QIM and 3D Image Analysis

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Center for Quantification of Imaging Data from MAX IV

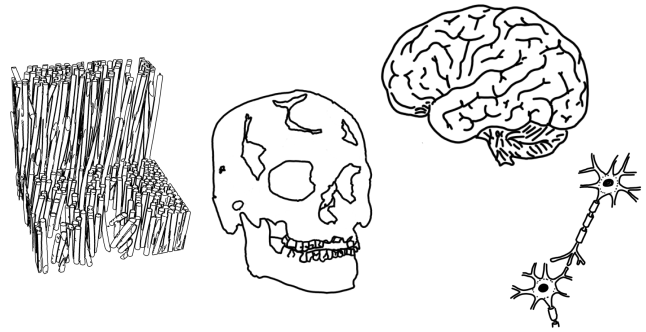
At QIM we develop algorithms for quantitative image analysis in order to support the research carried out at large-scale imaging facilities.

Stephen Hall, Lund

Rebecca Engberg, DTU

Jon Sporring, DIKU

Triangle of imaging science



Scientific question

These must be essential research questions for everybody involved!

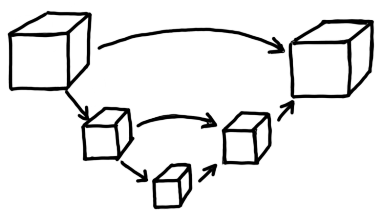
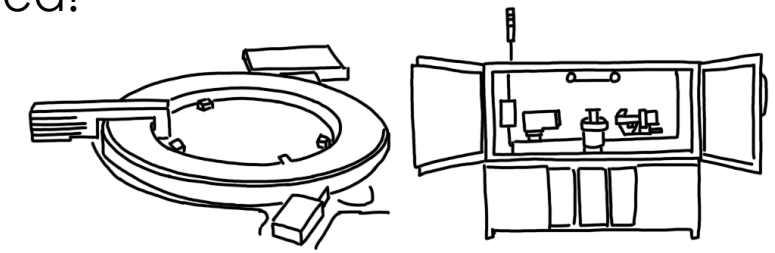


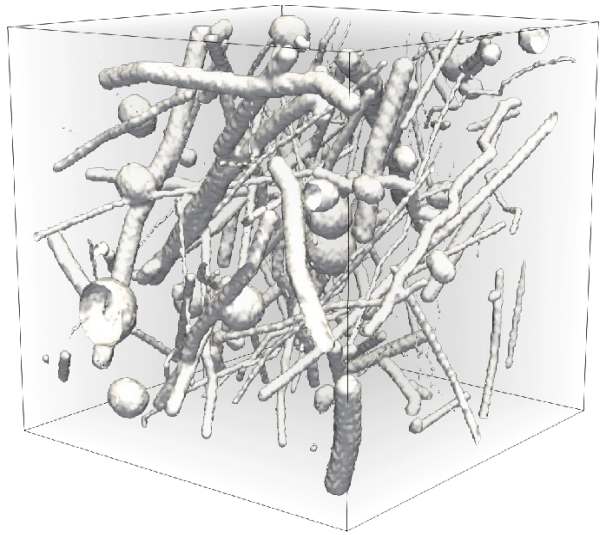
Image analysis



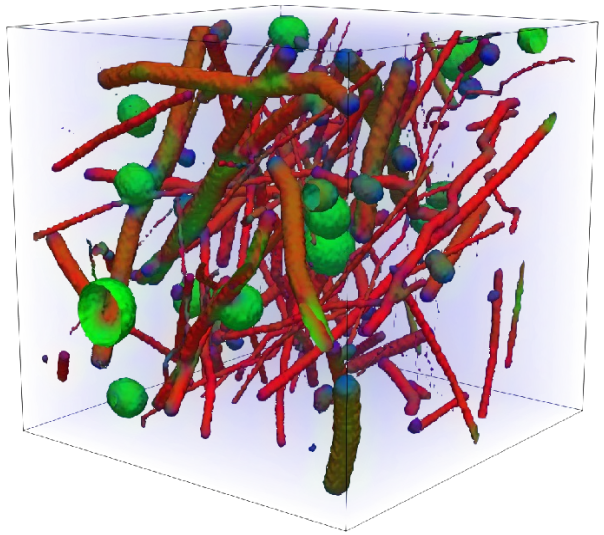
3D imaging

Information – structure tensor

The structure tensor gives information about orientation and how strong the signal is

