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ai

Inria

PROGRAM & ORGANIZATIONAL INFORMATION

4TH INRIA DFKI EUROPEAN SUMMER SCHOOL ON AI

2024

SAARBRÜCKEN
SEPTEMBER 09 - SEPTEMBER 13
2024

triathlon

RICAIP

INTRODUCTION

Welcome 2024

The 4th Inria-DFKI European Summer School on AI (IDESSAI 2024) pursues the series of yearly Summer Schools organized by the two renowned German and French AI institutes, DFKI and Inria, in coordination with RICAIP and Triathlon. This year's summer school has been sponsored by Université franco-allemande.

IDESSAI 2024 will be a 5-day in-person event held at the Innovation Center at the Campus of Saarland University, Germany, from September 9 to September 13, 2024. It stands out from the crowd of offerings for AI students in several respects.

- We ensure a good balance in the number of participants and instructors: participants will have the opportunity to join a community of like-minded people and, at the same time, they will be in close contact with the experts.
- Our program features a line-up of courses focused on two themes, „Large AI Models" and „Robotics & AI", which are at the forefront of socio-economic issues related to AI.
- On top of the latest methodological advances and the shared vision of the future that both organizing institutes have to offer, IDESSAI 2024 will be practically oriented. We will achieve this through hands-on courses and the involvement of industry practitioners and innovators.
- Participants will be offered to the opportunity to present their work to each other in dedicated poster/demo sessions.

„Large AI Models" and „Robotics & AI" will take place in two parallel tracks. There will be plenty of opportunities to exchange between these two tracks at coffee breaks, meals and social events, as well as through joint cross-track sessions.

Philipp Slusallek
(Executive Director of DFKI Saarbrücken)

Pierre Alliez
(Scientific coordinator of the Inria-DFKI partnership)

CONTENT & FLOOR PLAN

Courses - Track A	3rd floor, room 3.05.1
Courses - Track B	3rd floor, room 3.05.2
Opening Speech, Keynotes, Wrap-Up, Industrial Talk	1st floor, stairs
Start-up Workshop	3rd floor
Poster Sessions	1st floor (Foyer)
Coffee breaks	3rd floor
Lunch	Mensa (Building D4.1)

TRACK A & B

LARGE AI MODELS

The rise of large multimodal models like ChatGPT has significantly influenced both research and public perception of AI in recent months. Theme track A, "Large AI Models," dives into the foundational technology and the latest breakthroughs of such large models. The track will feature labs covering essential and fundamental topics such as language modeling, multimodal models, and training with massive datasets. Additionally, it will explore more advanced themes, including LLM alignment and efficiency, along with application-specific topics like using LLMs for code generation. Attendees will gain comprehensive insights from leading experts through a combination of theoretical and practical sessions.

ROBOTICS AND AI

The fields of robotics and industrial AI are rapidly advancing, reshaping existing industries and driving innovation. Track B: "Robotics and AI," delves into technologies and the latest breakthroughs that are transforming the landscape of modern production. Participants will explore essential and fundamental topics such as Human-Robot Collaboration, Digital Twins and Asset Administration Shells, Large Action Models and even rescue robotics for disaster relief. Attendees will have the opportunity to engage in hands-on workshops, live laboratory demo-tours and lectures, applying theoretical knowledge to practical scenarios. Join us for a deep dive into the world of Robotics and Industrial AI and discover how these technologies are revolutionizing industries.

KEYNOTES & COURSES

TIMETABLE

MONDAY

REGISTRATION	11am
OPENING SPEECH	12.45pm
KEYNOTE 1	1.30pm
COFFEE BREAK	2.30pm
COURSE 1	3pm
WELCOME PARTY	5.30pm

TUESDAY

KEYNOTE 2	9am
COFFEE BREAK	10am
COURSE 2	10.30am
LUNCH	1pm
POSTER SESSION	2pm
COFFEE BREAK	3pm
COURSE 3	3.30pm

WEDNESDAY

KEYNOTE 3	9am
COFFEE BREAK	10am
COURSE 4	10.30am
LUNCH & WORKSHOP	1pm
INDUSTRIAL TALK	2pm
COFFEE BREAK	3pm
COURSE 5	3.30pm
SOCIAL EVENT	6pm

THURSDAY

KEYNOTE 4	9am
COFFEE BREAK	10am
COURSE 6	10.30am
LUNCH	1pm
POSTER SESSION	2pm
COFFEE BREAK	3pm
COURSE 7	3.30pm

FRIDAY

COURSE 8	9.30am
COFFEE BREAK	11.30am
WRAP-UP	12am
LUNCH	1pm

KEYNOTES & COURSES

TIMETABLE

	Monday	Tuesday	Wednesday	Thursday	Friday
09:00		Keynote 2	Keynote 3	Keynote 4	Course 8
09:30					
10:00		Coffee Break	Coffee Break	Coffee Break	
10:30		Course 2	Course 4	Course 6	
11:00	Registration				
11:30					Coffee Break
12:00					Wrap-up
12:30					
13:00	Opening Speech	Lunch	Lunch & Workshop	Lunch	Lunch
13:30	Keynote 1				
14:00		Poster		Poster	
14:30	Coffee Break		Industrial Talk		
15:00	Course 1	Coffee Break	Coffee Break	Coffee Break	
15:30		Course 3	Course 5	Course 7	
16:00					
16:30					
17:00					
17:30	WelcomeParty				
18:00			Social Event		
18:30					
19:00					
19:30					

SPEAKER

MONDAY

KEYNOTE 1

Mon,
1:30-2:30pm

PROF. DR. RER. NAT. DR. H.C. MULT. WOLFGANG WAHLSTER (DFKI)

