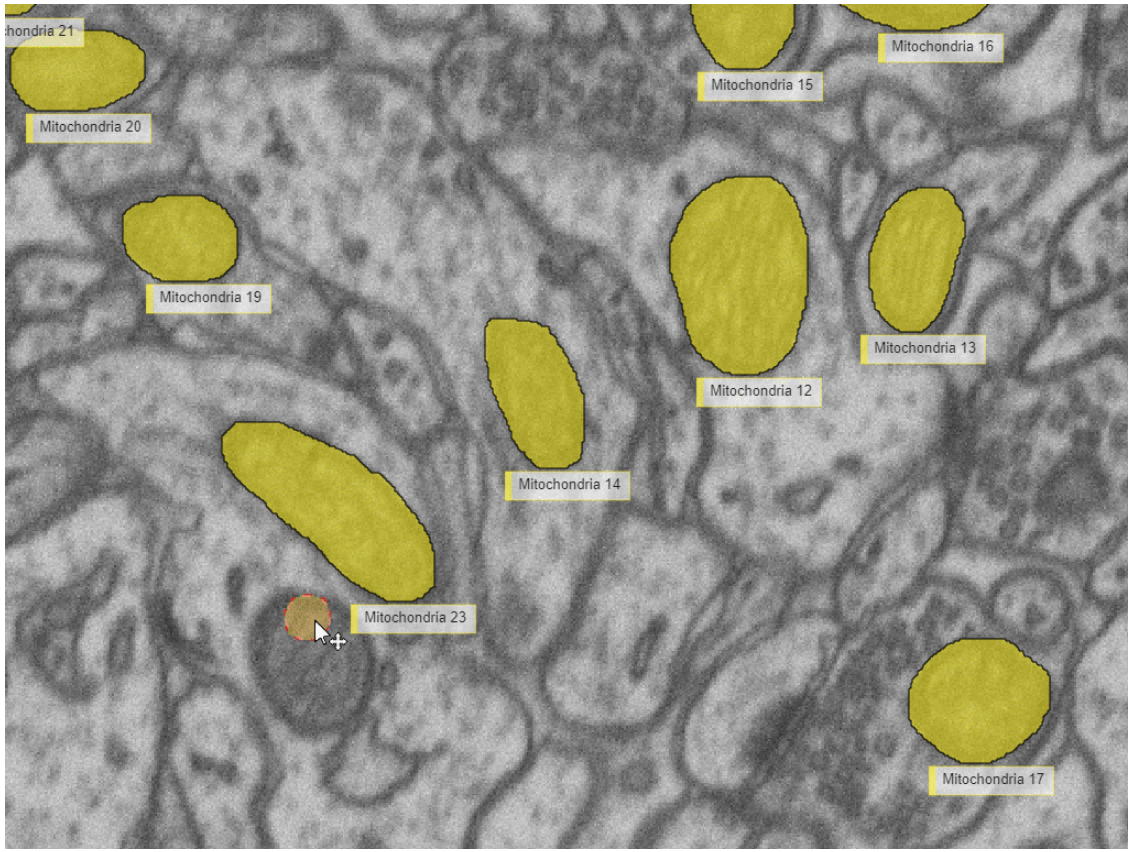
Use a tiling method to process (big) arrays
Open-Source python package cztile



