



Welcome to Maths Meets Image

Hackathon as part of the Math+ Thematic Einstein Semester on
Mathematics of Imaging in Real-World Challenges

Young Academy committee

Felix Ambellan (ZIB)

Robert Beinert (TU Berlin)

Christoph Kolbitsch (PTB)

Kostas Papafitsoros (WIAS)

Christoph von Tycowicz (FU Berlin, ZIB)

Berlin Mathematics Research Center



- DFG-funded Cluster of Excellence
- “Transforming the World through Mathematics”
- sustainable energy supply, individualized medicine, analyzing social processes...
- cross-institutional and interdisciplinary (TU, HU, FU, WIAS, ZIB)

Thematic Einstein Semester on

MATHEMATICS OF IMAGING IN REAL-WORLD CHALLENGES

Berlin, Winter Semester 2021/22

Organizers

Hans-Christian Hege (ZIB)

Michael Hintermüller (HU Berlin, WIAS)

Tobias Schäffter (TU Berlin, PTB)

Gabriele Steidl (TU Berlin)

Dates	Event
6-8 October 2021	Kick-off Workshop, PTB
November 2021 - January 2022	Three tandem talks
October 2021 - February 2022	Three tandem tutorials
17-19 March 2022	Hackathon event
22-25 March 2022	SIAM Conference on Imaging Science, TU Berlin

<https://mathplus.de/topic-development-lab/tes-winter-2021-22/>

Maths Meets Image

Hackathon as part of the Math+ Thematic Einstein Semester on
Mathematics of Imaging in Real-World Challenges

Solve challenges
Learn something
Great food
Have fun
Meet new people
Exciting science

Time table

	17 March	18 March	19 March
9am	Welcome	Welcome	Welcome
	Introduction	Team work	Team work
11am	Break	Break	Break
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	Task overview	Update	
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5pm			
6pm	Wrap-up	Wrap-up	

P1

Temporally dependent
TV/TGV regularisation

Andreas Kofler

Clemens Sirotenko

Felix Zimmermann

Evangelos Papoutsellis

David Schote

Fatima Antarou Ba

Katja Degenhardt

Johannes Mayer

Fabian Altekruiger

P2

Cardiac motion estimation
using heart models

Simone Hufnagel

David Sommer

Darian Viezzer

Benedikt Schmitt

Chiara Manini

Constance Gatefait

Lorenz Kuger

Felix Peppert

P3

Morphological Scoring of
Disease States

Florian Beier

Samira Kabri

Christian Wald

Julius Mayer

Nicolas Klenert

Paul Hagemann

Janina Schütte

P4

Geometric deep learning
for quantitative analysis of
stone tool reduction
sequences

Leonard Schmitz

Marian Berg

Tim Roith

Nikolas Tapia

Tom Neumann

Felix Herter

Giovani Fogalli

P5

Estimation of
displacements and
mechanical tissue
properties from MRE

Alfonso Caiazzo

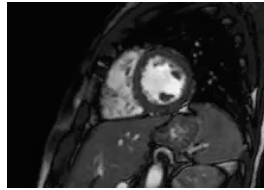
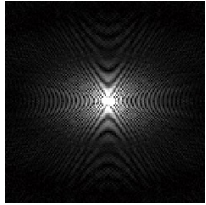
Felipe Galarce

Matthias Anders

Vanessa Guarino

Adriano Schlieff

Data acquisition



$$\mathbf{y} = A\mathbf{x} + \mathbf{e}$$

Acquisition
model

Noise

Start with:

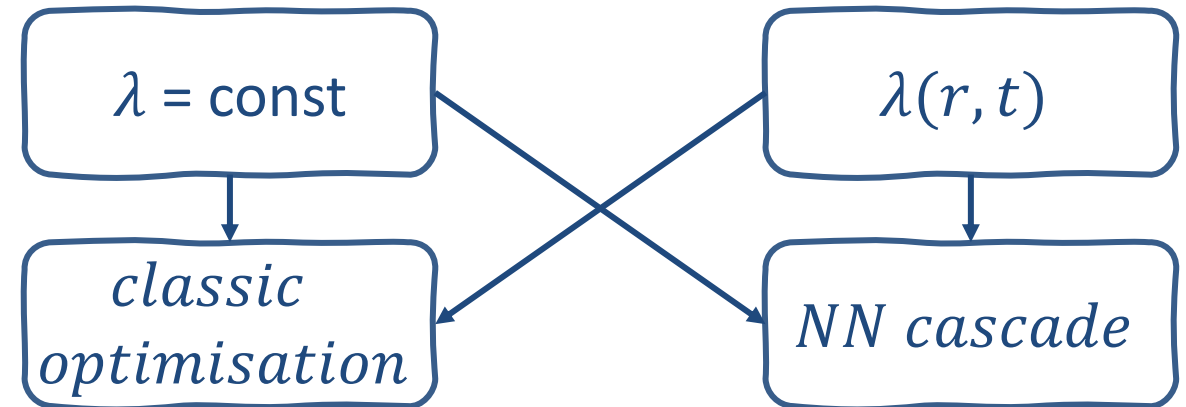
$$\min \|\mathbf{x} - \mathbf{y}\| + \lambda TV(\mathbf{x})$$

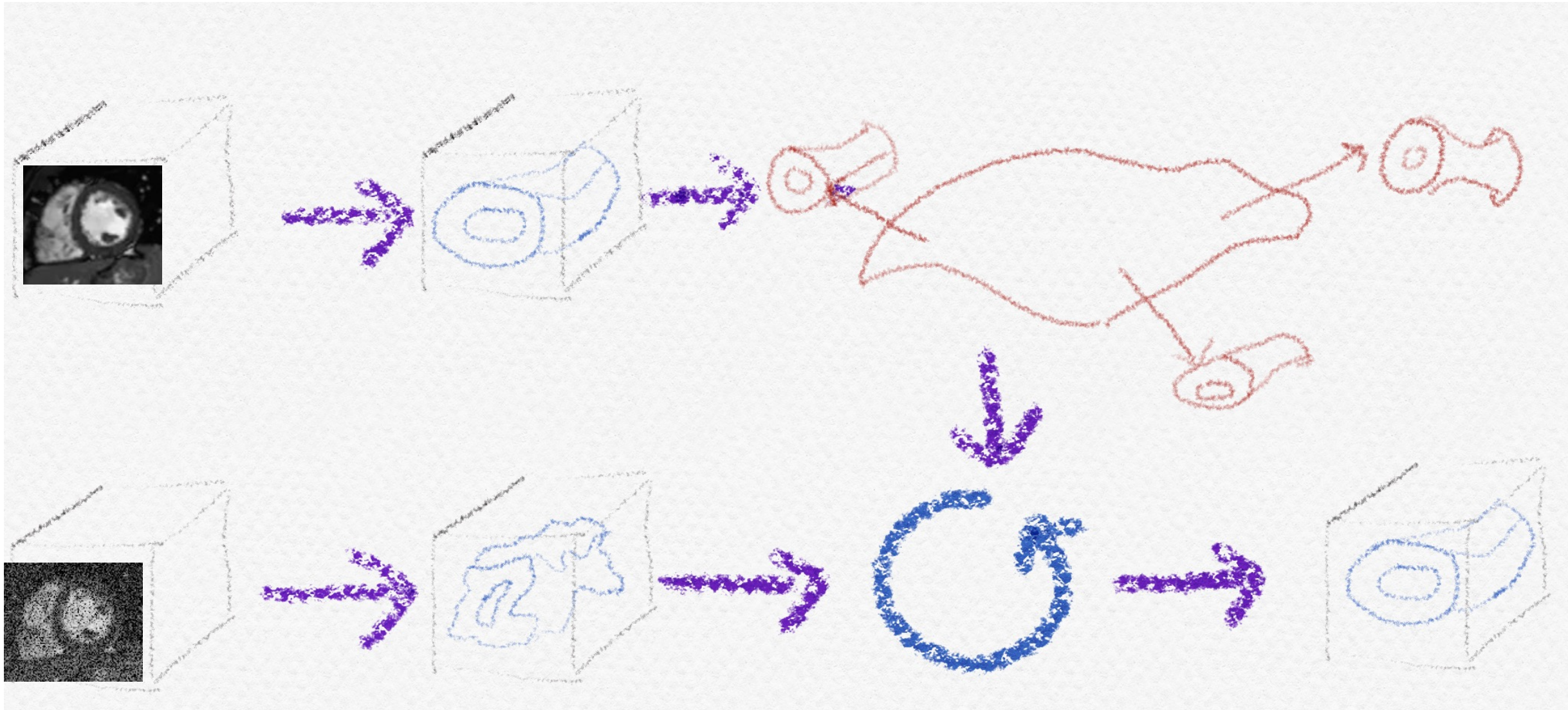
$$\mathbf{y} = \mathbf{x} + \mathbf{e}$$