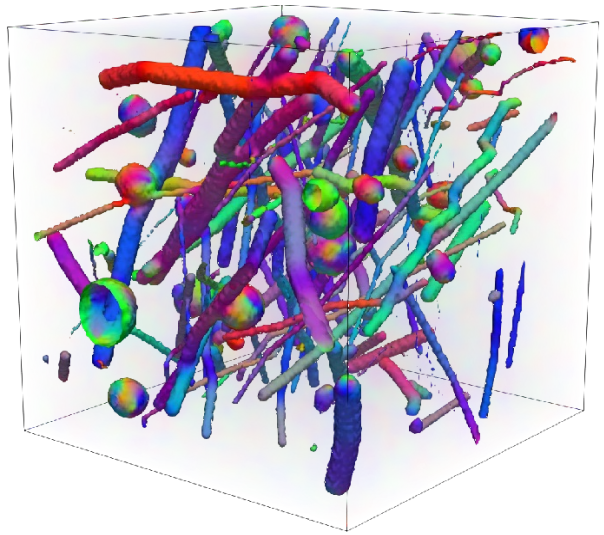


Rendering of stone wool

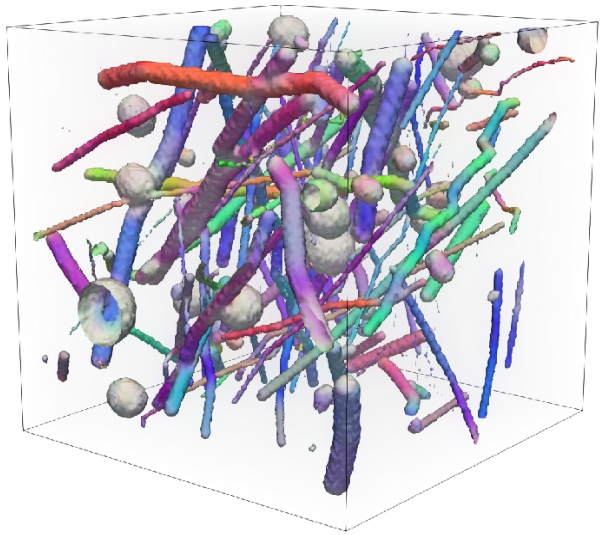


Degree of anisotropy

- Green: isotropic
- Blue: planar
- Red: linear

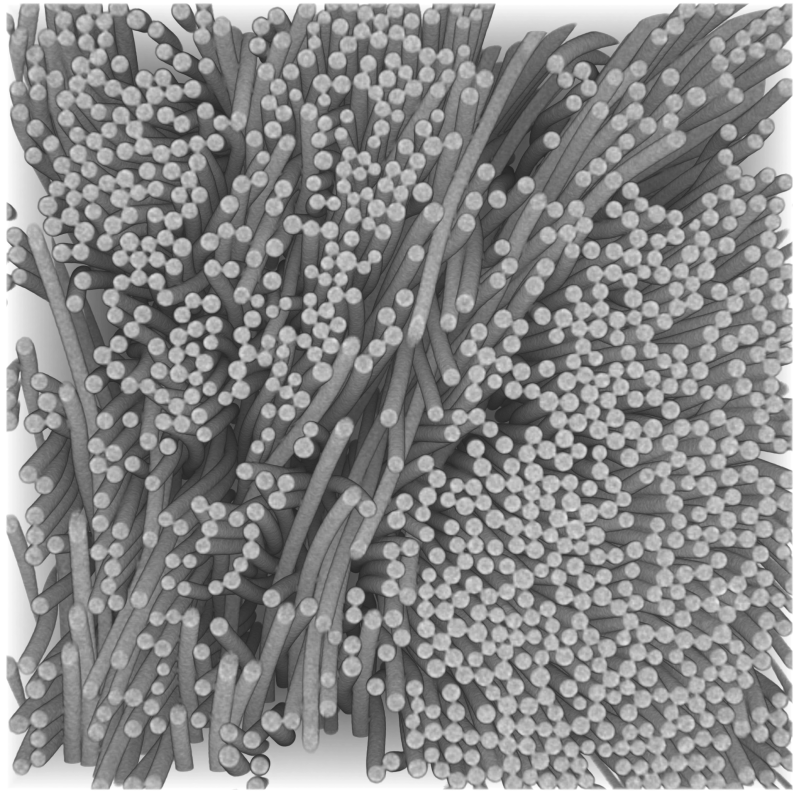


Orientation
Colors give direction

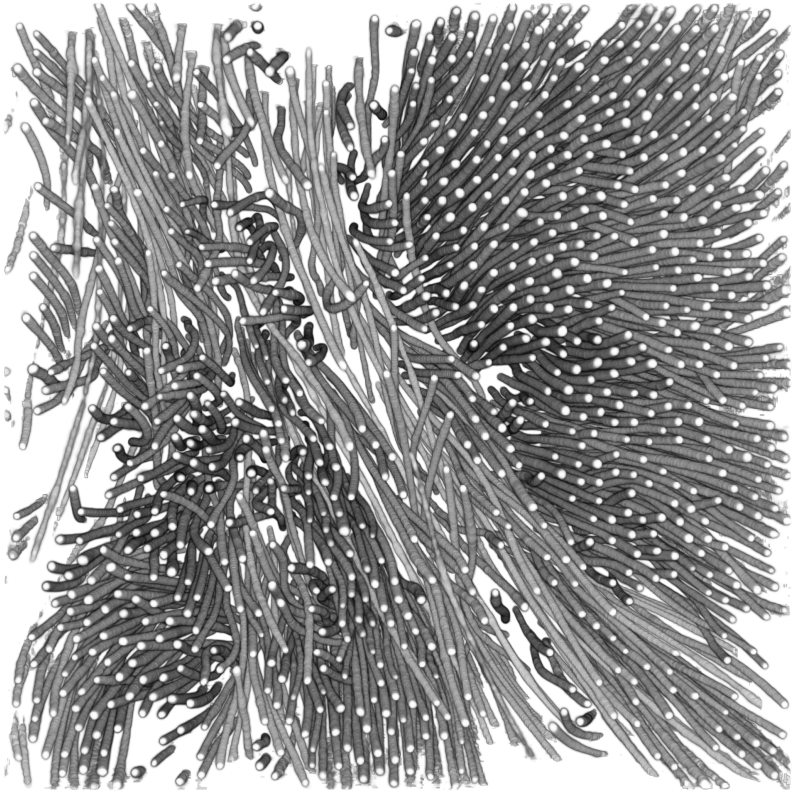


Orientation colored by degree of linearity

