Qualification Objectives
Master Artificial Intelligence
for Smart Sensors and Actuators

Faculty of Applied Natural Sciences and Industrial Engineering

Deggendorf Institute of Technology

Authors:
Prof. Dr. Josef Schmid, Programme Coordinator of
Artificial Intelligence for Smart Sensors and Actuators

Gender neutrality

To maintain readability and clarity, the use of double forms or other designations of female, male and diverse genders is largely avoided. All designations for the various groups of university employees refer equally to members of all genders of the groups concerned.

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1 Course Objectives

The consecutive, application-oriented master programme "Artificial Intelligence for Smart Sensors and Actuators" (MSS) is to enable diploma or undergraduate students of Mechatronics or closely related study programmes to substantiate their findings gained so far with theoretical knowledge to meet the challenges of modern research and development tasks significantly. This study programme complements undergraduate or diploma studies in depth and expands the knowledge base. Graduates are to be qualified for creative work in research and development departments. Furthermore, particularly qualified students are to acquire the fundamentals to absolve a PhD programme or work in scientific fields.

2 Learning Outcomes of the Course

The study programme consists of three semesters and is completed by an independent scientific paper (master thesis).

The master programme is module-based and encompasses three study semesters.

In total, students can acquire 90 ECTS credit points.

The learning outcomes of the individual modules including their detailed objectives as well as the knowledge, skills, and competencies to be acquired by the graduates are further described in the module handbook for the master programme "Artificial Intelligence for Smart Sensors and Actuators" at the DIT. The modules in the module handbook are listed according to their respective module number of the study and examination regulations.

3 Study and Qualification Objectives

Professional and Methodological Competence

This internationally oriented master's programme enables undergraduate students of Mechatronics or other closely related study fields to deepen their knowledge and understanding of smart systems, smart sensors and smart actuators, which are increasingly influencing both - industrial processes and the everyday environment. By combining teaching content on artificial intelligence (e.g., machine learning, data analysis), innovative sensor and actuator technology, system design, expert knowledge on innovative methods of data as well as information-processing is imparted. Central teaching contents encompass: Artificial Intelligence and machine learning methods, embedded control for smart sensors and actuators, autonomous systems, sensor technologies, data-processing methods (including cloud computing, Big Data - handling large amounts of data) and system design / networking in systems.
Students acquire the necessary technical knowledge, skills, and methods for the independent application of scientific knowledge and methods in both the industry and the service sector. In addition, students acquire fundamental knowledge and competencies about concepts, findings and methods in compliance with the current state of science and are qualified to familiarize themselves independently with technical advancements. This study programme is to qualify students for scientifically founded engineering activities in the following fields of work, for example:

- Development, construction and application of complex systems and products such as
  - mechatronic and cyber-physical products
  - autonomous and intelligent systems
  - smart sensors and actuators
  - embedded control systems
  - etc.

- Development of machine learning and deep learning models for products as well as in in production, logistics or in the customer environment
- Management of technical projects
- Technical sales and distribution
- Quality management and assurance
- Technology management
- Research and teaching.

A wide-ranging, qualified, and scientifically founded training is to equip graduates for working in diversified professions. Career options are not solely limited to economic and supply companies but further include research and teaching activities as well as independent practice. The master's thesis and master seminar demonstrate students' ability to apply the knowledge and skills acquired in their studies independently to complex tasks and the presentation thereof in an appropriate form, both written and orally. Correspondingly, students can demonstrate that they have acquired the ability to conduct scientific work independently. The skills acquired form the basis for the continuation of their studies, a PhD in Mechatronics or another closely related field.

Social and Personal Competence

The master programme "Artificial Intelligence for Smart Sensors and Actuators" fosters social competence, communication, and presentation skills. Upon entry into professional life, the high level of practical relevance prepares students for socialization and operational as well as scientific work environments. In addition to technical and methodological knowledge, corresponding management techniques as well as social competencies are equally conveyed. The case studies integrated in four modules not only promote technical skills but also foster personal and social competencies. The case studies offer the ideal opportunity to apply theoretical knowledge gained from the respective modules into practice.

Small student groups deal with individual scenarios. In the process, different solution approaches collide, which demands discussion to find a practical solution within the group eventually. Decision-making competencies are equally trained. Moreover, these case studies offer students the opportunity to consider problems from different angles. Theoretical knowledge relates to the analyses elaborated to understand and explain the respective scenario. The case studies also prepare students ideally for their everyday working life by working within a team. A group presentation on the findings obtained is also part of the case studies.

Graduates of the master's programme "Artificial Intelligence for Smart Sensors and Actuators" are capable of presenting work results in a structured manner and to further discuss their findings in front of an expert audience. Furthermore, graduates are qualified to organize themselves independently and to demonstrate team skills as well as high leadership competence for interdisciplinary collaboration.

4 Learning Outcomes of the Modules / Module Objectives / Target Matrix

The individual modules, their detailed objectives and the competencies graduates need to acquire are further described in the module handbook of this master's programme. The following table establishes the link between the individual modules and the objectives of the master programme described in the previous section.

Target Matrix of the Modules within the Master's Programme "ArtificialIntelligence for Smart Sensors and Actuators"

Module	Objectives											
	Knowledge				Skills				Competencies			
	Scientific/Technical Fundamentals	Engineering Methodology	Engineering Practice and Product Development	Interdisciplinary	Scientific/Technical Fundamentals	Engineering Methodology	Engineering Practice and Product Development	Interdisciplinary	Scientific/Technical Fundamentals	Engineering Methodology	Engineering Practice and Product Development	Interdisciplinary
Module MSS-01 AI and Machine Learning	x	x	xx		x	x	xx		x	x	xx	
Module MSS-02 Advanced Sensor Technology and Functionality	x	xx	xx		x	xx	xx		x	xx	xx	
Module MSS-03 Model-Based Function Engineering	x	xx	x		x	xx	x		x	xx	x	
Module MSS-04 Advanced Programming		xx	xx			xx	xx			xx	xx	
Module MSS-05 Edge Device Architectures		xx	x		x	xx	x			xx	x	
Module MSS-06 System Design		xx	x		x	xx	x			xx	x	
Module MSS-07 Deep Learning and Computer Vision		xx	x		x	xx	x			xx	x	
Module MSS-08 Big Data		xx	x		x	xx	x			xx	x	
Module MSS-09 Case Study Machine Learning and Deep Learning			xx	xx			xx	xx			xx	xx
Module MSS-10 Autonomous Systems		xx	x		x	xx	x		x	xx	x	
Module MSS-11 Case Study Edge Device Architectures			xx	xx			xx	xx			xx	xx
Module MSS-12 Network Communication		xx	x		x	xx	x			xx	x	
Module MSS-13 Subject-Related Elective Course (FWP)		x	xx	x		x	xx	x		x	xx	x
Interdisciplinary Area												
Module MSS-14 Master's Module				xx				xx				xx

Key: xx strong reference; x intermediate reference