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Thinking AI

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VLW
Im Leben zu Hause

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Bezahlte Anzeige

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Thinking AI - AI thinks, thinking about AI, what do we think (about) AI?

Artificial intelligence is a scientific discipline that in recent years has attracted a great deal of attention from a broader cross section of the public. Remarkable results have already been achieved with the technologies behind AI, which directly raise expectations and stimulate our creativity. However, the hype surrounding the fascination, fantasy and excessive media attention has also caused disappointment and lack of interest in artificial intelligence at several points since the 1960s because hopes and expectations had not been fulfilled.

That is exactly why we need to think about artificial intelligence as holistically as possible and take a look behind the scenes of the hype and reveal the variety of methods and algorithms with all their strengths and weaknesses. That is also why this year's topic is deliberately so ambiguous. What we like to think of as a phenotype artefact that thinks for itself may well turn out to be more predictable, not at all threatening, and all the more useful upon closer examination of its genotypic principles.

People should be the focus of developments in artificial intelligence; learning in the future should not be limited primarily to machines learning from data, but should work between humans, data, and machines in all directions. What roles do the interpretability of models, explainability of algorithms, and correlation and causality play in this context? We want to address all of these questions in the context of this year's topic, and in the exciting arena between training, research, and development, the Softwarepark ecosystem will be a guarantee for thinking about the topic in a sound, and visionary manner based on well-founded theory without losing sight of reality.

Photo: Sara Aschauer

FH-Prof. Priv.-Doz. DI Dr.
Michael Affenzeller
Scientific Head of
Softwarepark Hagenberg

Photo: Sara Aschauer

Dr. Sonja Mündl
Manager Softwarepark Hagenberg

For a long time, it was only we humans that could decide and act based on our experiences. Using artificial intelligence, machines and systems are also able to learn from experience and adapt to new information. Deep Learning teaches machines to learn by recognising and deducing meaningful patterns from existing data.

This allows the strengths and weaknesses of human and artificial intelligence to complement each other perfectly, and it is precisely this synergy that must be made use of in the future.

During the Softwarepark Hagenberg IT expert series "Thinking AI", we think about these and other challenges together and ask ourselves, for example, how AI solutions can be designed so that the focus remains on people rather than technology.

What do you think about artificial intelligence? I look forward to hearing what everybody thinks!

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Photo: Land OÖ

As the "driver" in autonomous vehicles, in the diagnosis of diseases, in the control of robots or entire manufacturing systems, artificial intelligence has triggered a transformation in the economy and society that Upper Austria wants to actively shape. Softwarepark Hagenberg once again lives up to its role as an innovation motor for the province of Upper Austria by hosting a series of events to promote an exchange on future topics with renowned experts from business and science. The current focus is on "Thinking AI", in particular the key issue of how AI solutions can be designed to focus on people rather than technology.

Markus Achleitner *Minister of Economy, State of Upper Austria*

Power Location Hagenberg!

Softwarepark Hagenberg is still growing and continuously extending its network. In addition to 12 expansions and the opening of two new office buildings, Softwarepark Hagenberg has welcomed several new partner companies this and last year. One of the new partners is Porsche Informatik GmbH, who relocated to Softwarepark Hagenberg at the beginning of 2021. An interview with the Head of Porsche Informatik in Hagenberg is on page 18.

In spring 2021, phase two of Business Campus One was completed, offering an additional 4,500m² of space. The new building offers space for 4 companies to develop new ideas and solutions in these modern premises. The opening ceremony of the whole Business Campus One complex took place in September 2021.


Business Campus One complex Photo: Fahrner GmbH

The companies COUNT IT Group and ventopay gmbh also moved into their new company building, which offers space for innovation on six floors and a total area of 2,400 m². Here, there is plenty of room for the employees to create and develop.

COUNT IT Group & ventopay gmbh building Photo: Softwarepark Hagenberg


Photo: Children's University FH Hagenberg


Business Campus One opening ceremony, from the left: a.Univ.-Prof. DI Dr. Josef Küng (JKU), FH-Prof. Priv.-Doz. DI Dr. Michael Affenzeller (FH/SWPH), Softwarepark founder O.Univ. Prof. Dr.phil. Dr.h.c.mult. Bruno Buchberger, builder and architect DI Markus Fahrner, Member of the National Council Mag.ª Johanna Jachs, Dr.in Sonja Mündl (Manager SWPH), Mayor David Bergsmann, Vice President KommR DI Dr. Clemens Malina-Altzinger (WKO) Photo: Softwarepark Hagenberg

The Park Hotel Hagenberg, which also includes a fitness area, opened in spring 2022.

Business Park Hotel Photo: Fahrner GmbH

Photo: AdobeStock/3dsculptor

Strong in Digitalisation

The economy is in the middle of a digital revolution - driven partly by the Corona pandemic. Companies face the major challenge of taking the right steps now towards customised digitalisation. This requires a great deal of know-how.

Softwarepark Hagenberg Digitalisation Check

Experts from Softwarepark Hagenberg support companies from analysis through to the implementation of customised solutions. Softwarepark Hagenberg is a full solution provider.

The synergy of research, education and business that is practised at Softwarepark Hagenberg is unique and is also reflected in the digitalisation check. Our top experts from the three sectors work together to find the best solution for your company. The measures that are developed together during the Softwarepark Hagenberg digitalisation check can then be implemented directly with the experts.

The ability of the experts to move from rapid analysis to fast implementation is thanks to the synergy of research, education and business that is practised at Softwarepark Hagenberg.

"The Softwarepark Hagenberg digitalisation check brings you to innovation quickly, professionally and unbureaucratically and is available to everyone who is interested in successfully leading their company into the future," says Dr. Sonja Mündl, Manager of Softwarepark Hagenberg.

If you are interested, please contact us at office@softwarepark-hagenberg.com.

Implement projects successfully - with experts from Softwarepark Hagenberg

Are you looking for a project partner in the IT sector? Does your company have an innovative idea or an exciting project in the pipeline? Softwarepark Hagenberg Management would be pleased to support you in finding the right partners for your project. Get your project off to a successful start with the know-how and expertise of our experts at Softwarepark Hagenberg.