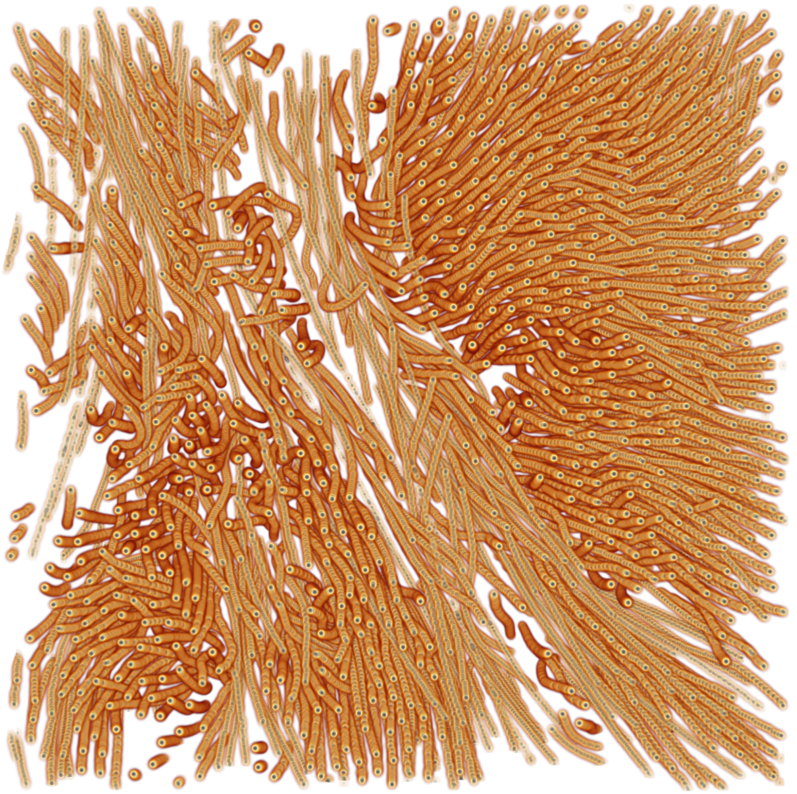
Fiber tracking



Fiber sample



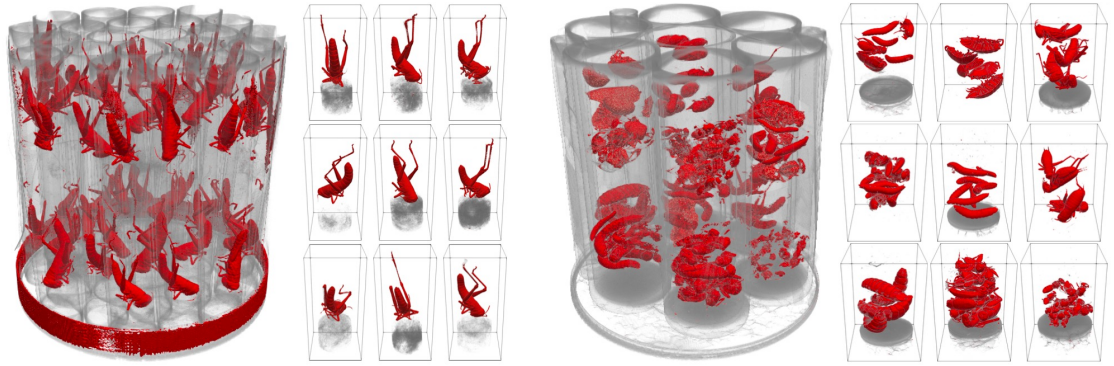
Segmented center points

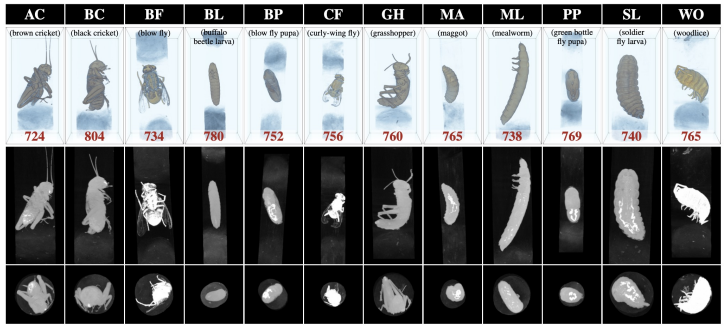


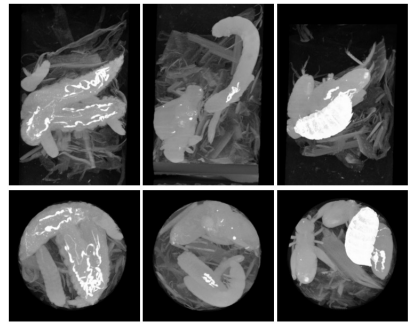
Tracked fibers

Deep learning benchmark data

- Topic: Object detection and segmentation
- Problem: Annotation is difficult and time-consuming
- Idea: Create a setup where annotation is easy
- Dataset for deep learning:
  - 9087 individual bugs – reflecting shape variation
  - 400 volumes of mixtures
  - Scans with background material (no bug scans)
  - Publish data and baseline solution for object detection







