AI COMP

Future skills for a world shaped by AI.

DHBW
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Die Lernplattform
für Künstliche Intelligenz

NEXT EDUCATION

AIComp
Future Skills for a world shaped by AI

The competence model AIComp (Artificial Intelligence Competences) was developed as part of the two projects KI-Campus and KI-Campus Hub Baden-Wuerttemberg. It is based on an empirical study in which over 1,600 professionals in Baden-Wuerttemberg were surveyed on the skills requirements arising from the fact that artificial intelligence is increasingly finding its way into the world of work and life.

AI-Campus
The learning platform for artificial intelligence

The AI-Campus is the learning platform for artificial intelligence with free and freely accessible online courses, videos and podcasts to strengthen AI and data skills. As a research development project, the AI-Campus is funded by the Federal Ministry of Education and Research (BMBF) and the Dieter Schwarz Foundation and coordinated by the Stifterverband (www.stifterverband.org).
More about the AI-Campus initiative: www.ai-campus.org

NextEducation

NextEducation is an internationally active research collective at the Baden-Wuerttemberg Cooperative State University. It deals with teaching and research on the transformation of educational organizations and processes, teaching and learning, and lifelong learning processes under the conditions of an increasingly digitalized world. In international and national projects, the research group focuses on the future of educational organizations and learning processes.
More: www.next-education.org

NextSkills

As part of the NextSkills initiative, a German-language competency structure model for future skills was developed specifically for the higher education sector in 2019 and 2020. Since then, empirical studies on future skills for various educational sectors and specialist domains have been regularly implemented, including AIComp on future skills for AI in 2023. The results are made available open access.
More: www.nextskills.org

DHBW Duale Hochschule Baden-Württemberg

KI-Campus Die Lernplattform für Künstliche Intelligenz

KI-Campus Hub Baden-Württemberg Ein Projekt des Stifterverbandes

NEXT EDUCATION

What are competences and future skills?

Competences are dispositions to act, i.e. the potential to be able to act in certain situations. It can only be seen whether someone has a competence when the action is actually carried out. Here we are talking about performance.

Competences are made up of three components: knowledge, skills and inner attitudes. Knowledge and skills together form the so-called ability to act, while knowledge and inner attitudes and values lead to the willingness to act. The ability to act and the willingness to act together then form the basis for professional and private actions.

Future skills - i.e. future competences - are empirically determined competences that are important for specific areas (domains) or contexts of action. There are various ways to determine this, for example expert surveys or the analysis of job advertisements.

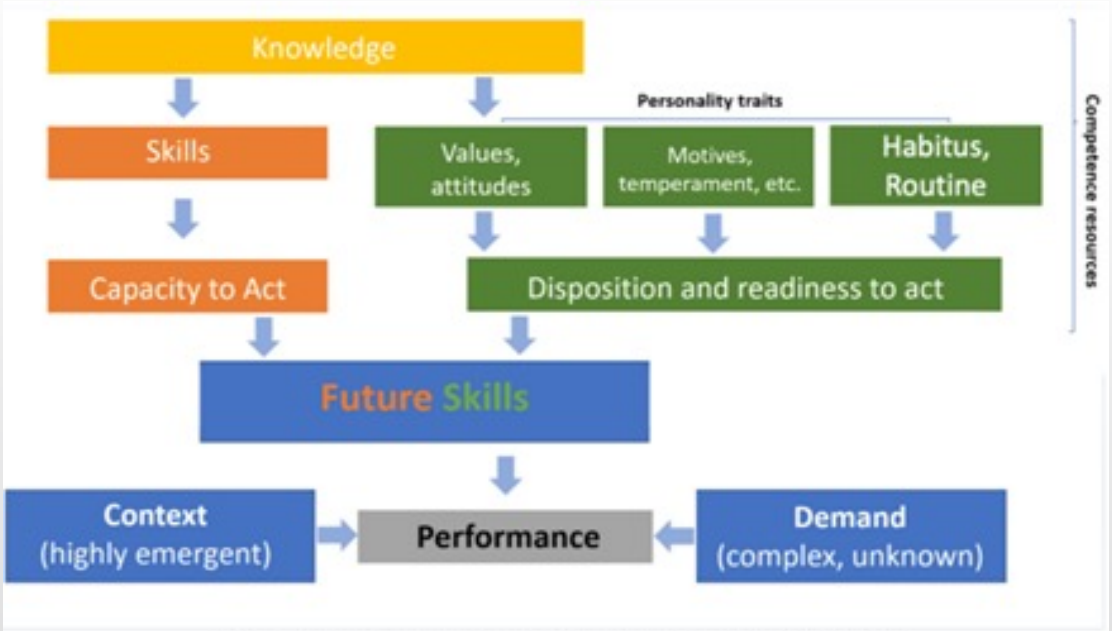


Fig. 1: Competence structure model for Future Skills (Ehlers 2020)

Definition of Future Skills

“Future Skills are competences that allow individuals to solve complex problems in highly emergent contexts of action in a self-organised way and enable them to act (successfully). They are based on cognitive, motivational, volitional and social resources, are value-based and can be acquired in a learning process.” (Ehlers 2020)

For example

The ability to “use AI creatively for the further development of one’s own professional context” is not just an accessible skill, but rather the ability to be able and willing to appropriately apply AI concepts in the right situation. And therein – in appropriateness – lies a weighing process that is value-based. Future skills therefore require knowledge, are based on skills and experience and, thirdly, require a good portion of your own positioning, which consists of values and motivations.

U.-D. Ehlers (2020), Future Skills - The Future of Learning and Higher Education.

More about Future Skills: www.nextskills.org

Ehlers, U.-D. (2023). Future Skills Framework. Kompetenzen für die KI-Welt. Heft 305. ManagerSeminare

What is artificial intelligence ?

“Artificial intelligence” (AI) refers to special computer programs that can independently learn new things and make decisions independently in complex situations. They are often capable of feats that approach human intelligence. In many places, computers already use such AI components in the background without non-experts noticing. In this study, we ask about your experiences and assessments of AI applications that you perceive and recognize as “artificial intelligence”. Examples include ChatGPT or similar applications, the DeepL translation program, image-generating AI, but also smart home devices, recommendation systems on the Internet and of course AI applications at your workplace or in companies.