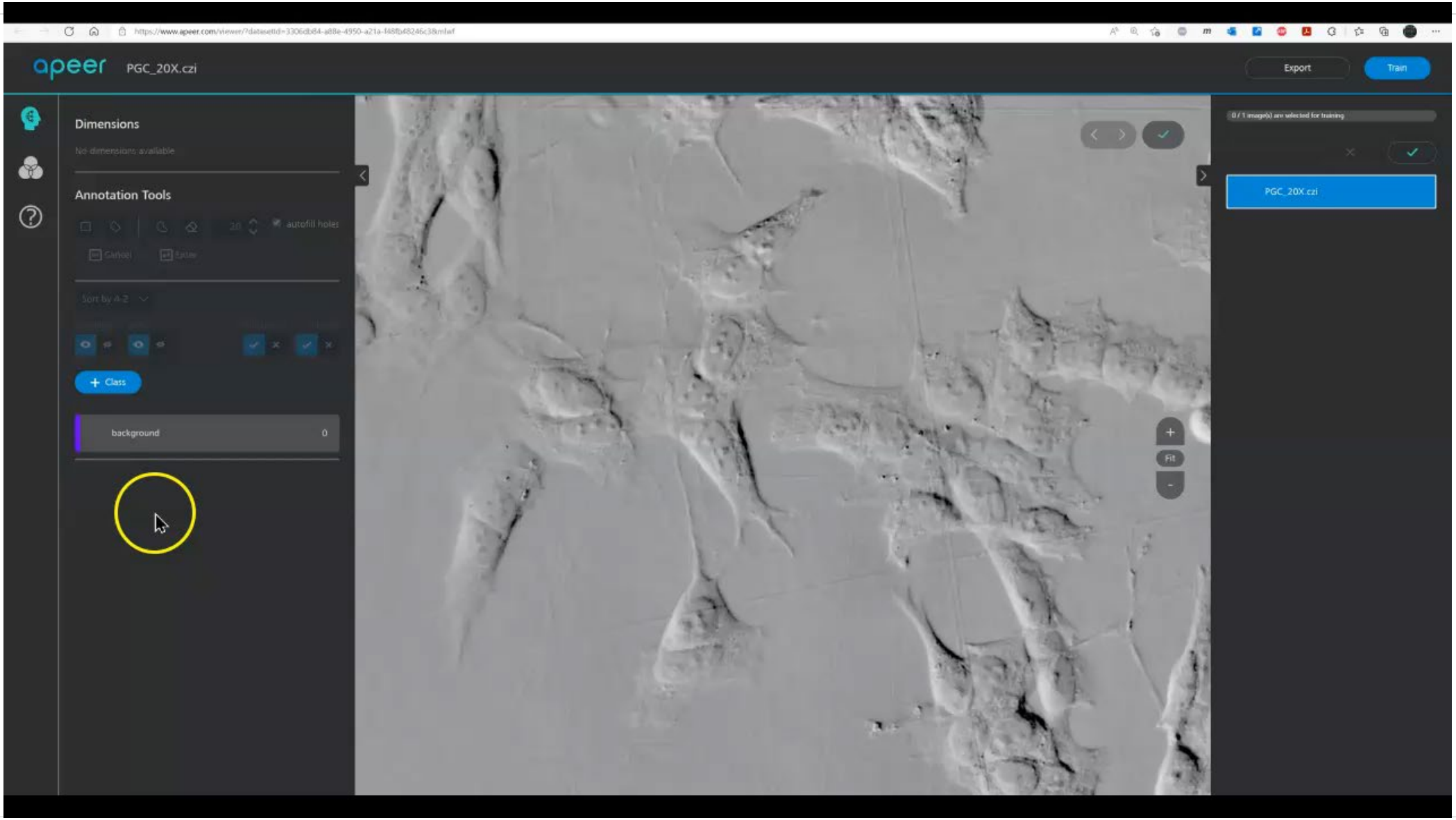
- General library to create identical tiles with overlap for an array
- not limited to CZI images or any specific format
- Can be directly used together with **pylibCZIrw** to read and write tiles
- focus on application code and not on re-inventing “tiling” over and over … ☺
- “unified” tiling algorithm gives consistent results

APEER-ML – Data-Driven Model Development
“Better Data beats better models”

