Modulbezeichnung:	Computational Magnetic Resonance Imaging (Computational MRI) (Computational Magnetic Resonance Imaging)	5 ECTS
Modulverantwortliche/r:	Florian Knoll	
Lehrende:	Bruno Riemenschneider, Florian Knoll	

Startsemester: WS 2021/2022	Dauer: 1 semester	Turnus: jährlich (WS)
Präsenzzeit: 60 Std.	Eigenstudium: 90 Std.	Sprache: Englisch

Lehrveranstaltungen:

Computational Magnetic Resonance Imaging Vorlesung (WS 2021/2022, Vorlesung, 2 SWS, Florian Knoll)

Computational Magnetic Resonance Imaging Uebung (WS 2021/2022, Übung, 2 SWS, Florian Knoll et al.)

Es wird empfohlen, folgende Module zu absolvieren, bevor dieses Modul belegt wird:

Medizintechnik II (Bildgebende Verfahren)

Magnetic Resonance Imaging 1

Inhalt:

Computational Magnetic Resonance Imaging provides a deeper look into computational and machine learning methods for the inverse problem of MRI data acquisition and image reconstruction. It is organized as a series of lectures with accompanying programming exercises. In the exercises, students will use Matlab or Python and PyTorch to implement and test the different methods discussed in class. Topics covered will include but are not limited to:

- Recap of MR signal and encoding, Fourier imaging
- Introduction to the inverse problem of imaging
- Partial Fourier imaging
- Parallel imaging
- Compressed sensing
- Machine Learning in MRI

Lernziele und Kompetenzen:

After completing this course, students will be able to:

- Understand the theory and algorithms of MR data acquisition and image reconstruction
- Apply them themselves in real-world MR imaging tasks

Literatur:

Z.P. Liang. Constrained Reconstruction Methods in MR Imaging. http://mri.beckman.illinois.edu/resources/liang_199
D. Nishimura. Principles of Magnetic Resonance Imaging. https://www.lulu.com/en/us/shop/dwight-nishimura/principles-of-magnetic-resonance-imaging/paperback/product-1nqdq4j2.html?page=1&pageSize=4
M. Bernstein. Handbook of MRI Pulse Sequences. https://www.amazon.com/Handbook-Pulse-Sequences-Matt-Bernstein/dp/0120928612

Verwendbarkeit des Moduls / Einpassung in den Musterstudienplan:

Das Modul ist im Kontext der folgenden Studienfächer/Vertiefungsrichtungen verwendbar:

[1] **Artificial Intelligence (Master of Science)**
(Po-Vers. 2021s | TechFak | Artificial Intelligence (Master of Science) | Gesamtkonto | Nebenfach | Nebenfach Artificial Intelligence in Biomedical Engineering | Computational Magnetic Resonance Imaging)

[2] **Data Science (Master of Science)**
(Po-Vers. 2021w | Gesamtkonto | Studienrichtung Simulation and Numerics | Computational Magnetic Resonance Imaging)

[3] **Data Science (Master of Science)**
(Po-Vers. 2021w | Gesamtkonto | Anwendungsfach | Medical Data Science | Computational Magnetic Resonance Imaging)

[4] **Informatik (Master of Science)**
(Po-Vers. 2010 | TechFak | Informatik (Master of Science) | Gesamtkonto | Nebenfach | Nebenfach Artificial Intelligence in Biomedical Engineering | Computational Magnetic Resonance Imaging)

Studien-/Prüfungsleistungen:

Computational Magnetic Resonance Imaging (Prüfungsnummer: 31091)
Prüfungsleistung, mündliche Prüfung, Dauer (in Minuten): 30
Anteil an der Berechnung der Modulnote: 100%
weitere Erläuterungen:
Grade will be determined by a 30 Min oral exam at the end of the course.
Prüfungssprache: Englisch

Erstablegung: WS 2021/2022, 1. Wdh.: SS 2022
1. Prüfer: Florian Knoll

Computational Magnetic Resonance Imaging (Prüfungsnummer: 31092)
Studienleistung, Übungsleistung, Dauer (in Minuten): 30
weitere Erläuterungen:
Students can receive bonus points during the practical exercises.
Prüfungssprache: Englisch

Erstablegung: WS 2021/2022, 1. Wdh.: SS 2022
1. Prüfer: Florian Knoll