Structure of the AICOMP model

AICOMP is the first German-language competence structure model and answers the question of which competences are important for being, becoming and remaining able to act successfully in a professional and life world permeated by AI. It is based on an action competence model with the aim of determining conditions for successful professional and private action.

As a competence structure model, it is not structured as a simple list of competences, but also defines competence areas and fields of competence that help to meaningfully relate and structure the different factors such as knowledge, values and the variety of possible skills.

It was constructed based on a comprehensive empirical study. The model structures the variety of possible competences into three levels.

Level 1: areas of competence

The model contains 3 competence areas that relate to (1) work/activity/task, (2) personal development and (3) the social environment/organization/world.

Level 2: 12 areas of competence

A total of 12 competence fields are assigned to these competence areas. Fields of competence are defined as thematic dispositions to act, for each of which the associated ability and willingness to act is described in the form of a definition.

Level 3: Knowledge, skills and values

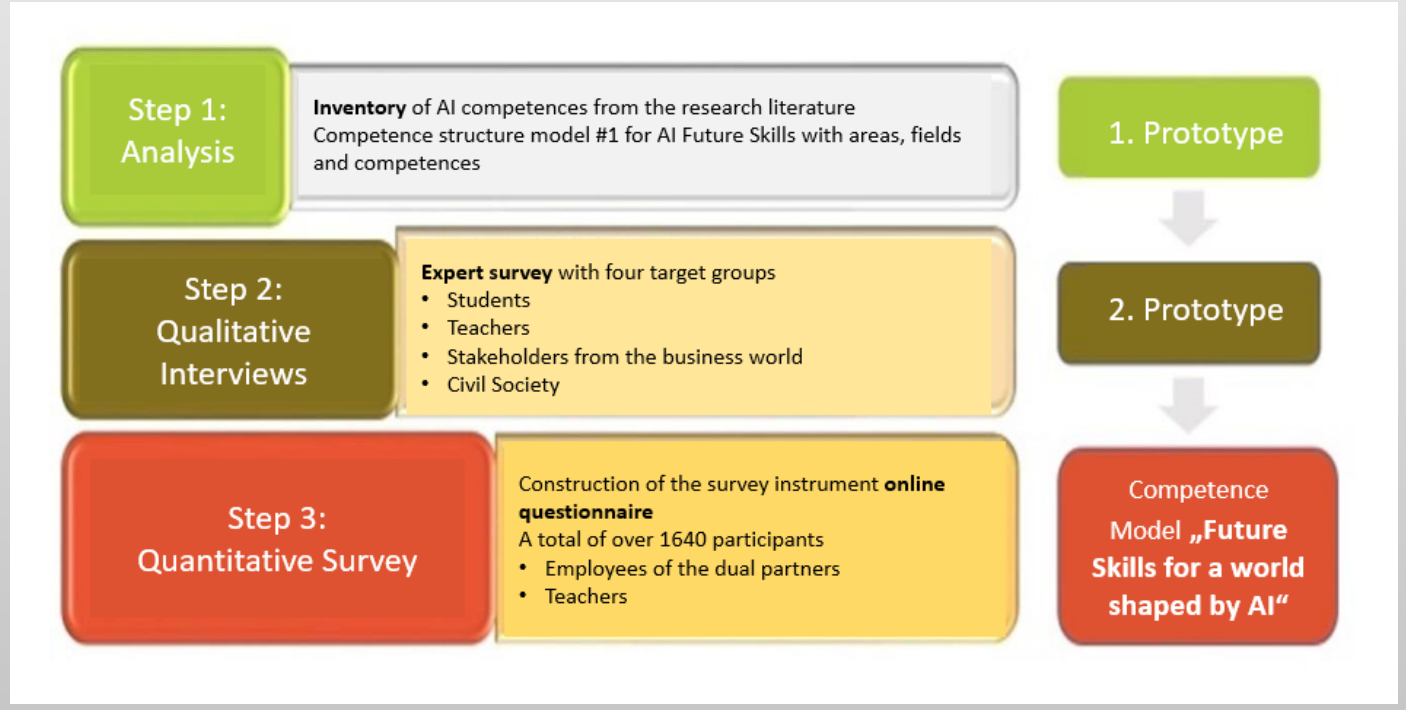
For each competence field, exemplary knowledge, skills and value attitudes are described, as well as examples of competence descriptions from the literature.

Research design: How was AIComp developed?

AIComp is the result of interlinked qualitative and quantitative research steps. After a comprehensive analysis of the existing research literature, an inventory consisting of 160 AI competence items was created. Using a qualitative and content-analytical approach, the inventory was shortened, clustered, summarized and thus reduced to a total of 13 areas of competence.

These were validated and sharpened as part of a qualitative interview study. As a result, the AIComp model was reduced to 12 areas of competence.