Professor Wolfgang Wahlster is a pioneer of AI in Germany and Europe as a founding director of the DFKI. He has served as an elected President of three international AI organizations: IJCAII, EurAI, and ACL. He is an elected Fellow of AAAI, EurAI, and GI. He laid some of the foundations for multimodal dialog systems, user modelling, and speech-to-speech translation cyber-physical production systems for the fourth industrial revolution (Industrie 4.0), a concept that he coined in 2010. Wahlster is a member of the Nobel Prize Academy in Stockholm, the German National Academy Leopoldina and three other prestigious academies. For his research, he has been awarded the German Future Prize, and the Grand Cross of Merit by the Federal President of Germany. (for more info see: https://www.wolfgang-wahlster.de/)

INDUSTRIAL AI FOR SMART MANUFACTURING

In the next decade of Industry 4.0 a new generation of AI technologies will take smart factories to a new level. Large Language Models (LLMs) will be complemented by Large Process Models (LPMs) and Large Action Models (LAMs), so that generative AI models not only predict what to say or visualize next, but also what to do next with explanations of why these actions make sense.
Although deep learning is the most powerful machine learning method developed to date, it has already reached its inherent limits in many industrial application domains. It must be combined with various symbolic approaches in new system architectures. This leads to hybrid LxM (x=L,P, or M) technologies that use holonic multiagent architectures for combining neural approaches with symbolic reasoning technologies such as constraint solving, physics-based simulation and terminological reasoning in knowledge graphs.

SPEAKER

KEYNOTE 2

Tue,
9:00-10:00am

KEVIN BAUM (DFKI)

Kevin Baum, a computer scientist (M.Sc.) with a doctorate in philosophy, is the head of the Center for European Research in Trusted Artificial Intelligence (CERTAIN) and deputy head of the Neuro-Mechanistic Modeling (NMM) research department at the German Research Center for Artificial Intelligence (DFKI). In various interdisciplinary research projects, he has researched primarily on the sense and nonsense of transparency and explainability requirements for AI systems with regard to societal desiderata such as recognizing unfairness, the effectiveness of human oversight and enabling moral responsibility. He developed the award-winning lecture Ethics for Nerds, is and has been a member of various ethics committees, and is part of Algoright e.V., the interdisciplinary non-profit think tank for good digitalization and science communication.

A PROVISIONAL KEYNOTE ON CURRENT ETHICAL CHALLENGES OF AI

Progress in the field of AI is breathtaking. Large models, foundation models, multimodality: all this not only opens up a wide range of new possibilities, be it in code generation with LLMs or in robotics via Large Action Models, but also raises new societal and ethical challenges. In his provisional keynote, Kevin Baum provides an overview of current normative challenges, sorts out loose threads, and outlines some resulting research opportunities.

SPEAKER

WEDNESDAY

KEYNOTE 3
Wed, 9:00-10:00am

KAI WARSÖNKE (VW) & HENRIK WASCHKE (VW)

Kai Warsönke is a graduate engineer (Diplom FH) in Production Engineering and a fourth-year PhD student at Volkswagen, focusing on data-driven product influence in vehicle projects. His research includes stochastic and statistical tolerance simulation models and preparing quality assurance data for the usage of AI methods. He creates and simulates measurement data-coupled tolerance models to propose targeted action plans for improving vehicle quality. His innovative approach integrates advanced simulation techniques to optimize product development and ensure high-quality outcomes in the automotive industry.

Henrik Waschke holds both a Bachelor and Master's degree in automotive engineering. Currently, he is a first-year PhD student at Volkswagen. His research focuses on enhancing quality in the automotive sector using 3D-AI technology. Henrik deals with AI systems to optimize customer-relevant quality features and streamline quality planning processes. His work aims to improve the customer-relevant quality features and accelerate quality planning processes.

INCREASING PRODUCT QUALITY IN THE AUTOMOTIVE INDUSTRY THROUGH THE VIRTUAL MEASUREMENT DATA ANALYSIS (VMDA)

The Virtual Measurement Data Analysis (VMDA) has been developed to assess how component deviations in the production process affect the corresponding closure dimension across the entire tolerance chain. VMDA uses the latest measurement data to show and analyze changes in how production-related deviations affect the whole process in real time. So far, the VMDA has given real-time feedback on measurement data to a tolerance analysis model that represents the whole vehicle. Right now, VMDA is used on stationary computers. User feedback has indicated a high level of complexity and the necessity for extensive technical knowledge regarding the interaction of individual assemblies and quality-relevant areas. The next step involves simplifying, refining, and explicitly transferring VMDA functionality to a portable device. This will provide the operator with specific instructions for correcting quality deviations. Subsequently, there will be a discussion on the potential applications of artificial intelligence subfields in optimizing planning processes.

SPEAKER

THURSDAY

KEYNOTE 4

Thu,
9:00-10:00am

XAVIER HINAUT (INRIA)

Xavier Hinaut is Research Scientist in Bio-inspired Machine Learning and Computational Neuroscience at Inria, Bordeaux, France since 2016. He received a MSc and Engineering degree form Compiègne Technology University (UTC), FR in 2008, a MSc in Cognitive Science & AI from EPHE, FR in 2019, then his PhD of Lyon University, FR in 2013. He is a member (Vice Chair) of IEEE CIS Task Force on Reservoir Computing. His work is at the frontier of neurosciences, machine learning, robotics and linguistics: from the modeling of human sentence processing to the analysis of birdsongs and their neural correlates. He both uses reservoirs for machine learning (e.g. birdsong classification) and models (e.g. sensorimotor models of how birds learn to sing). He manages the "DeepPool" ANR project on human sentence modeling with Deep Reservoirs architectures and the Inria Exploratory Action "BrainGPT" on Reservoir Transformers. He leads ReservoirPy development: the most up-to-date Python library for Reservoir Computing. https://github.com/reservoirpy/reservoirpy He is also involved in public outreach, notably by organising hackathons from which fun projects with reservoirs came out (ReMi project on reservoir generating MIDI and sounds).