Using the Softwarepark Hagenberg project algorithm, we will support you in finding the right project partner at Softwarepark Hagenberg quickly and easily. Simply submit your inquiry using the form on our website, which will then be forwarded in anonymised form to potential institutes and companies in the Softwarepark according to your requirements and specifications. We will immediately put you in touch with experts at Softwarepark Hagenberg most suited to working with you on your project. Softwarepark Hagenberg management supports and accompanies you throughout the entire process - from your initial inquiry through to the start of the joint project.

Photo: Sara Aschauer

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Prescriptive Analytics and its Implication for Artificial Intelligence

Photo: AdobeStock/Jackie Niam

Domain experts can understand what happened in the past and predict what will happen in the future by analysing historical data. However, a defined/targeted objective cannot be achieved in these processes. The further step is prescriptive analytics (PA), which takes advantage of the results of descriptive, diagnostic, and predictive analytics. By making use of scientific disciplines like statistics, machine learning (ML), simulation, and optimisation, PA searches for the best course of actions from the multitude of possible outputs that are simulated.

Many new algorithms have been emerging in the field of modelling and optimisation recently. On the one hand, these new algorithms enrich the toolkit of techniques of PA. On the other hand, due to the intersection of PA and artificial intelligence (AI), they underline prescriptive analytics' implication for AI, and they have a strong connection with the following subfields:

Human-AI

In the earlier development of AI systems, there was a clear line between the roles of humans and AI. However, in recent decades, this line becomes blurred, changing the role of AI solutions into a team mate instead of an automation tool. With the help of interactive heuristic algorithms that have been developed recently, the role of humans can be integrated into the interaction loop to evaluate solution components based on humans' experience, to add/change/relax additional constraints/goals, and to express their preference even during the modelling and learning processes.

Explainable/Interpretable AI

Machine Learning (ML), a subfield of AI, is commonly criticised for learning models only exploiting correlations of data but incapable of inferring causality. Therefore, providing models that can be explained and interpreted is the further step in ML. Among the currently available techniques, genetic-based symbolic regression (GP-SR) is hotly discussed by scholars. On the one hand, it is a classical white-box modelling technique to model non-linear system behaviour. On the other hand, GP-SR models can be explained and interpreted by using a mathematical expression. The new trend of GP-SR is to allow domain experts to synergetically integrate prior knowledge and soft/hard constraints into the model, thus enriching explainable/interpretable AI techniques.

Industrial AI

Along with the shift of business analytics from descriptive analytics to PA, a truly intelligent and holistic production system is emerging in the industry. In the past, data analytics and production lines were disjointed: the insights of sensor data were revealed to domain experts, but such information didn't tell an expert what to do next. Thanks to PA, the best action or control parameters, searched by optimisation techniques, can be directly applied to production line operators, enabling performance improvements of the production line. In short, PA is a crucial component of the industry AI puzzle.

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Thinking AI

Interview with Priv.-Doz. Dr. Moser

What associations do you make with the title of this year's topic - Thinking AI?
I associate this primarily with the question of the potential of AI versus the risks. The question arises primarily because of the speed of current development. For some years now, this topic has created a real gold-rush atmosphere, fuelled by spectacular breakthroughs where the capabilities of human intelligence have been reached or even surpassed in some application areas. It makes me think of chess or Go duels, which have received a lot of media attention. There are now other lesser-known examples, but no less brilliant successes, in various fields of science and technology. Many of the latest COVID-19 vaccines, for example, owe their fast launch to the capabilities of AI, an achievement that would have amazed biomedical researchers just two years ago. Machine learning and computer-aided analysis play an important role here. These methods help researchers understand the virus and its structure and predict which of its components will bring about an immune reaction, an important step in vaccine development. This is where AI becomes an indispensable tool in science and research to help solve important complex problems, and in a much shorter time than usual.

These positive aspects are undoubtedly accompanied by risks. That AI can be used to jeopardise our values of freedom, privacy, fairness, and democracy has been demonstrated by developments in China, where AI is being used for social surveillance. This kind of "social scoring" would contradict the protection of privacy in our Western culture. For this reason, a legal basis for regulating AI is currently being developed under the leadership of the European Commission to ensure that AI is applied in a way that is consistent with our values.

There is no universally accepted definition for AI. Can you share your working definition with us?
The fact that there is no universally accepted definition of AI is due to its history and also to the interdisciplinary nature of the "intelligence" phenomenon. Psychologists and brain researchers, for example, have a different approach to that of mathematicians and computer scientists. For me, as a mathematician, AI stands for computer-based predictable models inspired by human cognitive abilities such as association, learning, and analogical reasoning that defy conventional constructive methods. Fifty years ago, AI was primarily understood as logical, deductive reasoning based on given symbols and rules. Nowadays, another aspect dominates, which is learning as inductive reasoning based on example data, especially with neural networks. What is special about this aspect is that the starting data can also be unstructured and then structured using AI methods and placed in a meaningful context. As a result, neural networks are used to learn associations that allocate meaning categories to patterns of measured values. For example, images are initially unstructured. Only our cognitive ability combined with our experience recognises structures like objects or whole scenes in the image. The situation is the same with AI. However, the inductive and the deductive aspects of AI are currently separate sub-disciplines, but they will continue to merge.

At this point, I would like to emphasise that the strengths and weaknesses of human intelligence and artificial intelligence complement each other. The strengths of human intelligence are, above all, flexibility and the ability to take context into account while detecting necessary adaptation measures from just a few clues. Incidentally, making the most of this complementarity is the main idea behind the European project I coordinate "TEAMING.AI".

You have been president of the Austrian Society for Artificial Intelligence since February 2020. What tasks is the society dedicated to?
The Austrian Society for Artificial Intelligence, in short ASAI, is a non-profit association dedicated to promoting Austria as a research location in the field of Artificial Intelligence with all its scientific and technical sub-disciplines as well as the related interdisciplinary and transdisciplinary aspects. ASAI provides a platform for the AI community in Austria.

