Modulbezeichnung:	**Machine Learning in Signal Processing (MLISP)** (Machine Learning in Signal Processing)	**5 ECTS**
Modulverantwortliche/r:	Hochschullehrer der Elektrotechnik	
Lehrende:	Hochschullehrer der Elektrotechnik	

Startsemester: WS 2022/2023	Dauer: 1 Semester	Turnus: jährlich (WS)
Präsenzzeit: 60 Std.	Eigenstudium: 90 Std.	Sprache: Englisch

Lehrveranstaltungen:

Machine Learning in Signal Processing (WS 2022/2023, Vorlesung, 3 SWS, Hochschullehrer der Elektrotechnik)

Supplements for Machine Learning in Signal Processing (WS 2022/2023, Übung, 1 SWS, N.N.)

Inhalt:

This course is an introduction into machine learning and artificial intelligence. The special emphasis is on applications to modern signal processing problems. The course is focused on design principles of machine learning algorithms. The lectures start with a short introduction, where the nomenclature is defined. After this, probabilistic graphical models are introduced and the use of latent variables is discussed, concluding with a discussion of hidden Markov models and Markov fields. The second part of the course is about deep learning and covers the use of deep neural networks for machine learning tasks. In the last part of the lecture, the use of deep neural networks for speech processing tasks is introduced.

The course is based on the materials and video footage from Dr. Roland Maas. He is an outstanding machine learning expert and a former member of the Chair of Multimedia Communications and Signal Processing.

Lernziele und Kompetenzen:

After attending the lecture, students will be able to

- understand regression and classification problems
- apply PDF estimation algorithms
- understand Gaussian mixture models and expectation-maximization
- apply principal component analysis and independent component analysis
- assess different estimation algorithms
- explain the application of machine learning to system identification
- apply hidden Markov models
- understand different artificial neural network architectures
- explain deep learning principles
- apply artificial neural networks
- devise learning strategies for deep neural networks
- assess the application of deep neural networks for speech processing tasks.

Literatur:

Literature:

- C. M. Bishop: Pattern Recognition and Machine Learning, http://www.research.microsoft.com/en-us/um/people/cmbishop/PRML
- S. Theodoridis and K. Koutroumbas: Pattern Recognition
- M. Nielsen: Neural Networks and Deep Learning.

Verwendbarkeit des Moduls / Einpassung in den Musterstudienplan:

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

[1] **Advanced Signal Processing & Communications Engineering (Master of Science)**
(Po-Vers. 2021w | TechFak | Communications Engineering (Master of Science) | Gesamtkonto | Machine Learning in Signal Processing)

Studien-/Prüfungsleistungen:

Machine Learning in Signal Processing (Prüfungsnummer: 84401)
Prüfungsleistung, Klausur, Dauer (in Minuten): 90
Anteil an der Berechnung der Modulnote: 100% Prüfungssprache: Englisch

Erstablegung: WS 2022/2023, 1. Wdh.: SS 2023
1. Prüfer: Jürgen Seiler