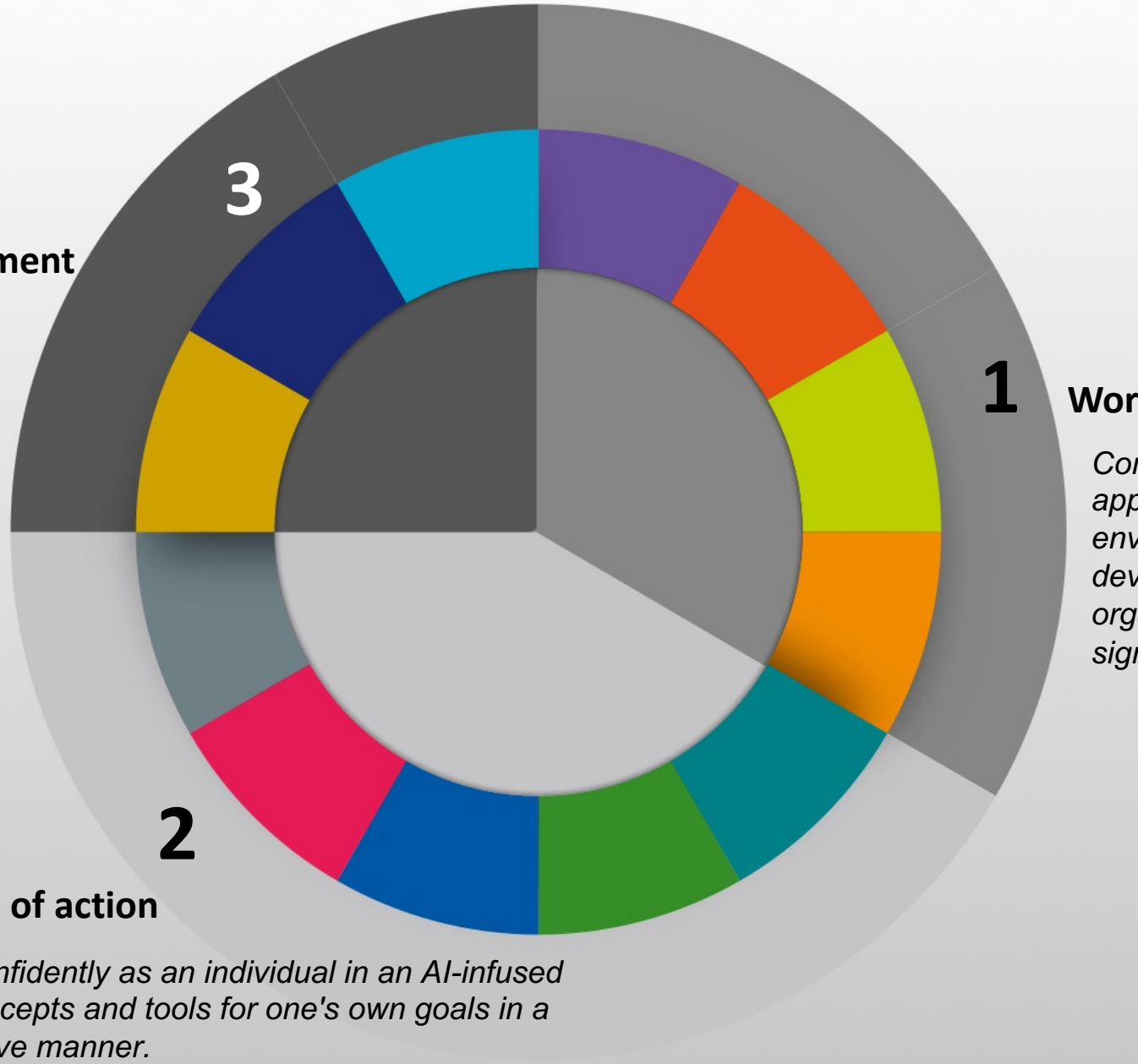
Based on the 12 competence areas, a questionnaire was designed for a quantitative online study and further developed in pretests. In this questionnaire, each of the 12 competence areas was asked with three items. The field phase of the study ran from June 15, 2023 to July 31, 2023 and was aimed at working people in Baden-Wuerttemberg. More than 1644 people took part. The data allows the empirical construction of a competence model based on the respondents' subjective assessments of their experiences, self-assessments and attributions of meaning for the 12 competence areas.



More about Research design:

Ehlers, U.-D., Lindner, M., Sommer, S. & Rauch, E. AICOMP – Future Skills in a World Increasingly Shaped By AI (2023) Ubiquity Proceedings, 3 (1): 230-239. https://ubiquityproceedings.com/articles/10.5334/uproc.91

Ehlers, U.-D. (2023). Future Skills Framework. Kompetenzen für die KI-Welt. Heft 305. ManagerSeminare.



Shaping the social environment with and for AI

Competences to use AI appropriately in one's own private or professional social environment and to creatively design new AI-related areas of action in collaboration with others.

Work and create with AI and for AI

Competences to use AI applications in a professional environment and to (further) develop them for organizationally or individually significant contexts of action.

Personal Skills for AI-related areas of action

Competences to act confidently as an individual in an AI-infused world and to use AI concepts and tools for one's own goals in a responsible and reflective manner.

1 Activity and implementation Competence
Taking initiative

2 System-design Competence
Design AI-Systems

3 Creative problem-solving Competence
Solving problems creatively with AI

4 Critical digital Competence
Being able to assess the benefits and challenges of technical applications

5 Decision-making Competence
Using AI in decision-making processes

6 Self-efficacy
Confidence that you can overcome AI-related challenges with your own abilities

7 Critical Thinking
Questioning how AI influences actions and decisions

8 Active control Competence
Using AI systems specifically for yourself

9 Self-determination
Act independently with AI

10 Ethical Competence
Ethical awareness of AI-related issues

11 Cooperation Competence
Collaborate with others on AI projects

12 Communication Competence
Formulate and discuss AI topics specifically

Activity and implementation Competence

AI in professional action: Taking initiative

“In my opinion, it will be important for professional success in the future to take the initiative with regard to the use of AI.”

DEFINITION

Activity and implementation Competence for AI in professional activities is the disposition to act proactively in the field of artificial intelligence (AI) and to integrate innovations in this field into one's own work context. The Competence is fundamental in nature and encompasses the knowledge, skills and mindset to orient oneself with regard to the growing importance of AI in professional and private contexts, to approach the topic with openness and critical awareness and to internalize the importance of continuous self-initiative for further training in this area. The Competence also includes an awareness of the possibilities of using AI systems for the creative development of ideas and the motivation to introduce AI systems into one's own field of activity. It also includes the ability to communicate and collaborate effectively with colleagues on AI-related topics.

Activity and implementation Competence

AI in professional action: Taking initiative

“The ability to collaborate with others on AI topics will be important for my professional success in the future.”

LITERATURE REFERENCE

People with management responsibility can organize a team, coordinate and delegate tasks (bundles). They can communicate the potential and limitations of AI, allay fears and activate further training potential. When integrating AI systems into company processes, they can formulate reasonable goals and thus help shape the change process.
- André, Bauer et al. (2021)

People are interested in experimenting with different types of AI systems depending on their own personal needs (e.g. virtual assistant, image analysis software, voice and face recognition systems, autonomous cars, "embodied" AI such as robots).
- Vuorikari, Kluzer & Punie (2022)

Activity and implementation Competence

AI in professional action: Taking initiative

„ In my field of work, Communication Competence on the subject of AI will be particularly important in the future.“

EXAMPLE TO…

… KNOWLEDGE
I know the basics of AI-related stakeholder management.

