HSC DL Course

Conclusion

Save your code / data / models!

- **You can still log into Jupyter with your account until end of next week (Oct 31st).**

- Copying over data / code / models:

  - Upload to ownCloud or your cloud storage of choice on the jupyter desktop

  - Copy over via scp:
    - Add ssh key: https://docs.hpc.gwdg.de/start_here/connecting/generate_ssh_key/index.html
    - Use scp: https://docs.hpc.gwdg.de/how_to_use/data_transfer/index.html

Takeaways: Model Training

- Finetuning models for different tasks:
  - µSAM: Improves **interactive** and automatic segmentation
  - CellPose: Improves automatic segmentation (needs CP3 to run on small GPU)
  - **Improvements for small amounts of data.**

- Training your own models (from scratch).
  - Needs more annotated data.
  - But more flexible: you can change the target, loss function, etc.
  - **You can train real 3D models!** (unlike Cellpose, µSAM (for now))
  - And train classification models etc.

Takeaways: Data Annotation / Labels

- Iterative process:
  - Create first labels (for segmentation with µSAM or Cellpose)
  - Train models
  - Check predictions, improve, add to training data, repeat
  - (Same for classification / custom segmentation tasks)

- Check your label quality!
  - Check old labels and improve if necessary.

I have segmented stuff – What do I do now?

- Object-level analysis: With skimage or Fiji
  - https://scikit-image.org/docs/0.25.x/api/skimage.measure.html#skimage.measure.regionprops
  - Fiji: ROI Manager: https://imagej.net/ij/docs/menus/analyze.html#manager
  - Fiji: MorphoLibJ: https://imagej.net/plugins/morpholibj

- Measure distances between objects? Use distance transform: https://docs.scipy.org/doc/scipy/reference/generated/scipy.ndimage.distance_transform_edt.html

- (Cell) Classification:
  - Train your own network …
  - With ilastik object classification: https://www.ilastik.org/documentation/objects/objects
  - With µSAM: https://github.com/computational-cell-analytics/micro-sam/blob/master/examples/object_classifier.py (prototype!)

Using resources / tools - GWDG Jupyter Desktop

- Get a HPC account:
  - @Uni Goettingen / UMG / MPI in Goettingen: your group leader has / can get a HPC project with GWDG and add you to it. Check out details at:
  - https://docs.hpc.gwdg.de/start_here/getting_an_account/index.html#scientific-compute-cluster-scc

- With this account you can use the Jupyter Desktop as well as HPC / Slurm:
  - https://docs.hpc.gwdg.de/services/jupyterhub/index.html
  - https://docs.hpc.gwdg.de/how_to_use/slurm/index.html

- We will make the environment (.sif file) we have used for the course (with some updates) available next week and then share a tutorial on how to start it.

Using resources / tools - MPI-NAT

Light Microscopy Facility Computational resources

4 Physical servers with several GPUs each. Permanent virtual machines (not created on the fly). Faster data access as in the same network.

Access virtual machine through VM-Horizon (link works only in VPN MPI-NAT)

- Windows virtual machines with vGPU (Imaris, Arivis, “Deep Learning”)
- Linux virtual machines with vGPU (Deep Learning)
    - Create your own python environment
    - Use a container (Apptainer sif-file) with pre-installed environment (similar to GWDG cluster)

Using resources / tools - Setting it up yourself

- Which operating system?
  - Linux / Mac – Installation is quite reliable.
  - Windows: more difficult / less reliable.

- Set up a “conda-compatible” environment manager:
  - We recommend micromamba: https://mamba.readthedocs.io/en/latest/installation/micromamba-installation.html
  - Install environment. For ‘micro_sam’, ‘torch_em’, etc. follow these instructions: https://computational-cell-analytics.github.io/micro-sam/micro_sam.html#from-source
  - For CellPose: https://github.com/MouseLand/cellpose?tab=readme-ov-file#option-1-installation-instructions-with-conda
  - Most other tools also support installation via conda

Asking for help

Installation doesn’t work? Which tool can I use for my task?
A tool is not working as expected?

Ask experts for help on https://image.sc ! Forum for image analysis. You can tag me @constantinpape.

Why ask publicly?

- Other experts can also answer your questions.
- Other users learn from your questions and solutions.