inf960 - Fundamental Competences in Computing Science I: Signals and Dynamical Systems

Module label
Fundamental Competences in Computing Science I: Signals and Dynamical Systems

Module code
inf960

Credit points
6.0 KP

Workload
180 h

Used in course of study
Master's Programme Engineering of Socio-Technical Systems > Fundamentals/Foundations

Contact person

Module responsibility
- Martin Georg Fränzle
- Andreas Hein

Authorized examiners
- Die im Modul Lehrenden

Entry requirements
This course provides an introduction into digital signal processing. It covers the mathematical foundations necessary for understanding the impact digitization has on a continuous signal as well as the goal-directed synthesis of digital filters. As such, it lays the theoretical foundations preparing for understanding and designing applications of digital signal processing in a variety of fields relevant to the MSc EngSTS, like neurophysiological measurements, brain-computing interfaces, or embedded control. In contrast to subsequent modules of the study programme, the module itself does not aim at covering such applications, but at providing a solid grasp of the underlying principles and the fundamental constraints to digital signal processing. It is targeted at psychologists, but also at computer scientists who have not previously been exposed to a systematic mathematical treatment of the fundamentals of digital signal processing.

Professional competences:
The students:
- Name the concepts of signal and image processing in technical systems
- Name the methods/algorithms of preprocessing, filtering, classification, interpretation and visualisation of signals and pictures
- Select algorithms appropriately
- Evaluate the effectiveness of algorithms
- Design algorithms and processing chains and evaluate their quality

Methodological competences:
The students:
- Get used to specific subjects of signal and image processing

Social competences:
The students:
- Present solutions for specific questions in signal and image processing

Self-competences:
The students:
- Reflect their solutions by using methods learned in this course

Module contents
- Basic Concepts
- Signal Processing
- Signal Spaces and Signal Processing Systems
- Discrete and Constant Signals
- Labelling of Signal Transmitters with Test Signals
- Representations Areas and Transformations
- Time-Discrete Systems and Scanning
Estimation and Filtering
Construction with MATLAB
Image Processing
Introduction / Range of Applications
Functional Transformation
Image Enhancement/Filtering
Segmentation
3D Reconstruction an Visualization

Reader’s advisory

essential: Slides
recommended:
-Meyer, M.; Signalverarbeitung: Analoge und digitale Signale, Systeme und Filter
-Grüningen, D. C. v.; Digitale Signalverarbeitung: mit einer Einführung in die kontinuierlichen Signale und Systeme
-Tönnies, K.; Grundlagen der Bildverarbeitung; Pearson Studium 2005
-Lehmann, Th.; Oberschelp, W.; Pelinak, E.; Pepges, R.; Bildverarbeitung in der Medizin; Springer Verlag 1997
-Handels, H.; Medizinische Bildverarbeitung; Teubner Verlag, Stuttgart - Leipzig 2000

Links
Language of instruction English
Duration (semesters) 1 Semester
Module frequency Once a year
Module capacity unlimited
Reference text

This course is part of the base curriculum of the MSc program "Engineering of Socio-Technical Systems". It provides students featuring a background in psychology with fundamental competences in computer science and related subjects. This course is also intended for students with a background in computer science lacking prior knowledge in digital signal processing.

Modullevel BC (Basiscurriculum / Base curriculum)
Modulart Pflicht o. Wahlpflicht / compulsory or optional
Lern-/Lehrform / Type of program V+Ü

Vorkenntnisse / Previous knowledge
Examination Time of examination Type of examination Hands-on exercises and written or oral exam
Final exam of module At the end of the lecture period

Course type Comment SWS Frequency Workload attendance
Lecture 2.00 WiSe 28 h
Exercises 2.00 WiSe 28 h

Total time of attendance for the module 56 h