… SKILL
I have already written a modified production schedule once.

… ATTITUDE
I actively look for ways to use artificial intelligence and consistently implement ideas.

System-design Competence
Design AI-Systems

“I feel comfortable helping to shape the future use of AI technologies in my professional environment.”

DEFINITION

System-design Competence is the ability to plan and integrate both conceptual and technological AI systems in a professional context and to implement them in specialized fields of activity. System-design Competence includes the knowledge, skills and inner attitude to analyse existing systems (both technical systems and organizations) and to assess the potential and limits of the use of AI systems for these, to actively help shape and implement them. System-design Competence also includes the instrumental ability to understand and further develop AI applications systemically.

System-design Competence
Design AI-Systems

“I have already imagined how I could use AI systems for my own field of work in the future.”

LITERATURE REFERENCE

The person recognizes that the application of AI systems in many areas is usually uncontroversial (e.g., AI that helps avert climate change), but that AI that interacts directly with people and makes decisions about their lives can often be controversial (e.g., software for sorting resumes in hiring processes, scoring exams that can determine access to education).
- Vuorikari, Kluzer & Punie (2022)

This Competence describes the ability to use AI systems creatively in and for strategy processes and leadership concepts.
- André, Bauer et al. (2021)

System-design Competence
Design AI-Systems

„I have the confidence to take the initiative when it comes to introducing or using AI applications or systems in my field of work.”

EXAMPLE TO…

… Knowledge
I understand how our own AI systems are developed and trained.

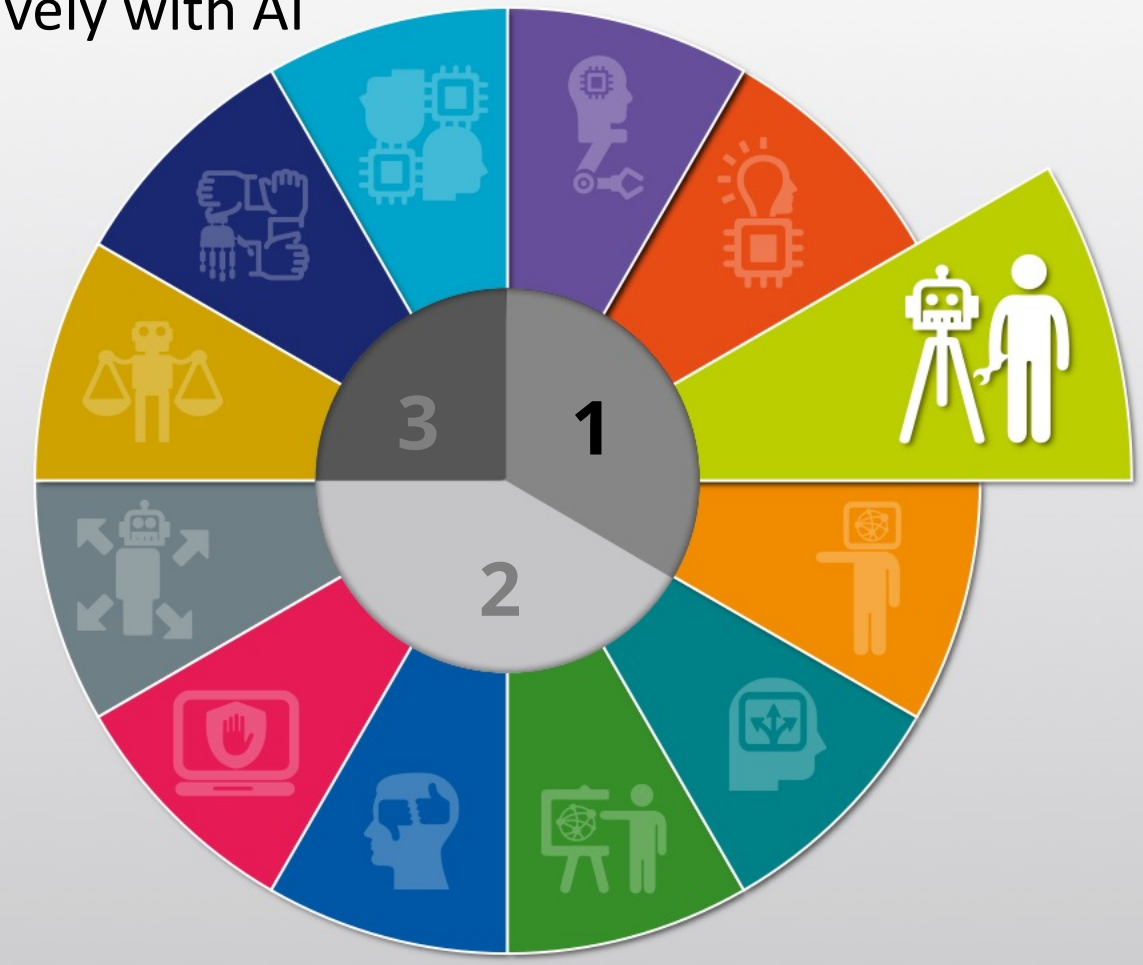
… Skill
I have mastered methods of user- and customer-centered development.

… Attitude
I create smart systems for AI applications that promote innovation and efficiency.

Creative problem-solving Competence

Solving problems creatively with AI

“I have experience in using AI-based solutions to develop ideas for creative problem solving (e.g. creative generation of images with an AI application).”



DEFINITION

Creative problem-solving Competence is the disposition to use AI systems for creative problem-solving, idea generation and vision development. It encompasses knowledge, skills and inner attitudes that make it possible to solve complex problems by combining technical and human systems.

Creative problem-solving Competence

Solving problems creatively with AI

“I am confident that I can get better suggestions and ideas from text AI systems and image AI systems by asking specific questions (prompts).”