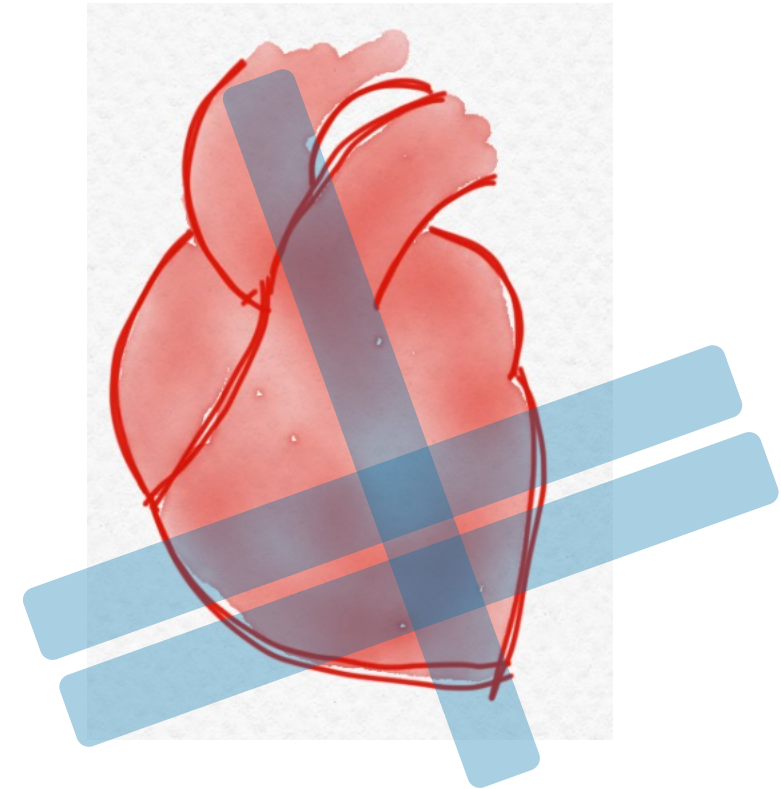
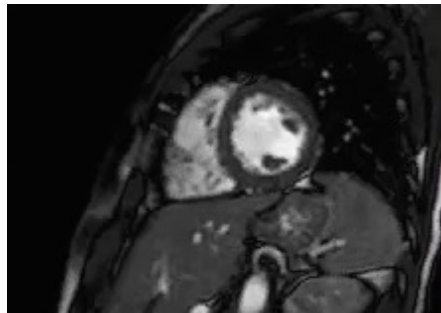
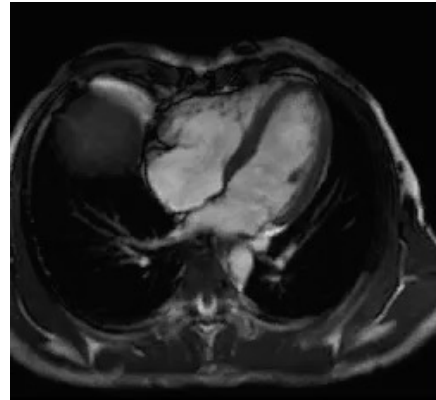
Image reconstruction