As early as 2019, the Austrian University Conference (uniko), together with a working group that was formed spontaneously, drafted a position paper with concrete and comprehensive measures to strengthen Austria as a research location and called for their prompt implementation in order to further strengthen Austria's competence in the field of AI and machine learning and, above all, to position Austria as a research location in the international AI community, especially in the European networks ELLIS and CLAIRE. Cooperation within the uniko working group has brought together the different scientific perspectives from the broad field of AI to promote their interest in a shared Austrian AI strategy. As a consequence, that is when the almost 40-year-old Österreichische Gesellschaft für Künstliche Intelligenz (ÖGAI) was reorganised under

Photo: AdobeStock/Jackie Niam

the English name "Austrian Society for Artificial Intelligence (ASAI)".

The main tasks are

- Strengthening research excellence in Austria in an international context: Currently, ASAI is involved in the organisation of next year's IJCAI in Vienna. IJCAI stands for International Joint Conference on Artificial Intelligence, which was founded in 1969 in California and is one of the largest scientific AI conferences in the world.
- Supporting the setting up of international lighthouse projects: Examples of these include participation in projects hosted by the European ICT48 network for AI excellence; from a total of four such projects, there is Austrian participation in three.
- Providing consultation for all related ministries: For example, concerning questions regarding an Austria-wide AI strategy or AI regulations, and last but not least
- Inspiring young talent for AI research: ASAI is currently organising a nationwide AI competition for school students.

Can you give us more details about this Austria-wide AI competition for school students?

This year, ASAI is organising the Federal Competition for Artificial Intelligence Competition (BWKI in German), for the first time. This is aimed at students aged 13 and above and is supported by the Austrian Ministry for Climate Protection, Environment, Energy, Mobility, Innovation and Technology.

The competition calls for ideas on how to use artificial intelligence to solve problems. Students aged 13 and above can register online themselves or in teams by the end of the year and start working on the project. No prior knowledge of artificial intelligence is required because an AI course is offered on our website. The course prepares the students perfectly for the competition. The goal of BWKI is to awaken students' interest in artificial intelligence and to apply the knowledge they have gained to their own project.

The prize-giving ceremony is scheduled for January 28, 2022. By the way, Hagenberg is on the shortlist as the location for this. Please check out our website for more news and deadlines (https://bwki.asai.ac.at or Instagram: @bwki_at).

What do you see as the special potential of the Softwarepark to advance disciplines in AI?

Across Europe, centres with a wide range of different focuses on AI and related topics such as GAIA-X, data security and cloud computing are just emerging. Our neighbours in Bavaria, for example, are focusing on AI Engineering at the universities of Passau and Würzburg. At the same time, we have very strong fundamental research at the JKU. Wouldn't it make sense to take a closer look at these and other European players nearby and position the Softwarepark as a link with a strong tech transfer profile? I see great potential, especially in the exciting field between fundamental research and industry-oriented AI engineering with its new requirements due to upcoming regulation. At the same time, however, this also requires the right strategy for establishing a suitable computing and data infrastructure, as well as connecting regions throughout Austria and the rest of Europe.

Which sub-areas of AI can especially help an economic area like Upper Austria to maintain or generate competitive advantages?

I would like to point out the importance of the upcoming AI regulations. The earlier and better an economic area is prepared for this, the better equipped the stakeholders concerned will be to exploit the potential of AI sustainably to gain a greater competitive advantage. Preparing for these regulations requires determined strategic cooperation of early adopters from industry together with research institutions that have competencies along the data-AI-software engineering chain.

Photo: private

Priv.-Doz. Dr. Bernhard A. Moser

Bernhard A. Moser is a lecturer in mathematics at the Johannes Kepler University Linz (JKU) and research director at the Software Competence Center Hagenberg (SCCH). He is interested in the mathematical principles of data-driven and human-centred AI. Currently, he is coordinator of the FFG COMET module "S3AI: Safe and Secure Shared AI by Deep Model Design" (www.S3AI.at) and the H2020 ICT-38 project "TEAMING.AI: Human-AI Teaming Platform for Maintaining and Evolving AI Systems in Manufacturing" (www.teamingai-project.eu). He has been President of the Austrian Society for Artificial Intelligence since February 2020.

Think bigger: Exploiting the full promise of AI today

There is far more to Artifical Intelligence than meets the eye. And certainly far more than in Hollywood's wildest dreams. This is especially true for business and media. Advances in technology have allowed computers to learn and solve problems. The full range of possibilities is the focus of teaching and research at the University of Applied Sciences Upper Austria's Hagenberg campus.

"These days, AI is often associated or even equated with machine learning, however, this is only one of its many sub-fields," says Dr. Michael Affenzeller, Vice Dean for R&D at the Faculty of Informatics, Communications and Media at the University of Applied Sciences Upper Austria (UAS) and Scientific Head of Softwarepark Hagenberg.

In addition to machine learning, which is used for example in data-based diagnostic systems in medicine and technology, there are various other applications in which machines provide human-like intelligence services such as learning, assessment and problem solving. "For example, processing texts and human speech, so-called Natural Language Processing or NLP, as used by Amazon's Alexa. Or symbolic regression, a promising method of machine learning, where complex relationships can be found in a form that can be interpreted and explained by humans," says Affenzeller.

AI methods also find plenty of applications in conjunction with simulation and optimisation: for example, in design automation, production and process optimisation, and finding hidden patterns in the relations between consumer goods and customer profiles.

This promising bandwidth of methods and their useful amalgamation with other industry-relevant disciplines is reflected in a wide variety of degree courses at the UAS Upper Austria. Students in Hagenberg first become acquainted with this at Bachelor's level, in hardware and software design and medicine & bioinformatics, for example. The Master's courses then go into broader and deeper detail - especially in Software Engineering (SE), but also in Data Science & Engineering, Information Engineering & Management, Embedded Systems Design, Interactive Media, Mobile Computing and Secure Information Systems.