TAILORING TRANSFORMERS INTO COGNITIVE LANGUAGE MODELS

Language involves several levels of abstraction, from small sound units like phonemes to contextual sentence-level understanding. Large Language Models (LLMs) have shown an impressive ability to predict human brain recordings. For instance, while a subject is listening to a book chapter from Harry Potter, LLMs can predict parts of brain imaging activity (recorded by functional Magnetic Resonance Imaging or Electroencephalography) at the phoneme or word level. These striking results are likely due to their hierarchical architectures and massive training data. Despite these feats, they differ significantly from how our brains work and provide little insight into the brain's language processing. We will see how simple Recurrent Neural Networks like Reservoir Computing can model language acquisition from limited and ambiguous contextual data better than LSTMs. From these results, in the BrainGPT project, we explore various architectures inspired by both reservoirs and LLMs, combining random projections and attention mechanisms to build models that can be trained faster with less data and greater biological insight.

COURSES

SPEAKER TRACK A

MONDAY

COURSE 1 & 3

Christophe Cerisara is a French researcher at CNRS (National Centre for Scientific Research), specialized in machine learning models for natural language processing (NLP). He has created and is leading the SYNALP research team composed of about 20 NLP researchers since 2012. He is also the leader of the AI-NLP axis of the LORIA laboratory since 2019, and he has been referent for the French National Plan in AI in 2020. He has supervised more than 12 Ph.D. thesis, and has lead several projects about AI and training Large Language Models in the past few years.

CHRISTOPHE CERISARA (CNRS)

INTRODUCTION TO LARGE LANGUAGE MODELS

Mon, 3:00-5:30pm

The first part of this course will give the basic principles of the transformer architecture and how the decoder can be trained to build a Large Language Model (LLM), including a short overview of its scaling laws. The second part will present how to use such a trained LLM, either directly through zero-shot and in-context learning, or through fine-tuning to adapt the LLM to a given task, but with a focus on the direct usage of the LLM on either low-end and high-end hardware and without going into the details of parameter-efficient fine-tuning and other advanced adaptation strategies. The third part (30′) will consist of a practical session about how to implement this with the huggingface transformers library. The prerequisites for this course are a good knowledge of python and of fundamentals of machine learning; some experience with pytorch is useful.

EFFICIENT LLM TRAINING

Tue, 3:30-6:00pm

The first part of this course will give the basic principles of the transformer architecture and how the decoder can be trained to build a Large Language Model (LLM), including a short overview of its scaling laws. The second part will present how to use such a trained LLM, either directly through zero-shot and in-context learning, or through fine-tuning to adapt the LLM to a given task, but with a focus on the direct usage of the LLM on either low-end and high-end hardware and without going into the details of parameter-efficient fine-tuning and other advanced adaptation strategies. The third part (30′) will consist of a practical session about how to implement this with the huggingface transformers library. The prerequisites for this course are a good knowledge of python and of fundamentals of machine learning; some experience with pytorch is useful.

SPEAKER TRACK A

TUESDAY

COURSE 2

Tue, 10:30am-1:00pm

Dr. Malte Ostendorff is a senior research engineer at Deutsche Telekom where he works on large language models (LLMs) and related topics. Previously, Malte was a senior researcher at the German Research Center for Artificial Intelligence (DFKI) and a Ph.D. student in the Scientific Information Analytics group at the University of Göttingen. Furthermore, Malte is a co-founder of Occiglot, a research collective for open-source language models for and by Europe, and a co-founder of Open Legal Data.

MALTE OSTENDORFF (DEUTSCHE TELEKOM)

TRAINING DATA FOR LARGE LANGUAGE MODELS

Large language models (LLMs) have emerged as a powerful technology underpinning state-of-the-art chatbots and various other natural language processing applications. Model sizes and computing resources that are used for building LLMs dominate the public discourse around these models, whereas one crucial aspect is often neglected – the LLM training data. LLMs are statistical models that learn from data and, therefore, the training data is crucial for LLMs and one of the main differentiators between different models. In this course, we will explore the datasets that were used by existing LLMs, automated tools for data curation and processing at the Web scale, and the most prominent sources where the data is coming from. We will discuss why commercial LLM providers are secretive about their data and what issues arise from training models on large-scale datasets. A basic understanding of what LLMs are and how they are trained is a prerequisite for this course.

SPEAKER TRACK A

WEDNESDAY

COURSE 4

Wed,
10:30am-1:00pm

Mariya Toneva leads the Bridging AI and Neuroscience group (BrAIN) at the Max Planck Institute for Software Systems. Her research is at the intersection of Machine Learning, Natural Language Processing, and Neuroscience, with a focus on building computational models of language processing in the brain that can also improve natural language processing systems. She obtained her PhD from Carnegie Mellon University in a joint program between Machine Learning and Neural Computation.

MARIYA TONEVA (MPI)

RELATING LLMS TO HUMAN BRAINS

Current large language models (LLMs, e.g. ChatGPT, GPT-4, etc.) have impressive capabilities, but how closely do they actually align with the capabilities of the only system that truly understands complex language–the human brain? In this session, we will learn the core computational techniques for relating language in machines and language in the brain. We will also have a hands-on session with brain recordings of people processing complex language (e.g. reading a book).

The prerequisites are good familiarity with programming in python and basic machine learning concepts, such as regression and cross validation.

