

Module: Medical AI

Level	Master	Short Name	MedAI
Responsible Lecturers	Prof. Dr. Marian Himstedt		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	ECTS Credit Points	5
Semester of Studies	(Unspecified)	Semester Hours per Week	4
Length (semesters)	1	Workload (hours)	150
Frequency	WiSe	Presence Hours	60
Teaching Language	English	Self-Study Hours	90

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Portfolio Exam	Exam Language	German/English
Exam Length (minutes)		Exam Grading System	One-third Grades
Learning Outcomes	<ul style="list-style-type: none"> • Students can explain common deep learning architectures with a focus on medical computer vision. • Students can describe challenges in medical applications of AI. • Students can apply models for classification, segmentation, and registration to existing and new medical applications. • Students can employ deep learning methods effectively for specific medical applications. • Students can confidently develop, evaluate, and deploy their own deep learning-based applications using Python. • Students can independently assess the relevance of scientific articles and adapt the presented methods for use in both existing and new medical applications. 		
Participation Prerequisites			

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	<ul style="list-style-type: none"> ✓ Use of gender-neutral language (THL standard) ✓ Target group specific adjustment of didactic methods ✓ Making subject diversity visible (female researchers, cultures etc.)
Applicability	
Remarks	

Module Course: Medical AI (Lecture)

(of Module: Medical AI)

Course Type	Lecture	Form of Learning	Presence
Mandatory Attendance	no	ECTS Credit Points	3
Participation Limit		Semester Hours per Week	2
Group Size		Workload (hours)	90
Teaching Language	English	Presence Hours	30
Study Achievements ("Studienleistung", SL)		Self-Study Hours	60
SL Length (minutes)		SL Grading System	

The following section is filled only if there is a course-specific exam.

Exam Type		Exam Language	
Exam Length (minutes)		Exam Grading System	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	<p>Introduction</p> <ul style="list-style-type: none"> • Motivation for AI in healthcare • Recent trends and challenges <p>Neural Networks</p> <ul style="list-style-type: none"> • Neurons and layers • (Multi-layer) perceptron • Backpropagation • Training networks using PyTorch <p>Neural networks architectures:</p> <ul style="list-style-type: none"> • CNN • Transformer <p>Medical data domains</p> <ul style="list-style-type: none"> • CT, MRI • Ultrasound • Endoscopy <p>Learning methods</p> <ul style="list-style-type: none"> • Supervised/unsupervised/weakly supervised approaches • Contrastive learning • Self-supervised learning <p>Fundamental tasks for medical domain</p> <ul style="list-style-type: none"> • Classification • Segmentation
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- Registration
- Explainable models

Recent approaches

- Foundation models
- Multimodal learning

Selected clinical applications

- ECG signal classification
- Organ and tumor localization and segmentation
- Image guidance
- Tumor/tissue tracking

Literature	Ian Goodfellow, Yoshua Bengio und Aaron Courville: Deep Learning - The MIT Press
Remarks	

Module Course: Medical AI (Lab)

(of Module: Medical AI)

Course Type	Practical Training	Form of Learning	Presence
Mandatory Attendance	yes	ECTS Credit Points	2
Participation Limit		Semester Hours per Week	2
Group Size	12	Workload (hours)	60
Teaching Language	English	Presence Hours	30
Study Achievements ("Studienleistung", SL)		Self-Study Hours	30
SL Length (minutes)		SL Grading System	Participation

The following section is filled only if there is a course-specific exam.

Exam Type		Exam Language	
Exam Length (minutes)		Exam Grading System	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	See lecture
Literature	See lecture
Remarks	