$$\min \|A\mathbf{x} - \mathbf{y}\|$$

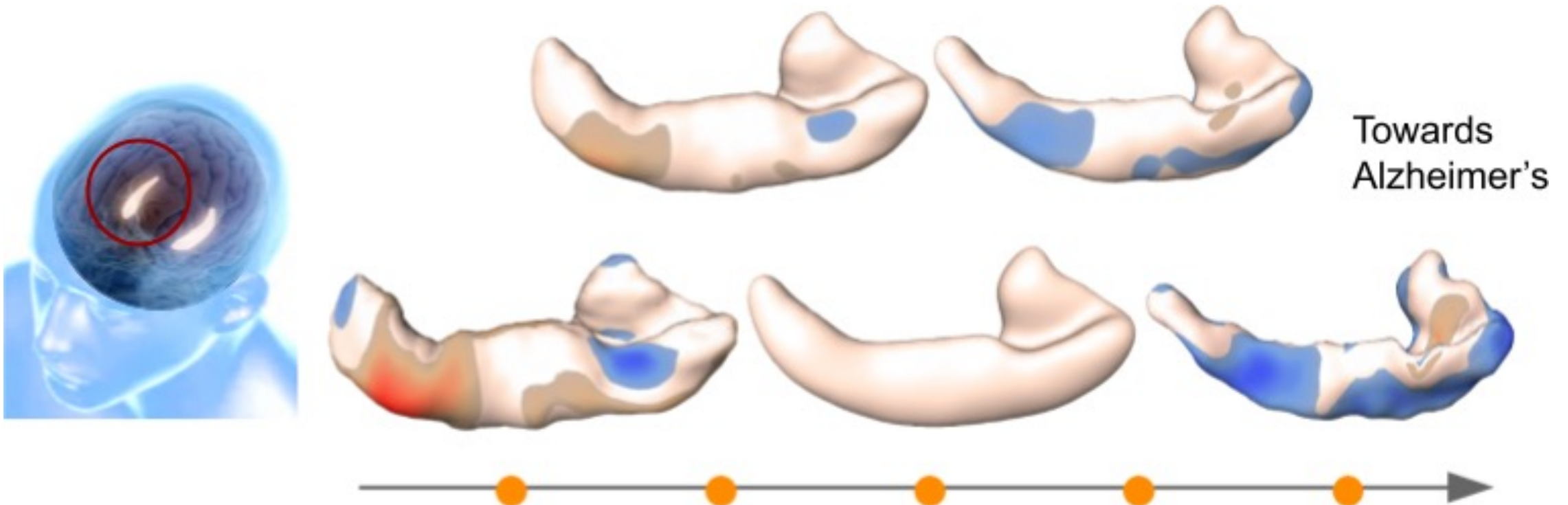
$$\min \|A\mathbf{x} - \mathbf{y}\| + \lambda TV(\mathbf{x})$$