SPEAKER TRACK A

WEDNESDAY

COURSE 5

Wed,
3:30-6:00pm

Dr. Jindong Gu is a senior research fellow at University of Oxford. He also partially works in Google DeepMind as a faculty researcher in Gemini Safety team. Prior to that, He received his Ph.D. Degree from University of Munich. His research focus is to build Responsible AI systems. Specifically, he is interested in the interpretability, robustness, privacy, and safety of visual perception, foundation models, robotic policy and planning, and their fusion towards general intelligent systems.

JINDONG GU (UNIVERSITY OF OXFORD/GOOGLE DEEPMIND)

RESPONSIBLE GENERATIVE AI

In recent years, generative AI (GenAI), like large language models and text-to-image models, has received significant attention across various domains. However, ensuring the responsible generation of content by these models is crucial for their real-world applicability. This raises an interesting question: What should responsible GenAI generate, and what should it not? This course will introduce the practical responsible requirements of both textual and visual generative models, outlining five key considerations: generating truthful content, avoiding toxic content, refusing harmful instruction, leaking no training data-related content, and ensuring generated content identifiable.

SPEAKER TRACK A

THURSDAY

COURSE 6

Thu,
10:30am-1:00pm

Dr. Lelarge is a researcher at INRIA and a lecturer in the computer science department of Ecole Normale Superieure. He graduated from Ecole Polytechnique, qualified as an engineer at Ecole Nationale Superieure des Telecommunications and received a PhD in Applied Mathematics from Ecole Polytechnique in 2005. His research interests include machine learning, deep learning, graphs and programming languages.

MARC LELARGE (INRIA)

LLMS FOR CODE

This course focuses on the use of large language models (LLMs) for generating and verifying code. Students will learn the foundational principles needed to build contemporary neural code generation systems, including techniques for formal-method aware fine-tuning models, performing inference, and evaluating results. This course explores new research in neural code generation, including improving interaction with human programmers, model reliability and adaptability, and applications to engineering, reasoning, and formal verification. The course encompasses algorithmic foundations, practical applications, and emerging research areas in neural code generation.

COURSES

SPEAKER TRACK A

THURSDAY

COURSE 7
Thu, 3:30-06:00pm

GERRIT GROßMANN (DFKI) & ISLAM MESABAH (DFKI)

Islam Mesabah obtained his Master's degree in Computer Science from the RPTU (Rhineland-Palatinate Technical University) in Kaiserslautern. His master's thesis focused on the application of Large Language Models (LLMs) for effective code generation through the utilization of API documentation. Additionally, he researched text-style transfer evaluation using LLMs. Since 2023, Islam Mesabah has been serving as a researcher at the German Research Center for Artificial Intelligence (DFKI) in Kaiserslautern. His research at DFKI primarily explores the applications of Large Language Models and key information extraction and structuring from image documents. In addition to his research endeavors, Islam holds the position of teaching assistant for the "Engineering with Generative AI" course at RPTU Kaiserslautern.

Gerrit Großmann received his doctorate in Saarbrücken. His PhD topic was the behavior of stochastic processes on graphs and networks, including the spread of (online and offline) epidemics. He also worked within the interdisciplinary project NextAID, where he researched neuro-symbolic approaches for drug discovery, specifically by using diffusion models and graph neural networks. Gerrit has been researching at DFKI in Saarbrücken and Kaiserslautern since 2023. His research interests there revolve around the question of how to integrate the distinct realms of discrete structures such as graphs and networks with the continuous nature of dynamic evolution, diffusion, and learning.

INCREASING PRODUCT QUALITY IN THE AUTOMOTIVE INDUSTRY THROUGH THE VIRTUAL MEASUREMENT DATA ANALYSIS (VMDA)

Despite their groundbreaking impact, LLMs have their imperfections. This track examines the integration of LLMs with structured information like knowledge graphs. We investigate ways to improve the quality and reliability of LLMs and techniques for extracting structured data from them. By the end of the lab, you will have a first prototype of an implementation of an LLM combined with a knowledge graph. No specific experience working with LLMs is required, but some basic knowledge of deep learning is recommended.

SPEAKER TRACK A

FRIDAY

COURSE 8

Fri,
9:00-11.30am

Alexandre is part of the founding research team at Kyutai, a leading non profit research lab in Paris. Before he was a research scientist for 3 years at Meta AI Research, leading in particular the development of the AudioCraft framework (EnCodec, AudioGen, MusicGen). Alexandre completed his PhD at Facebook AI Research and INRIA Paris, working in particular on music source separation (Demucs).

ALEXANDRE DÉFOSSEZ (KYUTAI)

AUTO-REGRESSIVE MODELING OF DISCRETE AUDIO TOKENS

In this course, we will learn the theory around discrete audio modeling, covering the different components and techniques used (neural audio codec, multi stream transformers, etc), as well as the specificities of the audio domain. Then, we will apply theses techniques to fine tuning pre trained audio models to new datasets of audio. Attendees should have previous experience with Pytorch for the practical part of the class, along with a setup google account to use google Colab. Previous experience working with audio will help but is not required!

SPEAKER TRACK B

MONDAY

COURSE 1

Mon,
3:00-5:30pm

Dr.-Ing. Daniel Porta received a diploma in Computer Science from Saarland University in 2007 and his doctoral degree in 2017. Joining DFKI's Cognitive Assistants research department already as a student in 2004, he is now a Senior Researcher leading a research group on industrial AI.

DANIEL PORTA (DFKI)

DIGITAL TWINS FOR AI-BASED INDUSTRIAL APPLICATIONS

Digital twins collect information on an asset over its entire life cycle and provide it in a standardised way for a wide range of applications. The course will introduce to digital twin architectures based on Asset Administration Shells and further sound abstraction layers for future-proof Industrie 4.0 infrastructures. It then discusses several industrial use cases in terms of AI-based applications at different life cycle phases.