LITERATURE REFERENCE

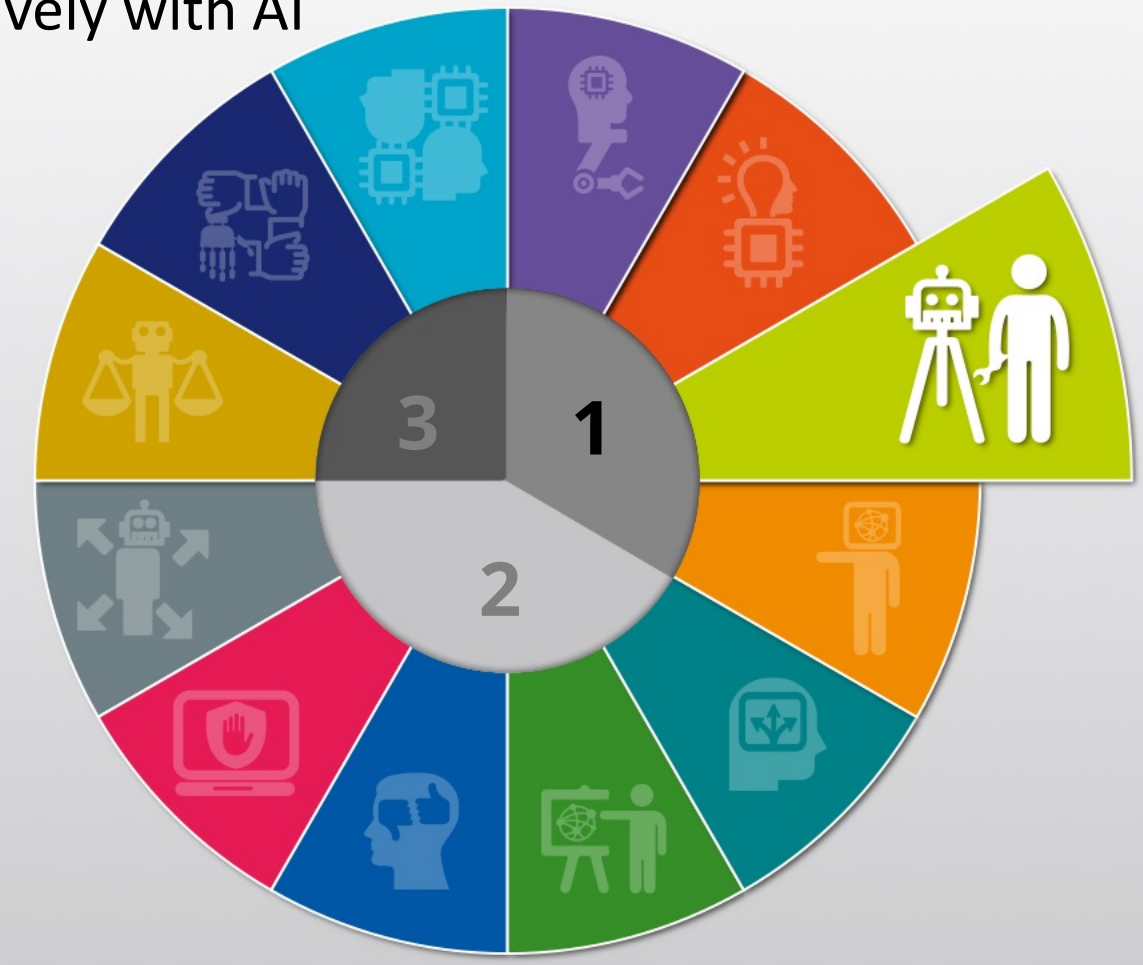
The person recognizes AI tools for creating images, writing and music are dependent on humans (e.g. in setting the initial parameters and selecting the results), while humans can use AI tools to enhance their creativity.
- Vuorikari, Kluzer & Punie (2022)

This Competence describes the ability to use AI systems creatively in and for strategy processes and leadership concepts.
- André, Bauer et al. (2021)

Creative problem-solving Competence

Solving problems creatively with AI

“I use AI applications as a tool to complete my tasks.”



EXAMPLE TO…

… Knowledge
I am aware of new developments and best practices in related AI fields.

… Skill
I can rapidly apply prototyping methods.

… Attitude
I see AI challenges as opportunities for innovative and ethical solutions.

Critical digital Competence

Being able to assess the benefits and challenges of technical applications

“In my view, it will be necessary in future for employees to have a deeper understanding of the AI systems in the company.”

DEFINITION

Critical digital Competence is the ability to understand, analyse and critically evaluate the inherent logic of AI systems with regard to their use of data and their impact on organizations and society. It includes the necessary knowledge, skills and inner attitudes to be able to assess AI systems in a critical and differentiated manner in relation to a given context of values and application. (Example: being able to assess and analyze the influence of AI technologies on the handling of data).

Critical digital Competence

Being able to assess the benefits and challenges of technical applications

“When using AI systems, it is always important to me to understand the logic behind the AI system.”

LITERATURE REFERENCE

People decide when the use of AI is appropriate and when human skills should be used.
- Long & Magerko (2020)

Confident handling of own and third-party data, also aware of the protection of personal data
- André, Bauer et al. (2021)

Ability to critically evaluate the information and results generated by AI systems and assess their quality.
- André, Bauer et al. (2021)

Critical digital Competence

Being able to assess the benefits and challenges of technical applications

EXAMPLE TO…

… Knowledge
I have a basic understanding of the possibilities and limitations of different AI systems.

… Skill
I can analyze and assess data quality and data completeness.

… Attitude
I critically analyze digital data to ensure fair and transparent AI decisions.

Decision-making Competence

Using AI in decision-making processes

“I often use AI recommendation systems in my field of work (e.g. with search engines or with recommendation and analysis systems such as LinkedIn etc.).”

DEFINITION

Decision-making Competence is the disposition to use AI applications and systems to weigh up alternative choices and make decisions. The Competence includes the necessary knowledge, skills and inner attitudes to consciously take responsibility for the decisions supported and/or made by AI.

Decision-making Competence

Using AI in decision-making processes

“I feel comfortable being advised by an AI assistant at work.”

LITERATURE REFERENCE

People are able to critically interpret and evaluate the information and results of AI systems. They can independently and competently assess when trust in AI systems and the data generated by AI systems is justified.
- André, Bauer et al (2021)

This describes the ability to use AI systems for decision support.
- Vuorikari, Kluzer & Punie (2022)

This describes the ability to reflect ethically when supporting or delegating human decisions by or to AI systems.
- Vuorikari, Kluzer & Punie (2022)

Decision-making Competence

Using AI in decision-making processes

“In my view, the ability to use AI systems to support yourself will become increasingly important in the future.”