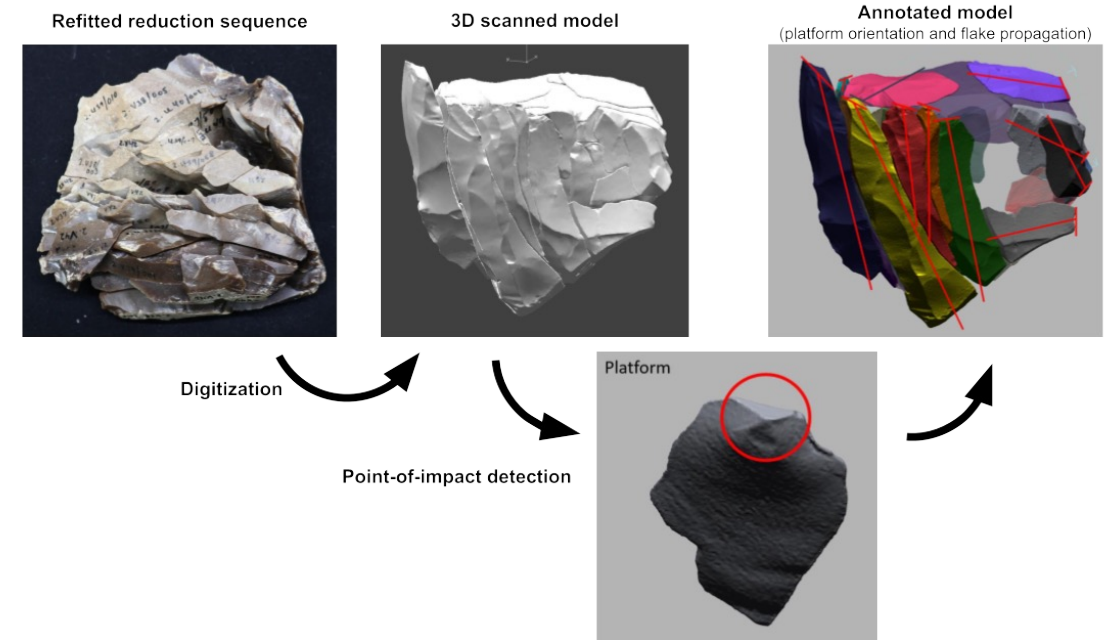
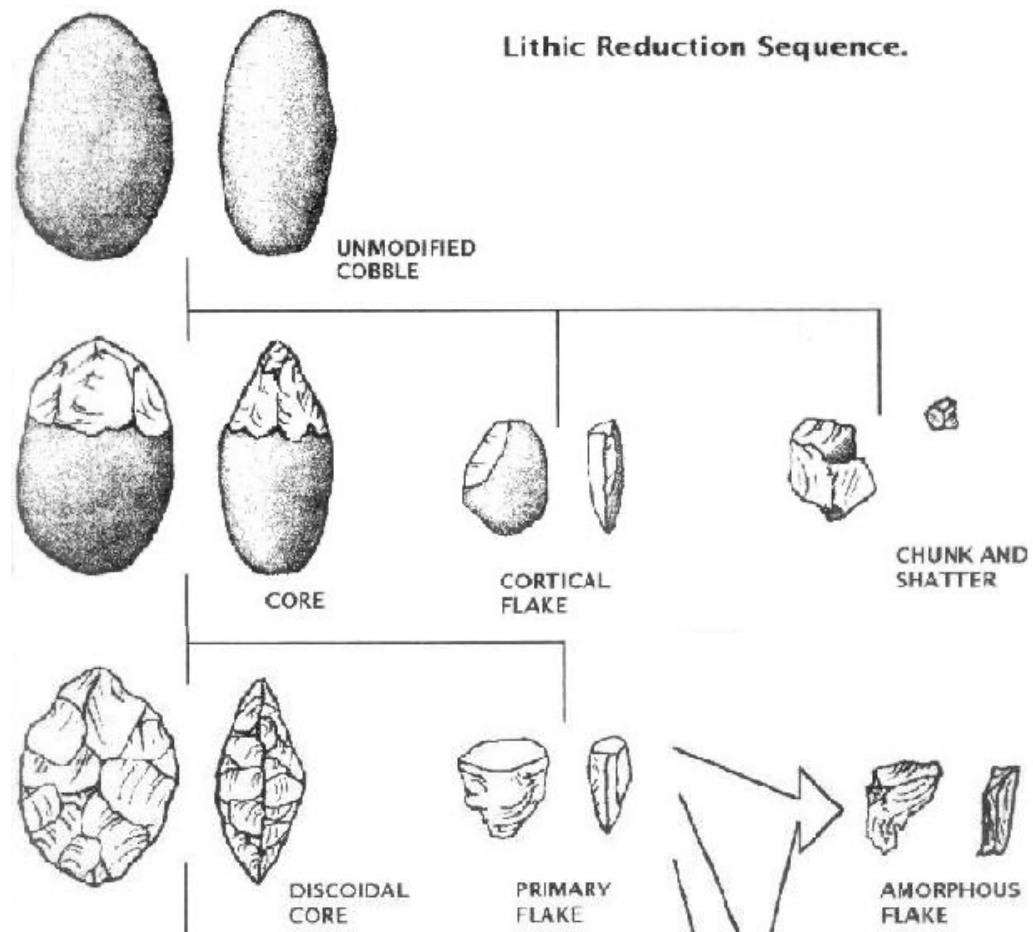