COURSES

SPEAKER TRACK B

TUESDAY

COURSE 2

Tue,
10:30am-1:00pm

PIA BIDEAU (INRIA)

Pia Bideau is a researcher at the THOTH team at Inria Grenoble and holds a junior research chair position for "Perception and Interaction" at MIAI Grenoble Alpes. Before joining Inria in October 2023, Pia Bideau was postdoctoral researcher at the robotics lab at Technical University Berlin and the Excellence Cluster "Science of Intelligence" (SCIoI). She received her PhD from the University of Massachusetts, Amherst, advised by Prof. Erik Learned-Miller. Her thesis proposed novel approaches towards segmenting independently moving objects from noisy optical flow fields.

Pia Bideau has co-organized the workshop "What is motion for?" at ECCV 2022 has engaged in numerous projects focused on research-oriented teaching. In the past she received a best paper award at the ECCV 2018 Workshop: What is optical flow for? for her paper "MoA-Net: Self-Supervised Motion Segmentation" and scholarships from DAAD for academic education abroad and from BMBF for excellent academic achievements during her Master studies.

NAVIGATING TOGETHER: INTEGRATING ANALYTICAL AND LEARNING-BASED APPROACHES FOR DISTANCE ESTIMATION

Distance estimation is an essential part of scene recognition and orientation, allowing agents to move in a natural environment. In particular, when humans or animals move in teams, they seem to be capable of doing this – moving together as a whole without colliding or bumping into each other. Different sensor systems but also different strategies of movement enable agents to localize themselves relative to their neighbors or neighboring objects.

This course provides an introduction into analytical and learning based approaches for distance estimation. While there are several cues to extract information about distance the focus of this course lies on object appearance and its relative size. Objects appearing at greater distance will appear smaller than objects nearby. This is one of the fundamental principles of perspective projection. A classical object detector (YOLOv5 small/nano) will be extended with the ability to estimate distance. When does a system benefit from learning? When should estimates be computed following known physical principles instead of being learned from data? This part of the assignment focuses on implementing both solutions to distance estimation – the analytical computation and a multilayer perceptron (MLP). It involves analyzing the advantages and disadvantages of each approach and ultimately deciding which algorithm to deploy on a real robot. If time permits, we will delve into ongoing research addressing the challenges of distance estimation for behavior analysis, specifically focusing on reconstructing speed and 3D trajectories of animals and humans.

Prerequisites: basic python programming skills.

SPEAKER TRACK B

TUESDAY

COURSE 3

Tue,
3:30-6:00pm

Gianluca Rizzello was born in Taranto, Italy, in 1987. He received the master's (Hons.) degree in control engineering from Polytechnic University of Bari, Bari, Italy, in 2012. He received his Ph.D. in Information and Communication Technologies from Scuola Interpolitecnica di Dottorato, a joint program between Polytechnic Universities of Torino, Bari, and Milano, Italy, in 2016. After his doctoral studies, he joined Saarland University, Saarbrücken, Germany, first with the role of a postdoc researcher and Group Leader Smart Material Modeling and Control (2016-2019), and subsequently as Assistant Professor in Adaptive Polymer Systems (2020 - present). His research interests include development, modeling, and control of soft robotic and mechatronic systems based on unconventional drive technologies, such as smart materials.

**GIANLUCA RIZZELLO
(UNIVERSITY OF SAARLAND)**

AN INTRODUCTION TO SOFT ROBOTICS

While traditional robots are essentials in many industrial tasks, they show limitations when performing certain tasks involving safe interaction with humans or exploration of complex unstructured environments. Taking inspiration from animals and other biological systems, the field of soft robotics offers a possible means to develop intelligent machines that can interact with their environment in ways rigid robots cannot. Soft robots benefit from the presence of elastic and soft elements that enhance their adaptability and versatility with respect to their environment, thus allowing to close the gap between traditional rigid robots and biological systems. Integrating soft features into robotic systems, however, involves several challenges in terms of system design, component selection, modeling, and control. This lecture aims at providing a general introduction to the field of soft robotics. The lecture will cover both hardware and software aspects of soft robots, ranging from soft design principles, soft actuators, and soft sensors, to challenges posed by modeling and control of soft robots. For each one of those areas, the main results from the state of the art, major challenges, and research opportunities will be illustrated. The presentation of the topics will be accompanied by several examples from the soft robotic literature.

SPEAKER TRACK B

WEDNESDAY

COURSE 4

Wed,
10:30-1:00am

Marie-Odile Berger is INRIA Research Director at the "Centre INRIA de l'Université de Lorraine" and currently heads the TANGRAM Computer Vision Group. Her research interests include computer vision, artificial intelligence with an application focus on augmented reality tasks requiring high-precision localization, both in classical environments and in medical imaging. Her research has led to several theoretical and practical results in the areas of matching and 3D tracking, reconstruction and visual perception. She has published more than 140 papers in conferences and journals. http://members.loria.fr/moberger

MARIE-ODILE BERGER (INRIA)

AI FOR COMPUTER VISION : USING HIGH LEVEL FEATURES FOR LOCALIZATION

Like many other fields, image-based localization methods have benefited greatly from the emergence of convolutional networks (CNN). In this course, after describing the main principles of methods using AI for localization, we will focus on methods based on high-level features derived from CNN. In particular, we'll look at methods that use objects detected in images as landmarks for localization. Such methods, based on the use of a generic object detector, have many advantages: they avoid systematic re-training of algorithms for new scenes, do not require a precise model of the scene and have very good accuracy.

