EDIH4UrbanSAVE

Course Content & Methodology

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EDIH
For urban interconnected supply and value Ecosystems

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Course Content & Methodology

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Executive summary

This deliverable describes the services related to the pillar "Course Content & methodology" in the European Digital Innovation Hub for urban interconnected supply and value Ecosystems[1] (EDIH4UrbanSAVE). Aligned with the Grant Agreement (GA), Tasks 4.1 – 4.6 and based on Deliverable 4.1, the document outlines a curriculum comprising innovative skill-enhancing formats. Concept of joint applied academy (*EDIH Academy*), which includes offering of application-oriented certificate courses as well as the Skills & Training formats, are presented. After a short overview in a catalogue, developed Skills & Training formats are explained in detail. Methodology and offering options for certificate courses for key technologies are highlighted.

[1] In the following text, EDIH4UrbanSAVE is also referred to as EDIH Hamburg.

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1. Introduction

The EDIH will prepare the European society and economy and place Europe at the forefront of sustainable tech development and the twin transition (digital & green). Therefore, important new and established innovation actors and the education sector have joined forces across clusters and industries. The EDIH Hamburg will contribute to the twin transition of local Small and Medium Enterprises (SMEs), small mid-caps and Public Sector Organisations (PSOs) with a portfolio based on existing local competencies, covering the key digital technologies of AI (Artificial Intelligence), HPC (High-Performance Computing), cybersecurity, distributed infrastructure and digital skills, including, where relevant, their environmental impact. A large-scale digital transformation of the metropolitan region of Hamburg will be facilitated by formats offered in *EDIH Academy*.

1.1 *EDIH Academy* Concept

All educational services to be provided under the project have been combined into a concept of joint applied *EDIH Academy*. It will offer demand-based (further) education opportunities aiming to provide project's target groups (SMEs, small mid-caps and PSOs) with the best tools to excel in the digital age and to promote the successful integration of key technologies into everyday operations.

In general, the *EDIH Academy* will offer needs-driven trainings (see Section 2) and application-oriented certified courses for key technologies (see Section 3). The trainings will be delivered in various formats developed by the project partners and provide a general overview or introduction to a topic or skill in a short and concise form. Whereas certificate courses will be longer learning interventions that will provide comprehensive, in-depth coverage of a topic or skill and offer formal certification.

Local SMEs, small mid-caps and PSOs will be able to acquire the required core competencies in the key technologies and digital skills in a demand-driven manner as well as learn about respective methods (e.g., agile development, design-thinking, technology road mapping) and a proper innovation mindset (open innovation and human-centred approach). Training and teaching activities will be based on modern methods from experience-based learning as well as e-learning and blended learning, using state-of-the-art software and hardware environments. The variety of topics and training formats developed will help to fill the knowledge gaps in the relevant field and ensure a positive learning experience.

To ensure continuous improvement of the services, the *EDIH Academy* emphasizes ongoing feedback by customers (see Sections 2.5 and 3.2). By implementing a Continuous Improvement Process (CIP), an agile feedback process is established. Direct feedback by customers will help to understand the target groups, their needs and preferences for training activities. Service development and improvement will follow a two-step process, starting with a pilot phase and progressing to regular operations to match customer needs.

Learning courses enable SMEs and PSOs to get an overview of suitable key technologies with their requirement, understand and use the latest tools, ensuring they remain at the forefront of technological change. Overall, outcomes by *EDIH Academy* operation to be achieved include:

- need-based (further) education is on offer
- awareness and skills on future topics among the young and aged is raised

- skilled workers are offered an opportunity to play an active part in the digital transformation, and, by extension, in their own future work environment
- generally, the level of digital skills and the local human capital is raised
- the shortage in skilled workers in the short and long term is alleviated

These positive effects on human capital will enable businesses to undergo digital transformation and to innovate.

2. Overall Skills & Training Services Curriculum

This section takes a closer look at the services and formats developed for the "Skills & Training" (ST) pillar of the project. The services are described in terms of formats, focus, scope and partner involvement. Materials for operation are handled by each partner individually. The entry formats (e.g., workshops at the basic and expert level) are essentially also embedded into a consulting process in which, tailored to the current practice, needs, goals and challenges of enterprises or organisations are assessed in meetings/interviews/questionnaires in order to obtain an overview of potentials. This approach and an enterprise tech check-up are the basis to develop a strategy and EDIH Hamburg service roadmap to include sector and technology trends, business models, etc. towards organisation development goals, gains, risks, priorities and resource allocations. An outcome for the organisation is an overview of suitable key technologies with their requirement and concrete strategy road mapping steps: use case development, secure funding, identifying partners, event and networking opportunities.

2.1 Skills & Training Services Portfolio

Based on the target groups' needs, their context and these attributes, we identified how the key technologies of ADCH (AI, Digitisation, Cybersecurity, and HPC) have the potential to transform SMEs and public services. In what follows, the activities of the EDIH in the skills & training services are described in more detail in Figure 1.

