Medical Imaging

Prof. Dr. Tobias Knopp

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Institute für Biomedizinische Bildgebung

Organizational Matters

Team

- Lecture: Tobias Knopp (tobias.knopp@tuhh.de)
- Exercise: Martin Möddel (martin.hofmann@tuhh.de)

Disclaimer

- All lecture material is for your private use only. You are not allowed to share it.
- It is not allowed to screen capture live video sessions. You are violating the DSGVO since no student allowed you to do that.

Lecture

- Inverted classroom instead of classical lecture.
- Screencasts will be provided each week.
- If you wish so you can learn by yourself.
- Weekly meeting to answer your questions. Meetings will be either in-person or virtually after weekly announcements. No hybrid meetings are planned.
- No repetition or summary, so please watch the screencast in order to ask questions.
- Meetings will close early if there are no more questions to make up for the time you spend studying at home

Exercises will cover numerical problems related to the lecture. It will be your task to solve these problems with the methods provided within the scope of the lecture and lab course. The lab course aims to teach you some core programming paradigms related to medical imaging and scientific programming.

Lab Course & Exercises

- Programming based exercises cover larger topics (e.g inverse problems)
- You usually will have multiple weeks to solve an exercise.
- Exercise to be solved with the Julia programming language.
- Exercises are designed to be solved in groups with 2-4 people, which you set up in self organization in Stud.IP.
- The solution **must** be a single Julia file: **GroupL_ExerciseN.jl** where N is the number of the exercise sheet and L is the group number. No other naming scheme or file extension (like zip) are allowed.
- The solutions are uploaded into the corresponding group folder in Stud.IP.
- You can earn at most 10% bonus for the exam.

Lab Course & Exercises

- You can seek help from each other using the Stud.IP forum.
- You can ask questions regarding the exercise sheets in the weekly meeting taking place within the second part of the lecture time slot where Martin will take over.
- Solutions will be provided after the topic is closed.
- Screencasts will discuss solutions in more detail.

Literature

- Bildgebende Verfahren in der Medizin; O. Dössel; Springer, Berlin, 2016
- The Mathematics of Medical Imaging: A Beginner's Guide; T. Feemann; Springer, 2015

Content

- Foundations
  - Introduction to Medical Imaging
  - Signal Processing
- Inverse Problems
  - Introduction to Inverse Problems
  - Physical Principles of Computed Tomography
  - Analytical Image Reconstruction
- Discrete Inverse Problems
  - Physical Principles of Magnetic Particle Imaging

- Regularization Techniques
- Iterative Reconstruction
- Advanced Sampling Methods
  - Physical Principles of Magnetic Resonance Imaging
  - Nonequidistant Fast-Fourier Transform
  - Compressed Sensing
  - Learning-Based Image Reconstruction