SPEAKER TRACK B

WEDNESDAY

COURSE 5

Wed,
3:30-6:00pm

MELYA BOUKHEDDIMI (DFKI) & MALTE WIRKUS (DFKI)

Since March 2021, I have been working as a post-doc in Robotics at the DFKI – RIC Bremen. I am involved in and co-lead the Mechanics & Control research group. My research focuses on agile robots, mainly humanoid robots, and how to push their limits to generate highly dynamic, anthropomorphic, and precise motions. Before joining DFKI, I completed my PhD in Robotics with the Gepetto team at the LAAS-CNRS laboratory in Toulouse in 2020. Prior to that, I obtained my master's degree in Robotics and Mobility Assistance from Paris-Saclay University in 2016.
- Melya Boukheddimi (DFKI)

Malte Wirkus received his Diploma in Computer Science at the University of Bremen in 2010. He joined the Robotics Innovation Center (RIC) of the German Research Center for Artificial Intelligence (DFKI GmbH) in 2010. In different research and industry projects, he gained experiences in the fields of robotic mobile manipulation, multi-agent architectures and human-robot collaboration. With his current scientific research interest in control architectures and frameworks for robotic applications, he works as researcher, project and team leader at DFKI-RIC.

SMART AND DYNAMIC ROBOTS - HOW DO ROBOTS BECOME SMART AND AGILE

In this session, we will first give a general introduction to the question of how robots become intelligent. The many different aspects and technologies that are necessary to make robots intelligent will be discussed. We will then delve into the field of agile robots and how to push their limits, evaluating and improving their design and control strategies to generate highly dynamic, anthropomorphic, and precise movements.

COURSES

SPEAKER TRACK B

RICAIP - DAY AT ZEMA SAARBRÜCKEN

WEDNESDAY

COURSE 6 - HANDS-ON ROBOTIC-COURSE

Thu, 10:30am-1:00pm

Xiaomei Xu joined ZeMA – Zentrum für Mechatronik und Automatisierungstechnik gemeinnützige GmbH as a research assistant in the Robotics group in spring 2020 after graduating from RWTH Aachen University. She focuses on developing mathematical algorithms for 3D cameras and robotics applications. Xiaomei's work has been presented at conferences such as the CIRP Web Conference 2020, IEEE CASE 2021&2024, IEEE ICSC 2022, CIRP CATS 2024, and CIRP ICME 2024.

XIAOMEI XU (ZEMA)

MULTI-ROBOT SIMULATION USING SIEMENS TECNOMATIX

In the 90-minute "Hands-on Robotik-Kurs", we divide the group activity into two segments. The first segment, lasting 30 minutes, provides a Quick Guide for Siemens Tecnomatix (Software User Interface and basic function). This guide explains how to build a virtual environment for robotic simulation applications in welding, deburring, and painting. The second segment, lasting 60 minutes, involves robot path planning based on the manufacturing geometry for welding, polishing and painting processes.

SPEAKER TRACK B

RICAIP - DAY AT ZEMA SAARBRÜCKEN

WEDNESDAY

ROBOTICS-LAB TOUR

Thu,
10:30am-1:00pm

Dr.-Ing. Tim Schwartz studied computer science and computational linguistics at Saarland University. He received his PhD with the thesis "The Always Best Positioned Paradigm for Mobile Indoor Applications" in 2012. Since 2016, he is the head of the human-robot communications group and leads the German-Czech Innovation Lab for Human-Robot Collaboration MRK 4.0.

TIM SCHWARTZ (DFKI)

PRACTICAL TOUR THROUGH THE GERMAN-CZECH INNOVATION LAB FOR HUMAN-ROBOT COLLABORATION IN INDUSTRIE 4.0 (MRK 4.0 LAB)

In this tour, we will show you around in our german-Czech Innovation Lab for Human-Robot Collaboration in Industrie 4.0, or MRK 4.0 Lab for short. As the name implies, we focus on Human-Robot Collaboration. In extension we also deal with human-robot communication, the orchestration of hybrid teams (i.e. teams consisting of humans, robots and software agents) and practical applications of Industrial AI, Asset Administration Shells, Digital Twins and general Industrie 4.0 topics. Human-Robot communication is not necessarily limited to spoken or written language, but includes all sorts of modalities: from more traditional control units, over manual teach-in to Augmented and Virtual Reality etc. We will show you practical examples from different projects, we are currently working on or have been working on in the past, encouraging questions and discussions throughout the whole experience.

SPEAKER TRACK B

THURSDAY

COURSE 7

Thu,
3:30-6:00pm

Martin Suda is a senior researcher at the CIIRC institute of the Czech Technical University in Prague and the head of the Automated Reasoning Group there. He is also a part-time research scientist at Filuta.ai. His primary research interest is automated theorem proving and how it can be boosted through the techniques of machine earning. He is one of the main developers of the award-winning automatic theorem prover Vampire.

MARTIN SUDA (CIIRC)

POWERING LOGIC-BASED REASONING WITH MACHINE LEARNING AND VICE VERSA?

We will provide an overview of the state-of-the-art technology in logic-based reasoning, ranging from propositional satisfiability and satisfibility modulo theories to automatic and interactive theorem proving. The corresponding tools, often referred to as "solvers", find many applications in areas such as hardware verification (chip design), software verification (program correctness) or automation of math. We will also discuss how machine learning and, in particular, neural networks enter the picture of the development of such solvers, able to automatically help discover new guidance heurstics, so necessary for fighting the inherent combinatorial explosion. Finally, we will also contemplate the opposite direction for field synergy: Couldn't logic-based tools help us eliminate errors from neural networks' outputs, most notably guard as against LLM hallucinations?