"On the Software Engineering Master's course, for example, we deal with evolutionary algorithms, data mining, data warehousing, business intelligence, big data analytics, interactive visualisation, agent systems, modelling & simulation, and predictive and prescriptive analytics," explains Affenzeller, who is also the Head of this Master's course. "In the elective course, students can also expand their knowledge on current trend topics - such as quantum computing, real-time systems, image processing, including AI topics such as deep learning and neural networks."

Like Affenzeller, many of his UAS colleagues also teach in AI sub-fields while working on research in a wide variety of projects, the results of which flow directly back into teaching. The most prominent examples of these projects are currently being researched in Affenzeller's HEAL group (Heuristic and Evolutionary Algorithms Laboratory) at the on-campus Josef Ressel Centres for Symbolic Regression (SymReg), led by Dr. Gabriel Kronberger, and for Adaptive Optimisation in Dynamic Environments (adaptOp), headed by Dr. Stefan Wagner.

"Very recently, a research project on Human Centred AI jointly submitted by UAS Campus Hagenberg and the JKU was selected for funding as part of the doc.funds.connect initiative, announced by the FWF for the first time," Affenzeller is pleased to report. Under the direction of Dr. Ulrich Bodenhofer, five high-quality dissertations will be written in this field in cooperation with professors from both institutions. "Based on the high level of expertise in AI and prescriptive analytics available in the region, we can take the next steps toward cognitive analytics with Human Centred AI," says Affenzeller optimistically.

Photo: iStock/metaworks

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UAS Upper Austria Campus Hagenberg
www.fh-ooe.at/campus-hagenberg

Photo: iStock/metamorworks

Artificial Intelligence is More Than Machine Learning

Artificial intelligence is often equated with machine learning (ML). Additional physical rules can improve ML results when only a limited volume of data is available. At the Josef Ressel Centre (JRZ) for Symbolic Regression, an algorithm was developed to combine ML with physical rules.

When the Josef Ressel Centre for Symbolic Regression opened in Hagenberg in early 2018, one of the goals was to develop reliable symbolic regression algorithms to make them easier to use. The idea was to give the partner companies (AVL, Miba, EREMA) a tool that is easy to understand and delivers good and, in particular, explainable and trustworthy models with little configuration work needed.

Now, one year before the end of the project, one of the fastest and most accurate software implementations has also been released on github. Several models for friction components and recycling plants were developed and rolled out with the partners. One particularly exciting result is the ability to combine purely data-based models with physical laws, bringing the models closer to reality.

Symbolic regression - just like all other, purely data-based, methods - enables models to be developed that produce good results as long as the inputs are similar to the training data. However, if the inputs are not similar to the training data, then the results are often completely unusable. That is why for training ML models you need to provide as much data as possible so that the model will produce reliable results even for unexpected inputs. This works well as long as high volumes of data can be obtained with comparatively little effort.

In practice, however, data generation is often limited and a high level of uncertainty remains. For example, you can generate data on a friction test rig under laboratory conditions, but not with the same forces that may occur later in the vehicle under extreme conditions.

Here it can be helpful to take into consideration additional knowledge about the underlying physical processes. This is because while many correlations are often common knowledge to humans, an ML approach would first have to learn them from data. For example, knowing that the mass that flows into a recycling plant must also flow out of the plant and the energy input and output must be balanced.

Applications combining the laws of physics and ML can be found especially in the technical and scientific fields, where physical models are widely used but often highly abstracted. One example can be found in the design and optimisation of electric drives at JRZ's partner AVL. 80% can be described using physics and only about 20% remain to be modelled based on data (especially the battery systems). With internal combustion engines, the ratio was the other way round. This shows that the combination of physics and ML has become even more important in this field in recent years. More detailed background information on the implementation and links to software tools can be found in the latest JRZ publications at https://symreg.at .

At the Josef Ressel Centres, application-oriented research is conducted at a high level, with outstanding researchers cooperating with innovative companies. The Christian Doppler Research Association is internationally regarded as a best practice example for promoting this collaboration.

Josef Ressel Centres are jointly funded by the Austrian Ministry for Digital and Economic Affairs and the participating companies.