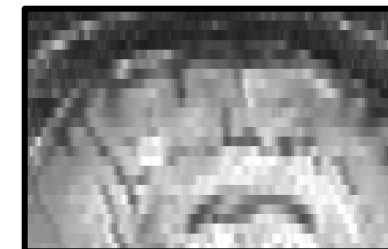
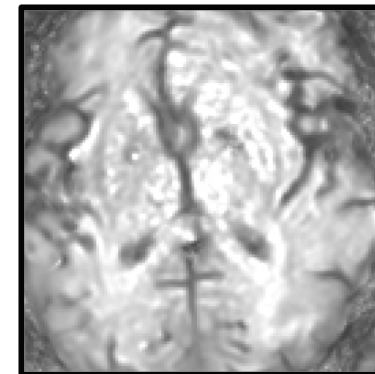
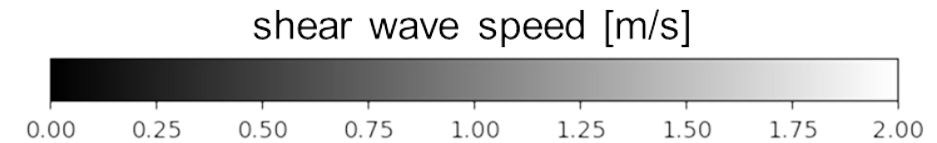
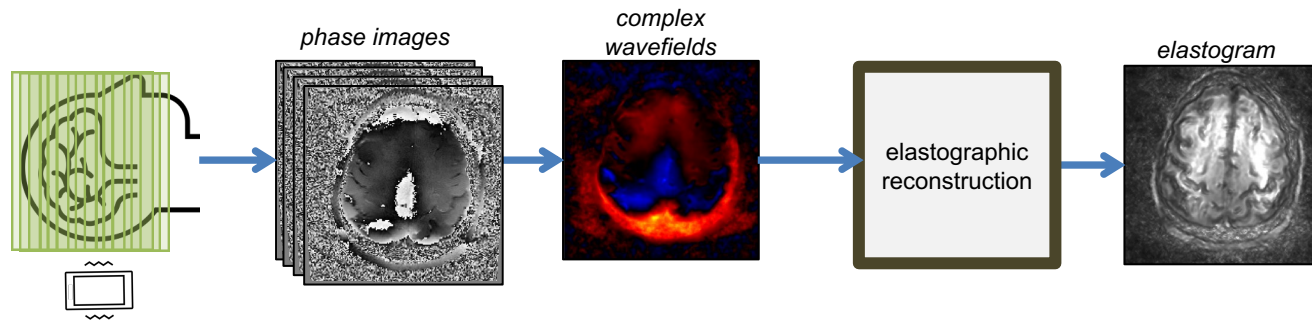


Alzheimer's and (right) hippocampal shape





<https://sites.google.com/site/lithictools/>



Images provided by Simone Hufnagel

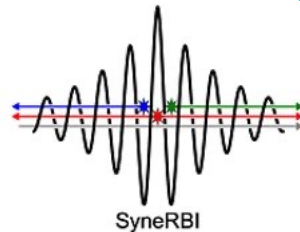
<https://github.com/MATHplus-Young-Academy>