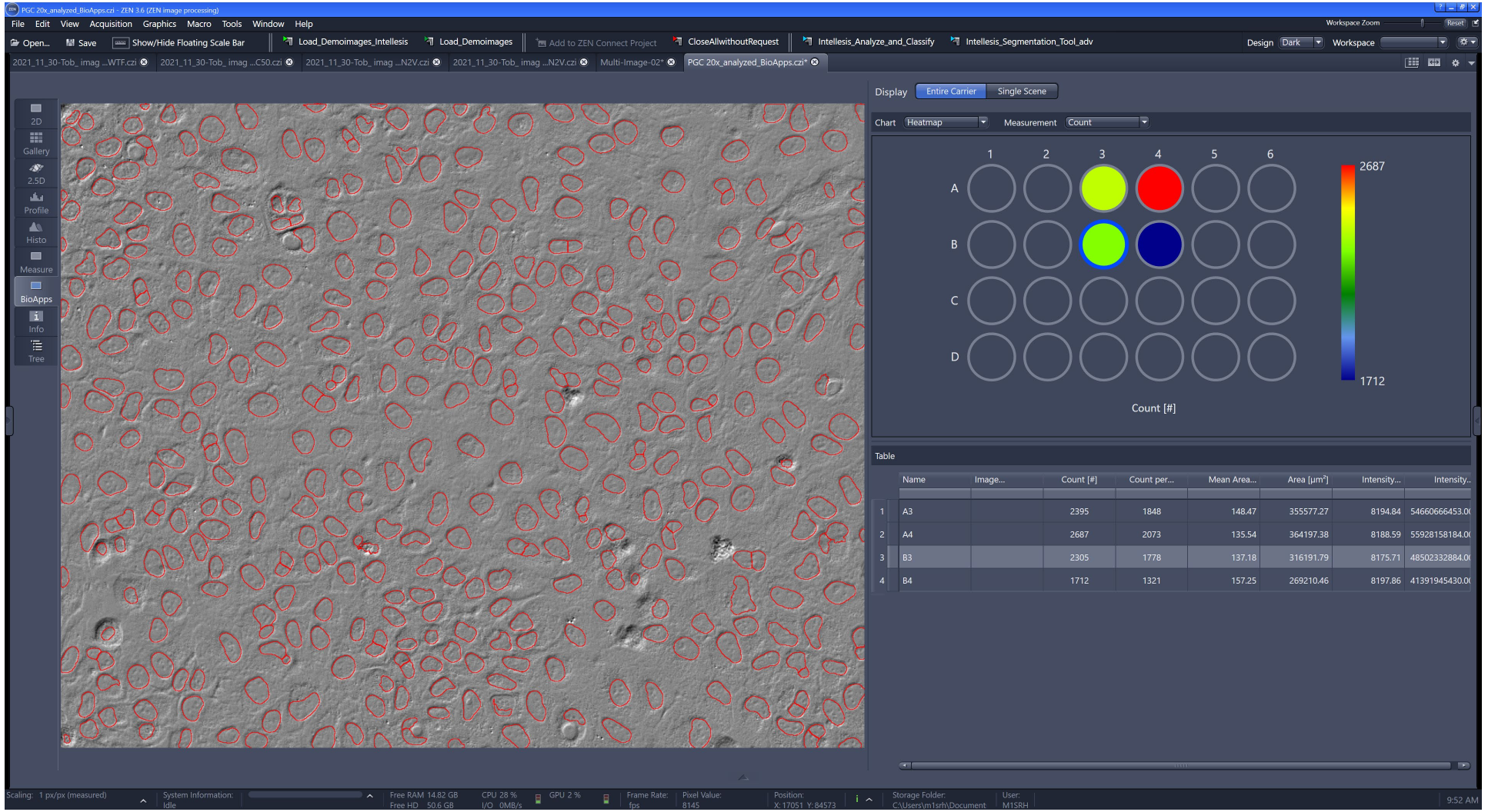
Annotate on APEER → **Train** your specific U-net → **Download** the model and use in ZEN or V4D or Napari or …



The ecosystem in action



Application Examples – Life Science
Label-Free Segmentation inside a ZEN BioApp



Links and additional information

---------- **Python Stuff and APEER** ----------

https://www.apeer.com/app/machine-learning/overview

https://pypi.org/project/pylibCZIrw/

https://pypi.org/project/czmodel/

https://pypi.org/project/cztile/

https://www.napari-hub.org/plugins/napari-czann-segment **(experimental)**

---------- **Additional Content** ----------

https://www.zeiss.com/microscopy/int/website/landingpages/zen-intellesis.html

https://github.com/zeiss-microscopy/OAD/tree/master/Machine_Learning

https://github.com/ZEISS/libczi

We make it visible.