Data analysis platform

- NNF Data Science Infrastructure: QUAITOM
- Challenge: Scale to support growth in the number of users
  - 150+ yearly users at lab facilities
  - DanMAX and ForMAX opening user program
- Solution: Data analysis platform
  - High-performance computing platform
  - Data and computing resources in one place – not moving data but software
  - Focus on the interface and ease of use – compute resources later

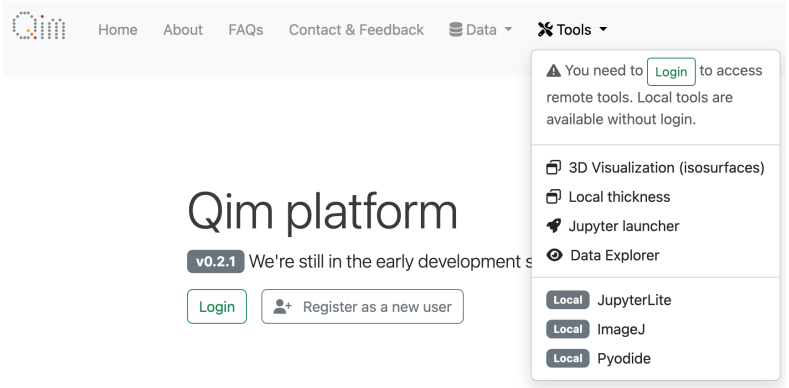
Felipe Delestro

Hans Martin Kjer

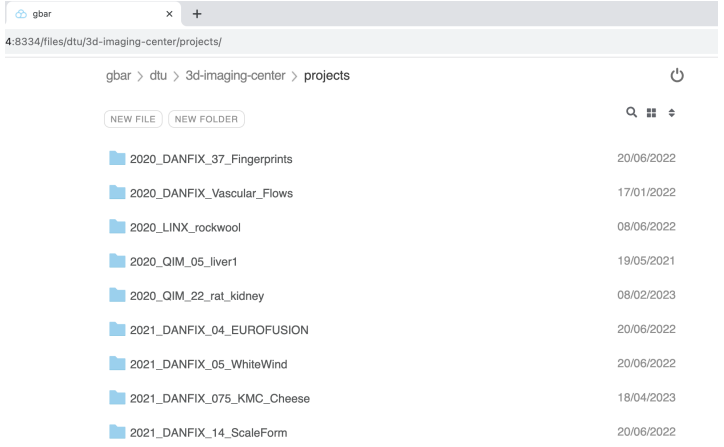
QIM platform

Design requirement: Platform for image analysis that is used by our research group for research.