contact

Josef Ressel Centre for Symbolic Regression
https://symreg.at

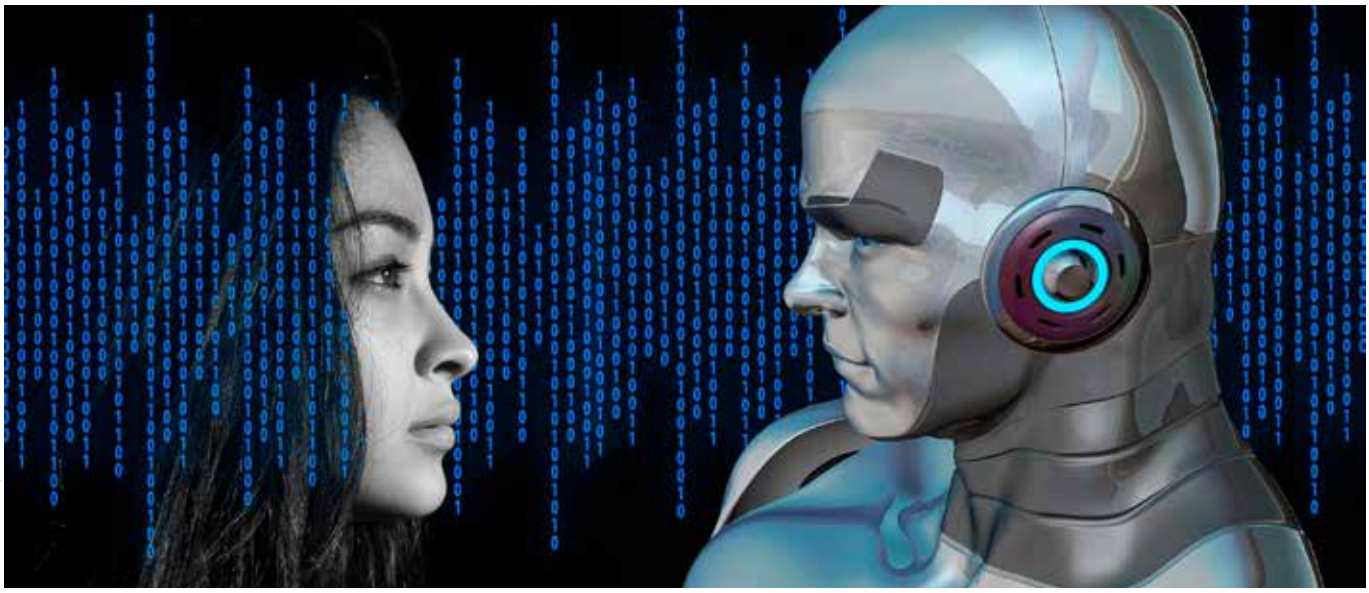

Photo: Pixabay

Humans and AI – Team for Flexible and Sustainable Production

International research project launched

The transition from mass production to sustainable and personalised services and products requires a rethink of production processes. AI supports sustainability and personalisation using data analysis, predictive models, and optimisation. But in particular, it also needs flexibility, which is our strength as humans. That is why in the future, artificial intelligence-based systems and humans will support each other like team mates. The important thing here is that the human trusts their artificial team mate and that they can communicate well with each other. That is why Software Competence Center Hagenberg (SCCH) has initiated the international research project TEAMING.AI, which is led by Priv. Doz. Dr. Bernhard Moser, Research Director at SCCH and President of the Austrian Society for Artificial Intelligence (ASAI). Together with top European partners from research and industry, this visionary concept is being implemented in the areas of quality inspection, machine diagnostics and accident prevention. "The potential of AI for industry is huge. But AI is even more powerful when teamed with humans. Both humans and machines have strengths that can complement each other perfectly," says Moser.

The role of humans

Lower volumes of production mean that less data is available for machine learning. It needs the knowhow of experienced specialists with their knowledge of processes and interconnections. For small batch sizes, maintenance work or retooling for a new production line, you need context information – this plays an important role in implementing flexible solutions. "We need to be able to process static and dynamic data. This can be technical documentation, sensor data and feedback from people. We need to use the diversity of data and boil it down to a common denominator to enable teamwork between humans and AI. We use knowledge graphs, which can be used to search for information and interconnect it," says Moser. The project takes a human-centred AI approach. This states that AI systems must meet ethical criteria. Ethical guidelines have been developed by the European Commission's High-Level AI Expert Group, among others. How can we ensure that AI systems follow such guidelines formulated in text? For example, it must be guaranteed that humans have control sovereignty over AI systems. "A key to this is a fast mechanism for updating and checking the consistency of interconnected data to automatically detect in good time, or in advance, if directives are being ignored," Moser said.

Project TEAMING.AI

- **Duration:** 3 years (January 2021 - December 2023)
- **Total budget:** € 5.7 million
- **Project partners:** Software Competence Center Hagenberg (AT), Idea Soc. Coop (IT), University of Mannheim (DE), Ideko (ES), Tyris Software (ES), Industrias Alegre (ES), Core Innovation and Technology (GR), Itunova Teknoloji Anonim Sirketi (TR), FARPLAS OTOMOTIV ANONIM SIRKET (TR), Global Equity & Corporate Consulting (ES), Time.Lex (BE), Goimek (ES), WU (AT), TU Dublin (IR) and PROFACTOR (AT).

www.teamingai-project.eu
www.asai.ac.at/en/

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Software Competence Center Hagenberg GmbH (SCCH)
www.scch.at

Artificial Intelligence in Laboratory Processes

For 20 years, STIWA has been involved in the digitalisation of medical laboratory processes in order to further optimise workflows and minimise errors. However, standardised algorithms cannot eliminate all sources of error. Especially in the area of laboratory orders, manual post-editing is still required for around 10% of the data. With the help of artificial intelligence, STIWA now wants to close this gap.

One of STIWA Laboratory Automation's key customers is SYNLAB, Europe's leading provider of medical diagnostic services. "In the German market alone, we currently process around 500,000 laboratory orders per week for SYNLAB. In our experience, doctors still forward many orders to laboratories in analog form. This is unlikely to change in the next few years. Another challenge is that each hospital, each doctor, can use their own form. This means that orders in around 6,000 different formats flow into our digitalisation software - with a correspondingly high number of potential sources of error," says Roland Wingelhofer, Business Unit Manager STIWA Laboratory Automation. This results in high costs being incurred by the invoicing stage at the latest due to incorrect insurance numbers or incorrectly assigned analyses. "Apart from the financial aspect, however, the most important thing is that all the analytical procedures that are important for the patient can be clearly identified and processed accordingly," says Wingelhofer.

Optimisation of data recognition

Optical recognition processes such as OCR and OMR are used to read in the data. These processes have now been optimised to such an extent that around 90% of these orders can be imported flawlessly. "The remaining 10%, however, are beyond the capabilities of our standardised algorithms. This means that even optimised digitalisation software like ours cannot always read the data in its entirety due to printer errors, illegible fonts or positioning errors," explains Stefan Pühringer, Product Manager STIWA Laboratory Automation. At the moment, these errors are corrected manually by laboratory staff.

AI in laboratory automation

In future, artificial intelligence will take the place of manual post-editing: "AI can detect an incorrect input using its own algorithms and, for example, expand bounding boxes to read content outside the text fields on the form. AI can also be used successfully in the reliable recognition of signatures. The aim is to reduce post-editing to a minimum and consequently to further reduce the time the samples spend in the laboratory process," says Pühringer.