SPEAKER TRACK B

FRIDAY

COURSE 8

Fri,
9:00-11:30am

**MARC TABIE (DFKI) &
FABIEN LOTTE (INRIA) &
MAURICE REKRUT (DFKI)**

Marc Tabie joined the Robotics Innovation Center of the DFKI in Bremen almost 17 years ago as an undergraduate student. He did his B.Sc. and M.Sc. in Systems Engineering at the University of Bremen, specialized in the field of robotics. His research in the field of biosignal-processing, focuses mainly on EMG- and EEG-processing for human robot interaction especially for exoskeletons with the purpose of stroke rehabilitation.

Fabien Lotte is a research director at the Inria Center at the University of Bordeaux and the LaBRI in France, where he is leading project-team Potioc.

He is a specialist of Brain-Computer Interfaces (BCI). He was/is an editorial board member of several BCI journals (e.g., TBCI, JNE or IEEE TBME), and was/is the leader of numerous BCI-related projects (e.g., ANR REBEL, ANR PROTEUS, ERC BrainConquest, ERC SPEARS). His work received various awards, including the USERN Prize 2022, The Lovelace-Babbage prize 2023 from the French academy of science and the French Computer Science Society, or the Nature award for mentoring in science 2023.

Maurice Rekrut is a Senior Researcher at the German Research Center for Artificial Intelligence (DFKI). In 2023 he received his PhD in Computer Science under the supervision of Prof. Dr. Antonio Krüger for the thesis "Leveraging EEG-based Speech Imagery Brain-Computer Interfaces". Since 2020 he is the head of Cognitive Assistants BCI-Lab which focuses on the application of Brain-Computer Interfaces (BCIs) in real-world scenarios. He is involved in several national und international research projects concerning this topic as for example EXPECT, BISON, NEARBY or HAIKU.

VARIABILITIES IN BRAIN-COMPUTER INTERFACES – TOWARDS APPLYING BCIS IN REAL-WORLD APPLICATIONS

Whereas Brain-Computer Interfaces (BCIs) are promising for many applications, e.g. human-robot-interaction, they are not reliable. Their reliability degrades even more across users or when used across contexts (e.g., across days or for changing users' states) due to various sources of variabilities. Unfortunately, such variabilities are 1) often ignored in the literature, as most BCIs are assessed in a single context, for a single day, and with user-specific designs, and 2) poorly understood. Thus, for BCIs to fulfil their promises and to be used in practice outside laboratories, we need to make them robust to such variabilities. This workshop aims at presenting applications for BCIs in Human-Robot-Interaction along different research projects, teaching the basics of variabilities for different BCI types, present potential methods to address them, and discusses challenges regarding the application of BCIs in laboratory settings and their transfer to real-world scenarios.

SPECIAL EVENTS

START-UP WORKSHOP AND LUNCH

Wed,
1:00-2:30pm

Entrepreuneurship for Scientists-Opportunities through knowledge transfer - Dr. Mara Schuler-Bermann- Start up Coach, Technology Transfer Triathlon, Sophie Pellat-Velluire (Inria), Thomas Armand (Inria)

INDUSTRIAL TALK

Wed,
2:30-3:00pm

During this panel discussion, we will talk about selected industies and their approaches to trusted AI, exploring how they address the specific challenges it presents. Additionally we will discuss the practical applications of AI within industrial organisations, highlighting current challenges, key topics, and the qualifications that are essential for aspiring AI engineers.

POSTER SESSION

Tue,
2:00-3:00pm

The poster session of the participants will take place on Tuesday at 14:00 - 15:00 in the foyer of the Innovation Centre.
In a relaxed atmosphere, the young researchers can present their various works to each other and exchange and discuss them on a professional level.
The open exchange and the public appearance of the poster session will also allow external parties to be addressed and reached.
So grab a coffee and exchange ideas!