EXAMPLE TO…

… Knowledge
I am familiar with the technical discussions on risk assessment in AI projects.

… Skill
I can use project retrospectives to gain insights into successful and failed decisions in previous projects.

… Attitude
I make AI-related decisions carefully to promote positive changes for which I am responsible.

Self-efficacy

Confidence that you can overcome AI-related challenges with your own abilities

“I am confident that I can keep up with new developments in the field of AI through further training and self-learning.”

DEFINITION

Self-efficacy as a Competence is the disposition to master the challenges associated with AI that arise in one's own context of action through one's own actions with conviction, courage and confidence. It encompasses the necessary knowledge, skills and inner attitudes to overcome AI-related challenges and to use AI systems in an appropriate way for one's own questions and tasks.

Self-efficacy

Confidence that you can overcome AI-related challenges with your own abilities

"My understanding of how AI systems work allows me to confidently use AI applications that are new to me."

LITERATURE REFERENCE

The person has a willingness to constantly learn, educate themselves and stay informed about AI (e.g. to understand how AI algorithms work, to understand how automatic decision making can be biased, to distinguish between realistic and unrealistic AI, and to understand the difference between Artificial Narrow Intelligence, i.e. current AI capable of narrow tasks, and Artificial General Intelligence (AGI), i.e. AI that surpasses human intelligence, which is still science fiction).

- Vuorikari, Kluzer & Punie (2022)

Self-efficacy
Confidence that you can overcome AI-related challenges with your own abilities

“I have the confidence to use AI technologies in such a way that they support me, but don't patronize me.”

EXAMPLE TO…

… Knowledge
I know how current AI applications work well enough to be able to realistically assess warnings about autonomous AI.

… Skill
I can use storytelling methods to concretize my own ideas.

…Attitude
I believe in my ability to use AI responsibly and to help shape its development.

Critical Thinking

Questioning how AI influences actions and decisions

“The ability to critically scrutinize AI systems will become increasingly important in my field of work.”

DEFINITION

Critical Thinking as a Competence is the disposition to reflect on the underlying ways of thinking, value systems and behaviors in AI-influenced spheres of activity and to be able to evaluate how they influence actions and decisions. It encompasses the necessary knowledge, skills and inner attitudes to analytically and critically assess AI-related circumstances, systems and applications as well as their effects.

Critical Thinking
Questioning how AI influences actions and decisions

“I have experience with the critical review of AI-generated information (e.g. with fact-checking or additional research).”

LITERATURE REFERENCE

People decide when the use of AI is appropriate and when human skills should be used.
- Long & Magerko (2020)

People understand that data cannot be taken at face value and must be interpreted critically.
- Long & Magerko (2020)

Critical Thinking

Questioning how AI influences actions and decisions

“I am confident in my judgment up to which point AI-generated information is useful to me, and at what point it is no longer useful.”

EXAMPLE TO…

… Knowledge
I am familiar with various positions in the critical discussion about current AI developments.

… Skill
I can apply management methods for critically thought-out solutions to problems.

… Attitude
I am not exclusively positive or negative about AI.

Active control Competence

Using AI systems specifically for yourself

“I have experience in adapting AI-based suggestion systems so that they don't confront me with things I don't want to see or hear.”

DEFINITION

Active control Competence is the disposition to personalize AI applications, systems and associated processes for one's own personal and professional development and to be able to shape them confidently and largely independently of external influences. This includes the knowledge, skills and inner attitudes for independent motivation and planning, cognitive load management and a high level of personal responsibility.

Active control Competence

Using AI systems specifically for yourself

“I have experience with the critical review of AI-generated information (e.g. with fact-checking or additional research).”

LITERATURE REFERENCE

People are able to critically interpret and evaluate the information and results of AI systems. They can independently and competently assess when trust in AI systems and the data generated by AI systems is justified.
- André, Bauer et al (2021)

You can decide when the use of AI is appropriate and when human skills should be used.
- Long & Magerko (2020)

The individual weighs up the benefits and risks before allowing third parties to process personal data (e.g. recognizes that a voice assistant on a smartphone used to give commands to a robot vacuum cleaner could give third parties - companies, governments, cybercriminals - access to the data).
- Vuorikari, Kluzer & Punie (2022)

Active control Competence
Using AI systems specifically for yourself

“I am confident in my judgment up to which point AI-generated information is useful to me, and at what point it is no longer useful.”

EXAMPLE TO…

… Knowledge
I know the most important principles of agile project management.

… Skill
I am adept at pattern recognition, in general and specifically in relation to AI-ready data.

… Attitude
I actively control my interaction with AI to uphold my values and achieve my goals.

Self-determination (Autonomy)