STIWA Laboratory Automation Photo: STIWA Holding GmbH

Roland Wingelhofer (Ing.), Business Unit Manager STIWA Laboratory Automation Photo: STIWA Holding GmbH

Stefan Pühringer, Product Manager STIWA Laboratory Automation Photo: STIWA Holding GmbH

The Reeds research project

As part of "Reeds", STIWA Laboratory Automation is working together with SCCH, Software Competence Center Hagenberg, on the integration of artificial intelligence into the laboratory process. The data used is not real data, but stems from transfer learning models, i.e. data from other fields. "We are also cooperating with SYNLAB on this project. This means we ensure that the results from the research project can be immediately applied. We want to be ready for the market by next year," says Wingelhofer.

contact

STIWA Group
www.stiwa.com

Why Won't Algorithms Do What We Want?

Photo: Christoph Koutschan/RISC

Has the screwdriver failed when it did not help for hammering in a nail? An algorithm is - in a nutshell - an exact instruction to solve a class of problems. Exact enough to program a computer to carry out this instruction. Problems from everyday life have to be transferred into a model in order to make them accessible to the computer. Modern mathematics gives us a myriad of models and methods that allow accurate modelling for many technical problems (e.g., route planning in a navigation system). Algorithms based on such models usually deliver very acceptable results in practice.

Now that digital technologies have entered into our daily lives, computers have recently had to answer questions, for which mathematics does not yet provide optimal modelling blocks (e.g., choosing "most relevant" posts on Facebook). In these model worlds, algorithms now deliver solutions for massively abstracted problems (e.g., calculation of a best-approximating function), which appear to be perfect in the model, but are often perceived as insufficient in practice due to the huge gap between model and the real world.

In many cases, modelling using symbolic objects and delivering solutions by manipulating them is possible ("Symbolic Computation", the main research topic at the RISC Institute). The reality-model gap is much smaller, resulting in a broader acceptance of the results in practice. However, these methods reach their limits as realities become more complex. The better the different approaches are combined depending on the area of application, the more useful AI will be to a broad audience.

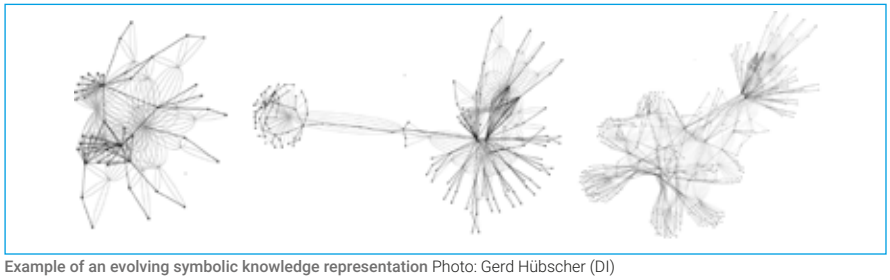
contact

RISC - Institute for Symbolic Computing (JKU)
www.risc.jku.at

Symbolic AI and the Bridge to Machine Learning

If in Google you enter 'Upper Austria', for example, the results include a table of facts. This lists the area, population, capital, and so on. The underlying data structure is known as a knowledge graph. Knowledge is stored in the form of networked terms (symbols).

This symbolic method of processing knowledge has always been a subject of research and teaching at the **Institute for Application-Oriented Knowledge Processing (FAW).** Currently, a team is working together with SCCH, SBA-Research and partners from industry to find out how such a knowledge structure can be successively created (learned) automatically. From individual data objects and sequences of operations using them, more complex mental concepts are created that are again related to each other, and so on. This can be particularly advantageous in knowledge-intensive and creative activities, where almost every task is different from the next. The system learns from the individual activities of knowledge workers and can soon provide suggestive support.



Example of an evolving symbolic knowledge representation Photo: Gerd Hübscher (DI)

Another topic concerns evolving neuro-fuzzy systems. Evolving systems allow incremental, open-loop processing of data streams and modelling while incorporating possible user feedback. Work on this type of systems is being carried out at the **Institute for Mathematical Methods in Medicine and Data-Based Modelling,** the successor to the FLLL.

contact

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M3DM - Institute for Mathematical Methods in Medicine and Data-Based Modelling (JKU)
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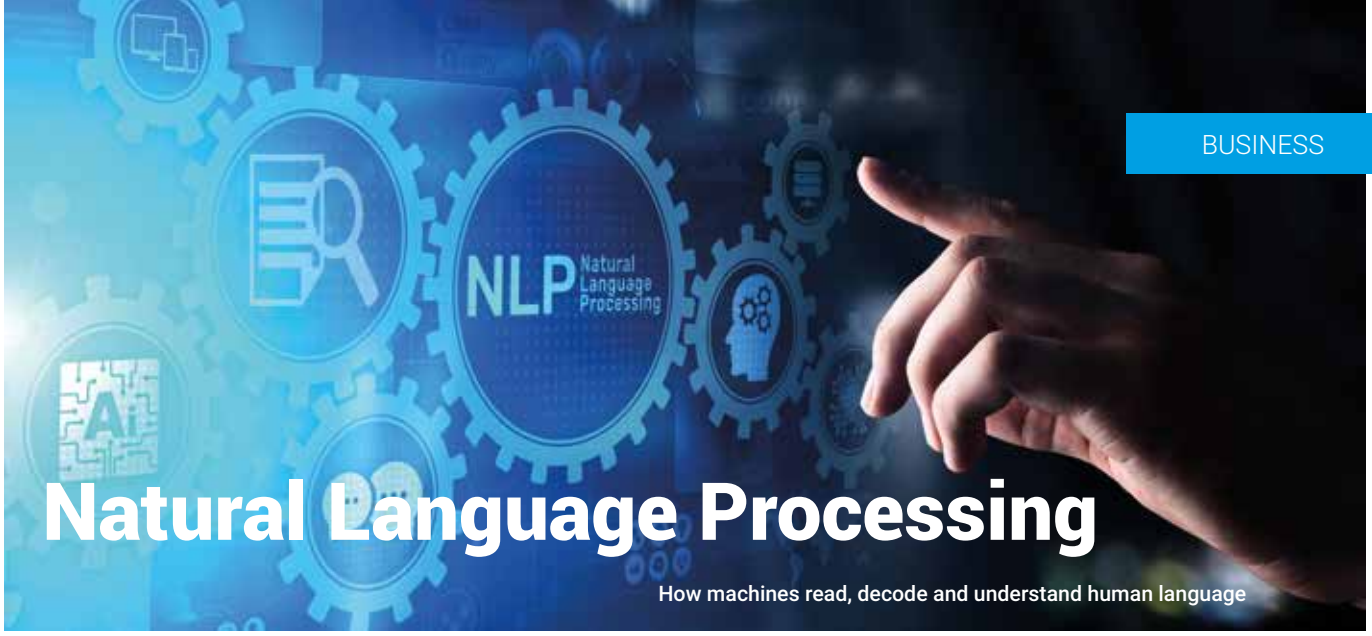