NOTES

OVERVIEW & VENUE

LOCATIONS

LUNCH

UNIVERSITÄT DES SAARLANDES

Campus, Gebäude D4 1

COURSES, KEYNOTES, SOCIAL EVENTS

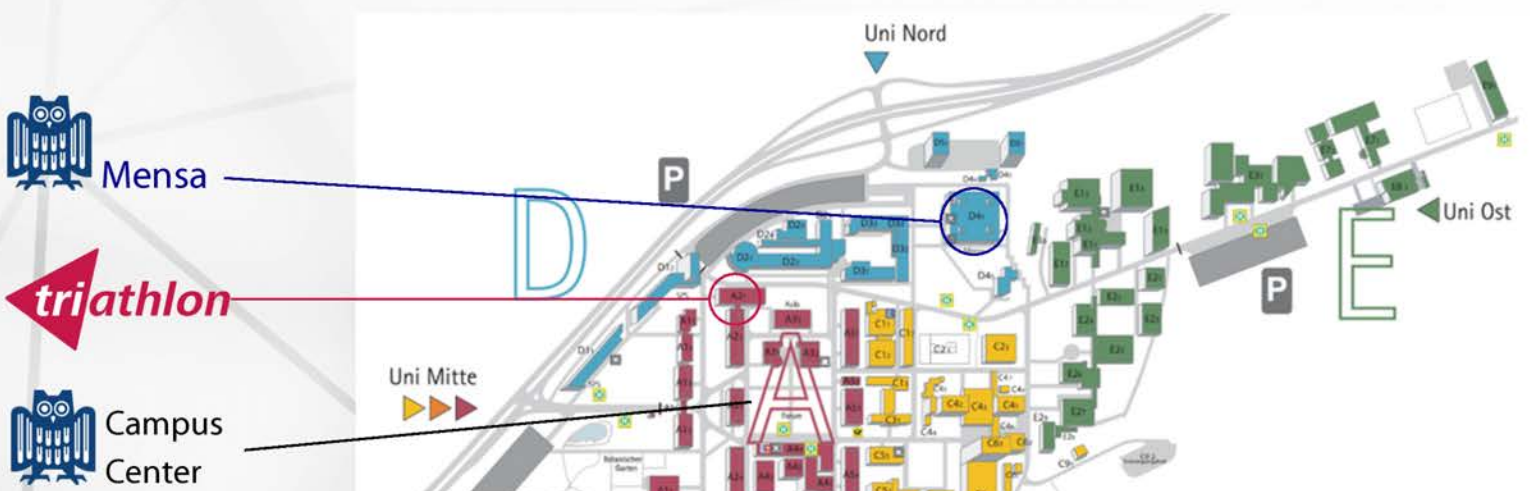triathlon

Campus, Gebäude A1.1

TRACK B (THURSDAY), LAB DAY AT THE MRK 4.0 LAB

RICAIP

Gewerbepark
Eschberger Weg 46, 66121 Saarbrücken

Mensa

triathlon

Campus Center

dfki
ai

Human Centric AI – Intelligent Solutions for the Knowledge Society
The German Research Center for Artificial Intelligence (DFKI) was founded in 1988 as a non-profit public-private partnership. It has research facilities in Kaiserslautern, Saarbrücken and Bremen, Niedersachsen, laboratories in Berlin, Darmstadt and Lübeck, and a branch office in Trier. In the field of innovative commercial software technology using Artificial Intelligence, DFKI is the leading research center in Germany.

Based on application oriented basic research, DFKI develops product functions, prototypes and patentable solutions in the field of information and communication technology. Research and development projects are conducted in 27 research departments, ten competence centers and eight living labs. Funding is received from government agencies like the European Union, the Federal Ministry of Education and Research (BMBF), the Federal Ministry for Economic Affairs and Climate Action (BMWK), the German Federal States and the German Research Foundation (DFG), as well as from cooperation with industrial partners. Twice a year, a committee of internationally renowned experts (Scientific Advisory Board) audits the progress and results of state-funded projects.

Apart from the state governments of Rhineland-Palatinate, Saarland and Bremen, numerous renowned German and international high-tech companies from a wide range of industrial sectors are represented on the DFKI supervisory board. The DFKI model of a non-profit public-private partnership (ppp) is nationally and internationally considered a blueprint for corporate structure in the field of top-level research.

DFKI is actively involved in numerous organizations representing and continuously advancing Germany as an excellent location for cutting-edge research and technology. Far beyond the country's borders DFKI enjoys an excellent reputation for its academic training of young scientists. At present, approx. 930 highly qualified researchers, administrators and 630 graduate students from more than 76 countries are contributing to more than 560 DFKI research projects. DFKI serves as a stepping stone to leading positions in industry and successful careers as founders of spin-off companies. Over the years, more than 160 staff members have been appointed professors at universities in Germany and abroad.

Inria is the French national institute for research in digital science and technology, and since January 2024 has been responsible for the Agence de programmes dans le numérique (Digital Programs Agency), designed to strengthen the collective dynamics of higher education and research. Its DNA is based on world-class research, technological innovation and entrepreneurial risk. Within 220 project teams, most of which are shared with major research universities, more than 3,800 scientists are exploring new avenues, often in interdisciplinary collaboration with industrial partners, to meet ambitious challenges. As a technology institute, Inria supports a wide range of innovation paths: from open source software publishing to the creation of technology startups (Deeptech).

Nearly 220 project teams work at Inria in an agile and partnership-based environment. An agile environment due to the project team model that promotes scientific excellence, technological development and innovation. A partnership-based environment since 80% of Inria's research teams are joint teams with leading research universities and organizations.

Founded in 2017 and repositioned in 2019, the Inria Foundation aims to mobilize new financial resources to allow the Institute to support bold projects that make sense of the digital world. What does this involve? Giving priority to Inria's strategic focuses, whether to support the Institute's strategic focuses (scientific risk-taking, technological entrepreneurship), causes the Institute supports (disability, making digital sciences and technologies more appealing to young people, digital transformation of lifelong learning, development of free software etc.) or to contribute to solving the major challenges of our society (personalized medicine, precision agriculture, sustainable development, smart city and mobility, trust-based society etc.) with digital technology as a driver for interdisciplinary collaboration.

RICAIP

RICAIP – Research and Innovation Centre on Advanced Industrial Production – is an international distributed research centre of excellence (CoE) that focuses on research in robotics and artificial intelligence (#AI). RICAIP is based on a strategic partnership of four leading Czech and German research institutions.
We aim to develop new, intelligent and secure solutions for distributed manufacturing in the Industry 4.0 environment.

triathlon

Your ecosystem for entrepreneurship, innovation and transfer

Initiate innovations? Found a start-up? Lead research ideas to commercial success? Learn to think and act like an entrepreneur? Plan your own career?
We will support you with any of these questions. What you previously knew as Gründer-Campus Saar, KWT, IT Incubator or one of the names of our sub-units is now one: Triathlon - the integrated ecosystem for entrepreneurship, innovation and transfer at Saarland University.

It's not about sporting success, but about achieving your goals, be it the realization of business ideas beyond the start-up, the exploitation of your research or the shaping of your professional future.

IDESSAI TEAM

SCIENTIFIC CHAIR

Tim Schwartz (DFKI)

André Meyer-Vitali (DFKI)

ORGANIZING & MODERATING

Ilka Wilk (DFKI)

Jens Philipp Hettrich (DFKI)

Andreas Schepers (DFKI)