Act independently with AI

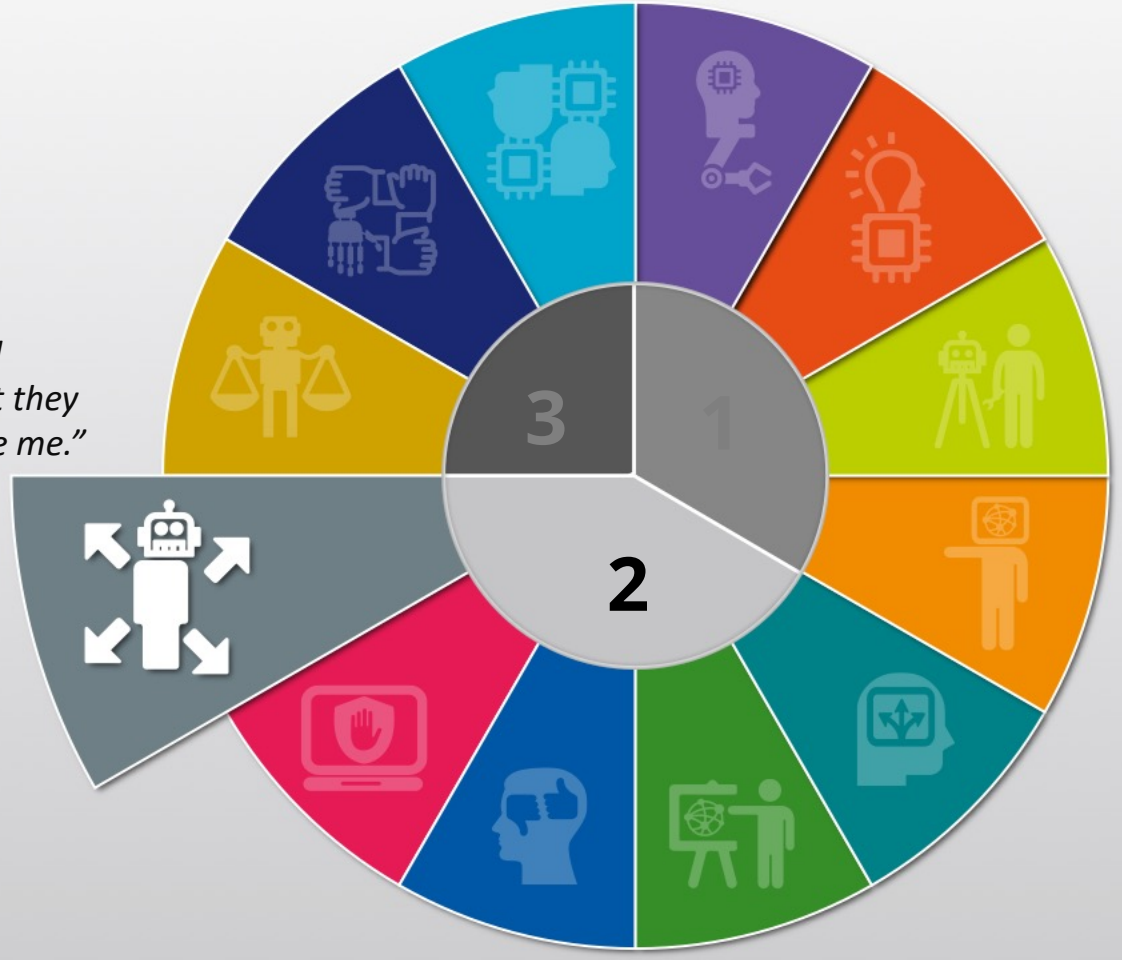
“In the future, it will be difficult to recognize the transition between self-determination and heteronomy through AI systems.”

DEFINITION

Self-determination as a Competence is the disposition to deal autonomously and confidently with AI applications without allowing oneself to be patronized. It requires the knowledge, skills and inner attitudes to develop a critical awareness of one's own personal limits and to act in a self-determined manner in relation to suggestion and decision-making processes with and through AI applications.

Self-determination (Autonomy)
Act independently with AI

“I have the confidence to use AI technologies in such a way that they support me, but don't patronize me.”



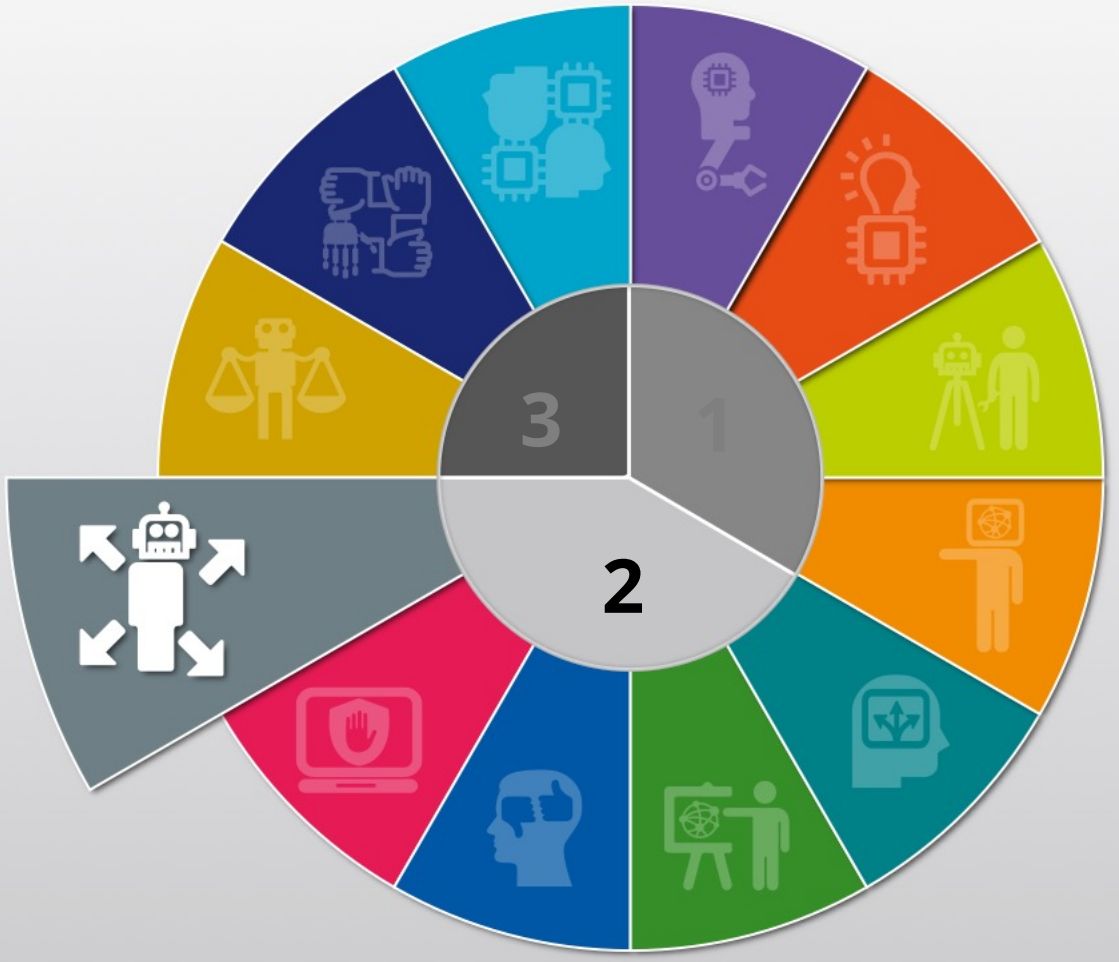
LITERATURE REFERENCE

The person is able to critically interpret and evaluate the information and results of AI systems. They can independently and competently assess when trust in AI systems and the data generated by AI systems is justified.
- André, Bauer et al (2021)

The person is open to AI systems that support people in making informed decisions in line with their goals (e.g. users actively deciding whether or not to follow a recommendation).
- Vuorikari, Kluzer & Punie (2022)

The person has the ability to weigh up the risks of consenting to the use of personal data in AI systems in both private and professional contexts.
- Vuorikari, Kluzer & Punie (2022)

Self-determination (Autonomy)
Act independently with AI



EXAMPLE TO…

… Knowledge
I am familiar with concepts of socially acceptable and human-centered AI design.