Photo: shutterstock

Natural Language Processing

How machines read, decode and understand human language

Language has many different concepts - while humans have created languages as a way of communicating over thousands of years, millions of zeros and ones form the machine code or machine languages that enable computers to understand and execute commands. Natural Language Processing (NLP) allows human language to be read, decoded, and understood by machines. Speech assistants, spell checkers, email spam filters - NLP as a technology is omnipresent and already behind many processes and software applications deeply embedded in our everyday lives.

Artificial intelligence as the interface between humans and machines

Machine processing of natural language is not a new field of research, but, due to the availability of higher computing power, enormous volumes of data (Big Data) as well as modern algorithms, the last few years have brought a number of revolutionary achievements in the NLP environment. As an interdisciplinary field of linguistics, computer science, and artificial intelligence, NLP enables communication between humans and machines in various forms (written and spoken) and in a huge choice of languages.

The complexity of language

Natural language in itself has no identifiable structure and is a complex system of characters that often show no interdependence in the way they are strung together. German, English, Russian, Japanese, Arabic - every language has its own complex syntax and characteristics. In addition, there are further complications, since language is often not linear, because it makes use of different stylistic devices, idioms, and information concealed between the lines (e.g., detection of sarcasm, context analysis). Older systems relied on rule-based or purely statistical approaches, whereas the breakthrough was only achieved with machine learning (especially deep learning) and the availability of large quantities of data. At the moment, the most promising models and state-of-the-art results for tasks concerning NLP are obtained using deep learning algorithms, which allow more complex modelling than conventional machine learning models. Deep learning was inspired by the way the human brain works, and uses multi-layered neural networks. The highly interconnected structures enable deep learning, which is essential especially for the complex construct of language.

Intelligent analysis of text data

More and more companies from different industries are turning to NLP solutions to better manage and leverage the accumulated volume of different text forms in a variety of fields. RISC Software GmbH supports its customers with its many years of practical experience when it comes to the development of custom-built, AI-supported solutions.

contact

RISC Software GmbH
www.risc-software.at

Use Cases

Automated document classification: You work as an editor and in future would like to receive only documents (or document types) for which you are responsible.

Automated extraction of information from documents such as invoices or delivery notes: You are the manager of the incoming goods department and in future you want to just check the details of the deliveries, rather than having to enter them manually.

Automated assessment of customer feedback: You are a marketing manager and want to get an overview of the feedback and reactions on social media regarding your recent advertising campaign or new product.

Photo: pixabay

Business process oriented approach with business impact analysis

Risk-Appropriate IT Security

The commitment of top management

For every company, the implementation of risk-appropriate information security measures is the basis for protecting business processes and the information and IT systems required for them. This makes it the foundation for competitiveness and essential for long-term success.

The media report almost daily on successful hacker attacks, data theft or unauthorised publication of secret company information. Many of the most prominent cases of this type that attract such attention in the media concern large, international companies, although hundreds of information security incidents occur every day - regardless of company size or field of activity - often discovered too late or not at all.

A major threat is posed by the way that companies are now networked all along the supply chain, the constant electronic exchange of data via email and cloud platforms, and the deep integration of the IT and OT/production control worlds, allowing attackers to inflict maximum damage through a variety of channels, either by deploying phishing/social engineering or by direct attacks on unprotected systems that are operated and accessed over the Internet. As a consequence, legislators have also reacted to this development in recent years and, by implementing new laws and regulations (GDPR, NIS directive, etc.), have brought more and more obligations into effect for companies and top management in order to ensure the (information) security of those affected, of critical infrastructures and of the economy. It is not sufficient to take only the technical measures into consideration because a holistic, custom-implementation of information security is required that includes the entire company in terms of human behaviour and the company's business processes.

Business impact analysis (BIA) for risk-appropriate information security

Many companies face the challenge of identifying and implementing the necessary technical and organisational measures to protect information and IT systems while not overshooting the mark. A first key step to success is top management's commitment to information security and the availability of the necessary resources to implement information security/IT security measures. Whereas in the past the approach was often to buy-in the best possible - and often very cost-intensive - IT security, a business process-oriented approach can often lead more quickly and cost-effectively to risk-appropriate information security measures being implemented. In the course of a business impact analysis, the first step is to identify the business processes that are important for the success of the company and the information and information systems required to maintain them. Based on this, the tolerable downtimes of the IT systems, the other resources required (e.g., IT employees and external service providers) and also the maximum tolerable data loss times are determined for the top business processes that are essential for the success of the company and the reputation and fulfilment of compliance requirements. Using risk analysis, the existing risks are evaluated for these assets and a limit is defined up to which organisational information security and technical IT security can be implemented in a sensible and cost-minimising way, and above which, risks and systems affected by those risks, risk shifting or residual risk acceptance would make more sense. The financial losses or liability risks deduced by the BIA in the event of failure or impairment of the business processes under evaluation can be used as the basis for this decision. Ultimately, for the relevant information processing systems, the requirements for the availability of IT infrastructure - and derived from this the necessary hardware infrastructure or, in the case of IT service providers, the necessary service level agreements - and the backup and disaster recovery strategies can be defined. Building on these results, organisational and technical information security measures are derived and prioritised for implementation, guidelines and regulations are implemented, and training measures are put in place. Since many companies already have various forms of information security measures in place, a GAP analy-

sis of proven and recognised best practice standards and measures (BSI, ISO 27xxx, TISAX, IEC62443, etc,) can help here. Based on what is already available, this allows the necessary add-ons to be determined and resources to be saved at the same time.