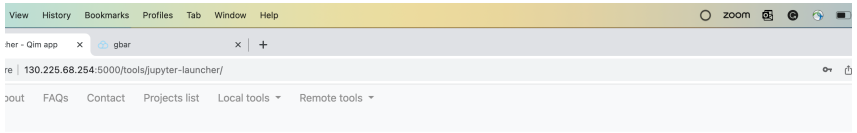
Online platform – browser access

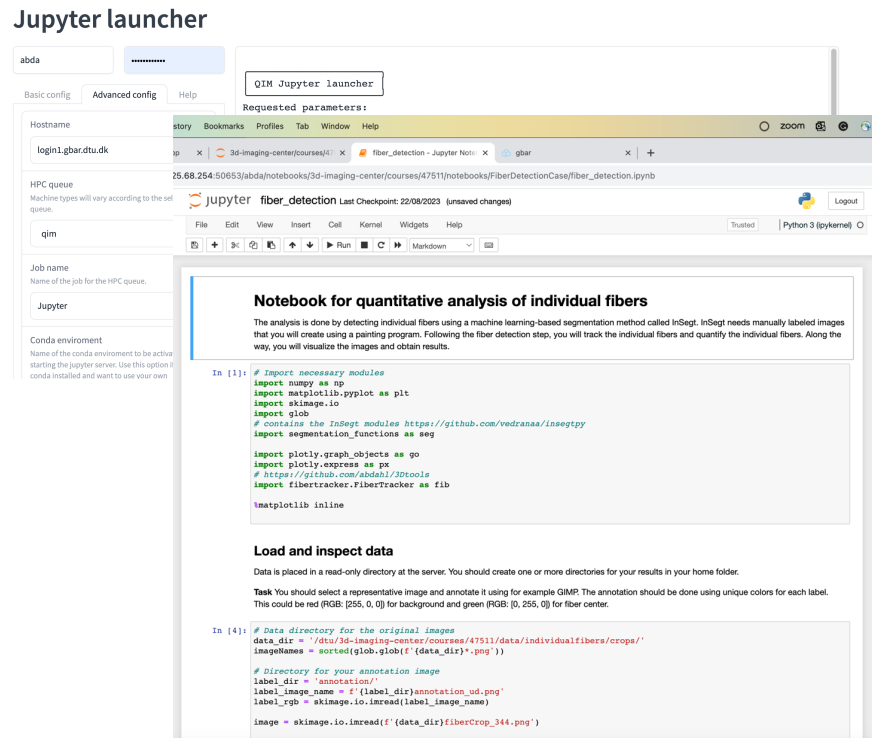


Easy access to files



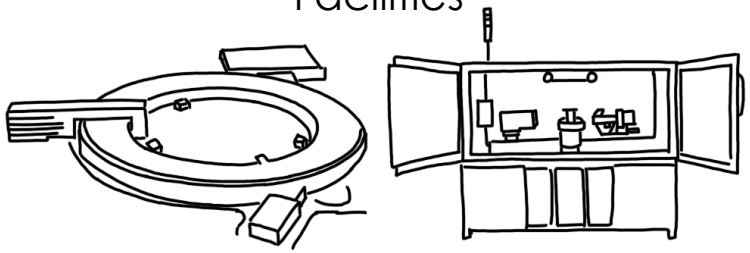
Easy access to analysis resources





Vision

Facilities



Scientific hub for 3D quantitative image analysis

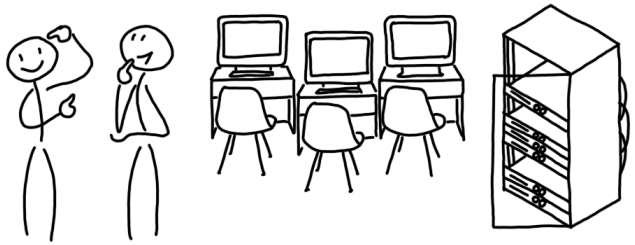
New research field

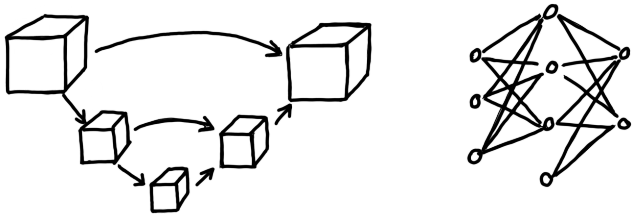
Fast from experiment to quantification

Methods

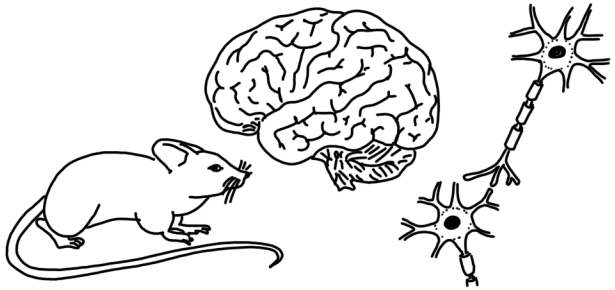
Benchmark data

Infrastructure





Data science



Science case

Conclusion

- QIM – science hub for 3D image analysis
- Research in quantitative methods that can handle large images
- Support users from large-scale imaging
- Create interest from vision community for 3D images beyond medical data

Thank you

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