… Skill
I can apply methods for target tracking (such as OKR).

…Attitude
I take responsibility for my own dealings with AI, set clear boundaries and pursue my own goals.

Ethical Competence

Ethical awareness of AI-related issues

“I feel safe to raise ethical concerns around AI.”

DEFINITION

Ethical Competence is the ability to recognize, articulate and critically reflect on ethically relevant issues and questions in connection with AI technologies and related processes. It encompasses the knowledge, skills and inner attitudes to deal intensively with the ethical implications of the use of AI applications and systems and includes an awareness of responsible action in relation to AI.

Ethical Competence

Ethical awareness of AI-related issues

“I have already dealt intensively with ethical issues relating to the use of AI systems.”

LITERATURE REFERENCE

Knowledge of ethical issues, fields of action and challenges in connection with AI is required.
- Laupichler, Aster & Raupach (2023)

The person considers the ethical consequences of AI systems throughout their lifecycle: this includes both the impact on the environment (ecological consequences of the production of digital devices and services) and on society (e.g. platformization of work and algorithmic management that may suppress workers' privacy or rights, the use of devices that may violate workers' privacy or rights, the use of cheap labour for labelling images to train AI systems).
- Vuorikari, Kluzer & Punie (2022)

Ethical Competence
Ethical awareness of AI-related issues

“In my view, the importance of ethical awareness in relation to AI will increase significantly in the future.”

EXAMPLE TO…

… Knowledge
I know the opportunities and dangers of AI in relation to gender bias.

… Skill
I can operate AI systems in such a way that their solutions to problems serve equality.

… Attitude
I integrate ethical principles into every phase of AI use for positive societal impact.

Cooperation Competence

Collaborate with others on AI projects

“I have already had experience of working with others on AI projects or plans.”

DEFINITION

Cooperation Competence is the disposition to work in cross-departmental/interdisciplinary development partnerships and cooperations on AI transformation projects and new projects in relation to AI, also across organizational or cultural boundaries. It includes the necessary knowledge, skills and inner attitudes as well as the willingness to learn and develop further in this regard.

Cooperation Competence
Collaborate with others on AI projects

“I feel well equipped to collaborate with experts from other fields in AI projects.”

LITERATURE REFERENCE

People can contribute to teams with different compositions. They can work together with colleagues from different professional backgrounds and with different levels of experience and expertise. In contact with customers and users of AI systems, employees can explain the special features of the use of AI systems for their respective area of responsibility.
- André, Bauer et al. (2021)

This refers to the ability to integrate AI systems for knowledge construction and concept development into team structures (distributed cognition)
- Vuorikari, Kluzer & Punie (2022)

Cooperation Competence
Collaborate with others on AI projects

“I have undergone further training on AI in the last 12 months (e.g. training on how to use AI tools or AI applications).”

EXAMPLE TO…

… Knowledge
I know a coherent and understandable terminology for describing AI systems.

… Skill
I can translate complex concepts into simple and visual explanations.

… Attitude
I work closely with others to incorporate diverse perspectives into AI developments.

Communication Competence

Formulate and discuss AI topics specifically

“I have already exchanged ideas on AI topics with colleagues or acquaintances.”

DEFINITION

Communication Competence is the ability to communicate with others about AI-related topics in different contexts in a way that is appropriate to the situation, including views that differ from one's own. It encompasses the knowledge, skills and inner attitudes required to empathically address and communicate other perspectives on AI and related issues.

Communication Competence
Formulate and discuss AI topics specifically

“I feel safe in discussions with others who have different views on AI topics.”

LITERATURE REFERENCE

People can contribute to teams with different compositions. They can work together with colleagues from different professional backgrounds and with different levels of experience and expertise. In contact with customers and users of AI systems, employees can explain the special features of the use of AI systems for their respective area of responsibility.
- André, Bauer et al. (2021)

They can critically analyze and discuss the characteristics that make an entity "intelligent," including a discussion of the differences between human, animal, and machine intelligence.
- Long & Magerko (2020)

Communication Competence
Formulate and discuss AI topics specifically

EXAMPE TO…

… Knowledge
I have a deeper understanding of AI applications.

… Skill
I am able to discuss technical details for different target groups and make them understandable.

… Attitude
I communicate clearly about AI topics, promote open dialog and contribute to realistic understanding.

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Impressum

AIComp was developed as a subproject of the two projects AI-Campus and AI-Campus Hub in Baden-Wuerttemberg by the NextEducation Research Group at the DHBW Karlsruhe. The AI-Campus is the learning platform for artificial intelligence with free online courses, videos and podcasts to strengthen AI and data skills. As an R&D project, the AI-Campus is funded by the Federal Ministry of Education and Research (BMBF); the AI-Campus-Hub project is also funded by the Dieter Schwarz Foundation and coordinated by the Stifterverband.
More: www.ki-campus.org

Title: AIComp – Future Skills for a world shaped by AI
Citation information: Ehlers, U.-D., Lindner, M., Rauch, E. (2023): AIComp - Future Skills for a world shaped by AI, Karlsruhe

Authors: Ulf-Daniel Ehlers, Martin Lindner, Emily Rauch
Karlsruhe Cooperative State University
Date: November 17, 2023

Location: Karlsruhe
Web: www.ai-comp.org
Contact: ehlers@dhbw-karlsruhe.de