P1-Temp-Reg Public
☆ 1 Apache-2.0 1 0 0 Updated 3 days ago
P2-Cardiac-Motion Public
Jupyter Notebook ☆ 0 Apache-2.0 0 0 0 Updated 9 days ago
P3-Morph-Scoring Public
☆ 1 Apache-2.0 0 0 0 Updated 8 minutes ago
P4-Geom-DL Public
☆ 0 Apache-2.0 0 0 0 Updated 3 days ago
P5-Elastography Public
☆ 0 Apache-2.0 0 0 0 Updated 3 days ago
TES_21_22_Tutorials Public
Tutorials for the Thematic Einstein Semester on Mathematics of Imaging in Real-World Challenges
Jupyter Notebook ☆ 0 Apache-2.0 5 0 0 Updated yesterday



Science and
Technology
Facilities Council

Scientific Computing



Synergistic
Reconstruction for
Biomedical Imaging



Core Imaging Library

Sign In

Username:

Password:

Don't have an account? [Signup!](#)

mathplus-XX

plugged.stardom.steps



SciML GPU environment

This configuration gives you 4 CPUs, 7GB of RAM, and a GPU, Tensorflow environment



Training School for SIRF and CIL GPU

For small jobs and prototyping: 10 CPUs, 60GB RAM and GPU. For Training School for SIRF and CIL



Dev Training School for SIRF and CIL GPU

For small jobs and prototyping: 10 CPUs, 60GB RAM and GPU. Development For Training School for SIRF and CIL



Training School for SIRF and CIL no GPU

For small jobs and prototyping: 12 CPUs, 60GB RAM and no GPU. For Training School for SIRF and CIL

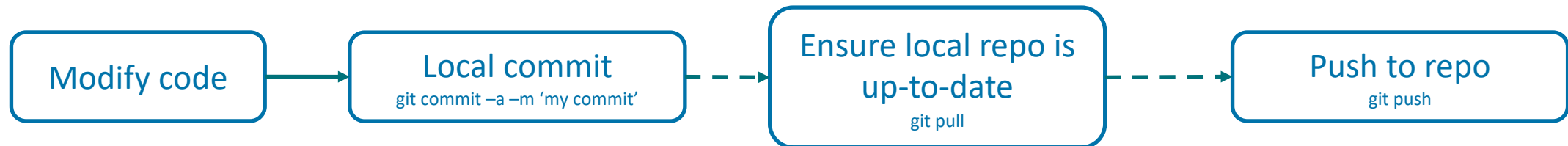
Start

Once: On stfc-cloud you still need to set-up your git name:

```
git config --global user.name "Christoph Kolbitsch"
git config --global user.email christoph.kolbitsch@ptb.de
git config --list
```

Clone repo(s): `git clone https://github.com/MATHplus-Young-Academy/P2-Cardiac-Motion.git`

Again and again:



On the STFC cloud: `/mnt/materials/SIRF/MathPlusBerlin/DATA`

<https://ocloud.ptb.de/s/YRmS7AsTZ43pHWr> PW: Hackathon2022

PTB

Maths_Meets_Image

Alle Dateien herunterladen

...

First version: 17th of March 2022

Author: Christoph Kolbitsch, Kostas Papafitsoros

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Photos

During the hackathon we would like to take some photos of you hard at work. We will use some of these photos for (internal) reporting such as in the final report sent to the funding agency and promotional purposes on the Math+ homepage. By attending the hackathon you agree to this use. If you have any more questions, please contact us.

Data

The data you will be working on during the hackathon is provided by different sources. You are all welcome to work freely with this data during the hackathon but you are not allowed to take a copy of any of the data with you after the event. If you would like to continue to use it after the hackathon, please contact us and we will get you in contact with the responsible person, usually there should be a way. By attending the hackathon you agree to this data policy.

Where can I get more information?

<https://github.com/MATHplus-Young-Academy>

[TES_21_22_Tutorials](#) Public

Tutorials for the Thematic Einstein Semester on Mathematics of Imaging in Real-World Challenges

 Jupyter Notebook  0  Apache-2.0  5  0  0 Updated yesterday

<https://github.com/SyneRBI/SIRF-Exercises>

<https://github.com/TomographicImaging/CIL-Demos>

<https://morphomatics.github.io/>

Morphomatics: Geometric morphometrics in non-Euclidean shape spaces

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3 challenging challenges!

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