The cooperation between the department chairs of Friedrich-Alexander University Erlangen-Nürnberg (FAU) and the departments at Fraunhofer is based on the transformation of lecture and seminar contents into practice-oriented, multiday workshops.

The direct reuse and ongoing evolution of themes used in the cooperative development of scripts and content for exercises results in a continuous exchange between research and industry via labs and forums.

This leads to continual improvement of the respective teaching concepts for students and industry developers.

In Zusammenarbeit mit:

FAU
FRIEDRICH-ALEXANDER
UNIVERSITÄT
ERLANGEN-NÜRNBERG

Gefördert von:

Bundesministerium
für Bildung
und Forschung

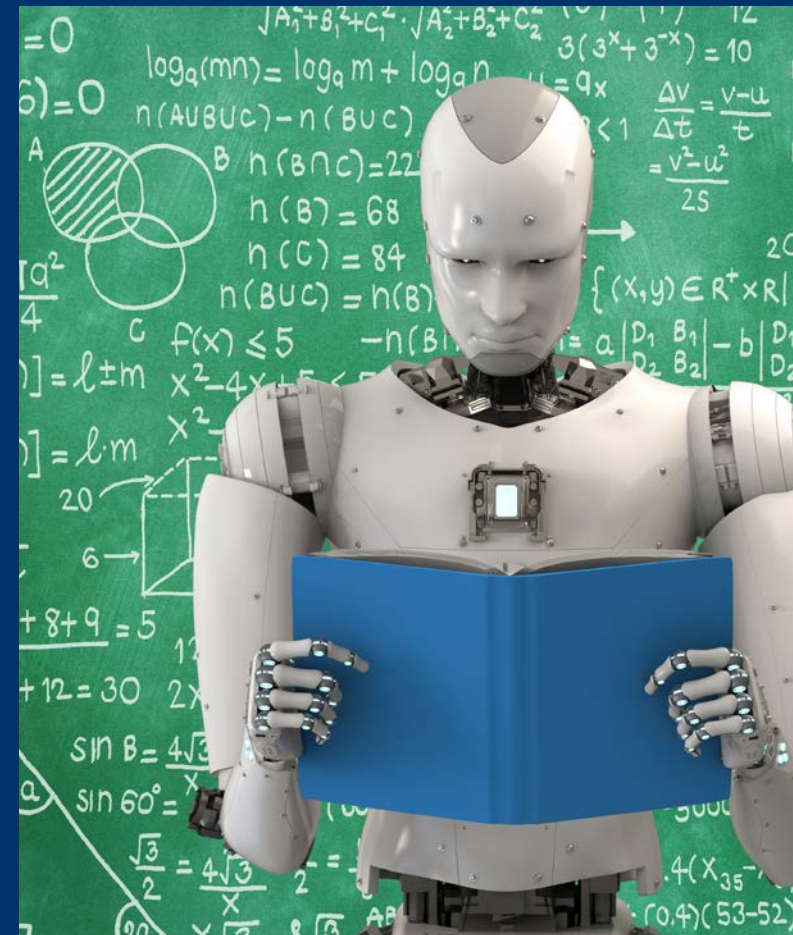**EDUCATION IN APPLIED MACHINE LEARNING**

MACHINE LEARNING FORUM

**Fraunhofer Institute
for Integrated Circuits IIS**

Management of the institute
Prof. Dr.-Ing. Albert Heuberger
(executive)
Dr.-Ing. Bernhard Grill

Am Wolfsmantel 33
91058 Erlangen, Germany

Contact
Dr.-Ing. Christopher Mutschler
christopher.mutschler@iis.fraunhofer.de
Phone +49 911 58061-3253

www.iis.fraunhofer.de

AT A GLANCE

The Machine Learning Forum offers a wide variety of advanced education options for students and developers in industry. On one hand, the new university courses offered for Master's students establish a wide range of options for deep immersion based on various seminars, practicums, and lectures. On the other hand, hands-on labs oriented toward industry work through the theoretical content, combining it with practical industry issues. This work aims to develop solutions for areas relevant to Germany, such as Industry 4.0, production, and the automotive sector.

In addition, the Machine Learning Forum helps small and midsize businesses to use data made available in the context of digitalization by applying ML and to make decision-making processes easier.

The cooperation of Fraunhofer IIS, Friedrich-Alexander University and the industry ensures the teaching of specialized and practice-oriented expertise that can be optimized jointly over the long term.

THE MODULES OF THE MACHINE LEARNING FORUM

Machine Learning

The goal of machine learning, a subfield of artificial intelligence, is not the explicit programming of the computer, but instead enabling it to learn independently from existing data.

The Machine Learning lecture at FAU provides insight into fundamental optimization processes, state-of-the-art machine learning approaches, and Monte Carlo methods. In addition, the associated Machine Learning seminar gives students an overview of various machine learning algorithms.

For the industry we offer a **„Localization and Machine Learning"** lab. The lab focuses on both the comprehensive implementation of machine learning projects and on examples in the areas of logistics, automotive applications, virtual reality, and localization that are relevant to practical situations.

Deep Learning

With deep learning, feature extraction is delegated to deep neural networks, i.e. networks with many "hidden layers."

The **Deep Learning Theory & Applications** lecture is already offered at FAU and provides an overview of the subject area

of deep networks and its distinction from existing, established machine learning approaches.

Two separate one-day, hands-on labs that build upon this content will be offered at Fraunhofer IIS for interested parties from industry: **Deep Learning & Computer Vision 1**, which offers an introduction to this subject based on specific examples of image analysis, and **Deep Learning & Computer Vision 2**, which takes a look at how deep learning architectures function and discusses the options and limitations of the process.

Deep Learning Hardware Architectures

Because the hardware in deep learning applications is subject to difficult requirements, special hardware architectures are introduced and discussed in this module.

Deep Learning Hardware Architectures, a new course in the form of a practicum, will be held in the Computer Architecture department. In the theoretical section, students become familiar with various hardware architectures and debate their suitability for deep learning algorithms. The practical section includes trials of the various hardware architecture using application examples related closely to industry.

A Deep Learning Hardware Architectures lab based on the practicum content will be designed. Initially, this lab will introduce the architecture of a selected deep learning system and demonstrate its suitability for certain applications. In the practical section, the system will be implemented based on a specific example.

Reinforcement Learning

Reinforcement learning (RL) represents another step toward true AI. In RL, an agent independently learns a strategy in order to solve a given problem by attempting to maximize the rewards for taking the correct action.

The **Reinforcement Learning practicum** offered at the university corresponds with this content. The practicum deals first with theoretical foundations which are later applied in specifically designed use cases.

The **Autonomous Agents lab** is a multi-day workshop in which, on one hand, theoretical foundations are taught, and on the other, work is done with simulated applications in the area of controlling complex systems in industry-related situations. In the Autonomous Robotics lab, in addition to theoretical foundations, the focus is on the challenges that occur when controlling robots.

MACHINE LEARNING FORUM

The Machine Learning Forum event is a network platform that connects research and industry. In the future, it will take place twice a year.

In addition to specialized lectures held by the university and practical lectures from industry experts, the event will stimulate the contribution of ideas and subjects from small and midsize businesses, job placement for graduates, and the initiation of (association) projects.

The individual modules are available starting in autumn 2018. To register, see www.iis.fraunhofer.de and fau.de.