Competent support from Hagenberg

The involvement of competent support is a further factor in achieving success as efficiently as possible when carrying out a business impact analysis, risk assessment, GAP analysis and evaluation of the required organisational and technical information security measures in the classic IT, but also OT/ICS production sector (and ICS/SCADA sector for NIS-relevant critical infrastructure operators). The team at UNINET it-consulting GmbH can draw on more than 25 years of project experience and offers professional support as consultants and auditors in the areas of IT/OT infrastructure and services, information security management systems and IT security measures. The range of consulting services includes carrying out security/business impact analyses and determining IT security measures (based on ISO/IEC 27XXX, NISG, DSGVO, TISAX, BSI base line, etc.), penetration tests (white/grey/black box tests), support in the implementation of information security measures and processes as well as awareness measures up to e-learning sessions based on our own training platform.

The consultant team at UNINET it-consulting GmbH, who have a wealth of research project experience and whose managing director, FH Prof. DI Robert Kolmhofer, heads the Department of Secure Information Systems with its three security courses at the University of Applied Sciences in Hagenberg, guarantees the highest level of consulting in-line with the latest findings in technology and science.

For more info, visit www.uninet.at

contact

UNINET it-consulting GmbH
www.uninet.at

InfoSec Conference Made in Hagenberg

The aim of the Hagenberger Kreis is to promote public awareness about information security through events such as the Security Forum. Here, experts can share their know-how, exchange ideas and make new contacts. The event is especially designed for an audience that would like to find out more about IT security.

In order to cover as wide a field of interest as possible, the Security Forum lectures are divided into two categories. One covers technical aspects such as penetration testing, firewall technologies and industrial security. The other features talks that deal with organisational measures, primarily aimed at management. Furthermore, topics such as the NIS Directive, incident handling and the protection of trade secrets are covered.

However, the Security Forum is not only about the technical component, the ideas and cooperation of all participants is welcomed. On the first day there is also a relaxed evening event at AMSEC with good food and live music.

To give readers an insight into the main aspects of information security, here is a brief explanation. The three goals of IT security are integrity, confidentiality and availability.

- **Integrity** - no unnoticed modification of your data
- **Confidentiality** - only authorised persons are allowed to view or modify your data
- **Availability** - your data should be accessible at required times

The media keep reporting on "Artificial Intelligence" and "Big Data" as well as cyberattacks on companies. The volume of assets in the possession of enterprises today is already so large that it is very difficult for humans to effectively manage the entire IT inventory. Tools are used for this purpose, which are based on artificial intelligence, for example. "Thinking AI", this year's topic at SWPH, not only helps in the effective management of assets in the field of cyber security, it can also, as the name of the topic implies, support IT experts in decision-making. This is especially important when every second counts, e.g. during security incidents. AI can help with the detection of an attack as well as how the incident needs to be handled. Thanks to the dynamic nature of artificial intelligence, it learns with every data input and can therefore detect previously unknown attack tactics at an early stage. The Security Forum also offers talks about artificial intelligence - among numerous other topics.

If you are also interested in visiting us at the next Security Forum, we would be pleased to welcome you to the Hagenberg Campus of the University of Applied Sciences Upper Austria in 2023.

contact

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Women in Technology

Woman power at Softwarepark

Softwarepark Hagenberg brings successful women into the spotlight. With our Successful Women campaign, we strengthen the network between women in technology. We present strong women, their careers and current projects in our 4232 Softwarepark Hagenberg magazine.

Photo: Porsche Informatik/PHOTO-FLAUSEN

How did your career path lead to your current job in IT?
During my professional life, I have already got to know a number of different jobs. I started as a software engineer at Porsche Informatik. Well-written source code has its own beauty for me, just like an architecturally sound building or a mathematical proof. When I was working on developing something myself, time often flew by without me noticing.

After that, I implemented rollouts of a software solution for Porsche Informatik in various south-east European markets. For more than 10 years I have been working as a department manager in software development. In March of this year, I also took on the new challenge as Head of lab:hagenberg at Porsche Informatik.

Why did you choose engineering / IT? Have you always been interested in these topics?
Engineering / IT was not always clear from the start. As a student, I tried out many interests: music, some foreign languages, chemistry, and also briefly computer science, but I was put off because it wasn't the right setting. Years later, while studying mathematics, I came across IT again during an introductory course to a programming language. This time it caught my interest and I applied to Porsche Informatik as a software engineer. So it was a change in career that got me into IT.

What exciting projects are you currently working on?
I am currently setting up the new Porsche Informatik location in Hagenberg. Here we want to inspire UAS students with our software solutions and the work being done by our teams. Software development is our main focus, where we also offer suitable opportunities for internships and graduate theses work. At the same time, I am also still responsible for the New Vehicle Stock & Order Services department at Porsche Informatik.

What is the most exciting thing about your job?
There are so many ways to actively create. Computer science covers a huge field that is developing highly dynamically. Some things remain for years, other things have changed completely. And IT is teamwork. I find the cooperation within the team hugely constructive and enriching. In particular, groups with great diversity perform amazingly well.

What advice would you give to young women who are passionate about IT?
Dare to do it! No matter what your background, there are many ways to get into it. When you work in IT, you can actively shape the future. That's why I think it's very important that women and diverse teams play an active role. IT is definitely more than just engineering: it also requires a lot of communication, organisation and working together constructively in a team. There is an enormous range of different possibilities, so "Just do IT"!

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event highlights

Secure your knowledge advantage!

All the events at Softwarepark Hagenberg are shown here
www.softwarepark-hagenberg.com/veranstaltungen

ISM 2022

International Conference on Industry 4.0 and Smart Manufacturing

Upper Austria University of Applied Sciences -
Hagenberg Campus -
Linz, Austria

2 - 4 November 2022
www.msc-les.org/ism2022/

Photo: Petra Wiesinger

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