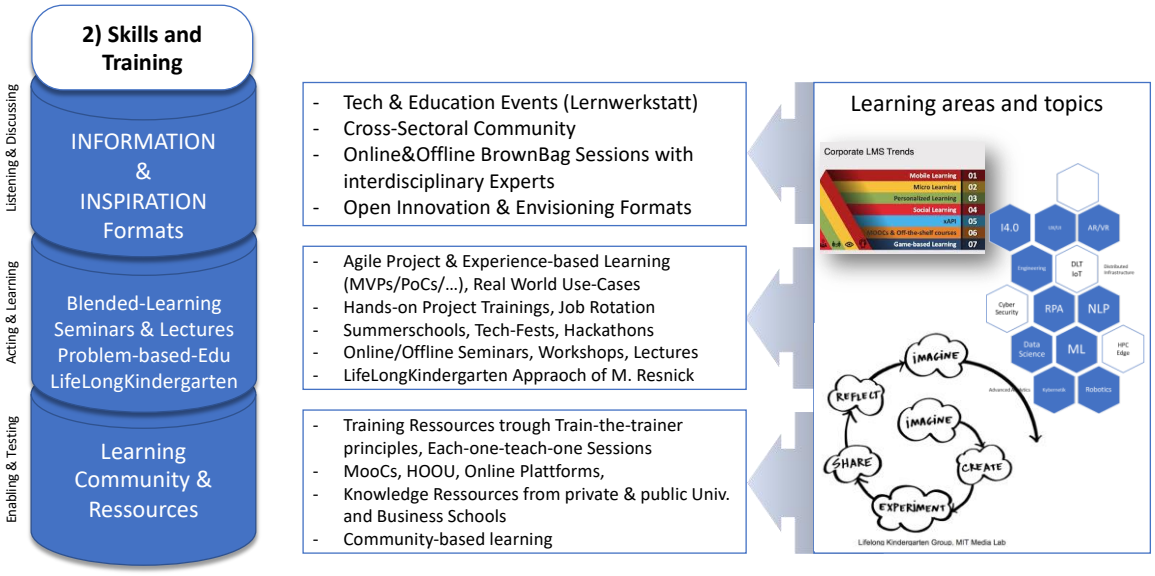

Figure 1: EDIH Hamburg service portfolio for Skills & Training

The service portfolio, depicted above, is divided into three levels, in which different types of interaction, learning and cooperation with the intended target groups (Logistics, Aviation-, Transportation-, Maritime-Industry, Services, Crafts & Food Industry and the public administration, integrated via the Public Private Partnerships) are promoted. These are information formats for different skill levels (e.g. brown bag sessions, webinars, cross sectoral community events), in which the target groups are rather inspired and "consume", up to hands-on implementation and education formats.

The first level of services is formed by "Listening & Discussing" formats that provide information about the key technologies ADCH (e.g., in expert lectures, tech sessions, deep dives and interactive meetups) and focus in particular on interdisciplinary exchange, networking in showrooms and innovative environments such as in the DigiHub, ARIC, or the innovation lab network of the EDIH Hamburg consortium.

The second level is formed by the "Acting & Learning" and "Advice & Matching" offers. Here, activities are compiled that actively involve the ecosystem, ensure interdisciplinary exchange (including demo days, hands-on sessions, hackathons, etc.) and publicly demonstrate applications to a broad target group that are already in use or are already being tested in pilots. In these formats, the target group is activated through interaction, collaboration and joint learning. In the pillar "Skills & Training", blended-learning concepts and train-the-trainer models are applied and self-developed in this level (e.g., data literacy courses). Problem and project-based learning helps to focus on transfer of knowledge, strengthening practical relevance and competencies that are needed in the real world.

The third level supports the measures and offerings of the first two levels. The innovation community is built up analogously, which bundles experts, use cases and network access. EDIH tech scouts will network bilaterally with experts to enlarge this community (ARIC already has >360 AI, HPC, Big Data, Cloud digitalisation experts in the community).

2.2 Skills & Training Services Catalogue

The *EDIH Academy* will offer Skills & Training services in various formats (e.g., masterclasses, webinars, seminars, workshops, demonstrations, consultations, community events) on a variety of topics (e.g., AI, HPC, cybersecurity, Machine Learning, digital transformation) for different skill levels. The condensed list of Skills & Training services is listed in Table 1.

The project partners are committed to further developing and discovering new non-standard training formats for the project's target groups. For example, competencies are imparted through concrete "doing" (e.g. summer schools, workshops, implementing, experimenting) in the joint innovation laboratories such as the ARIC "AI Lab/Showroom"[2], "Creative Space for Technical Innovations"[3], "DESY Innovation Factory"[4], "Homeport Lab"[5] and other training facilities (e.g. Institute for "Responsible AI"[6]). The creative industries (artists, musicians, designers and other creatives) could be involved, in particular through the cooperation partner Cluster *Kreativwirtschaft* (e.g., in workshops series "AI & music" and "AI & arts"). This creates a creativity-promoting mix between tech and art that breaks up usual thought patterns and has a focused people-centred approach. An example of a non-standard training format is also a didactic card game[7] developed by *PLOT4ai* that performs threat modeling on AI/ML systems. The consortium has already established intensive contacts with representatives of the above-mentioned fields.

[2] https://aric-hamburg.de/pressemeldung/ai-showroom/, retrieved in November 2023

[3] https://csti.haw-hamburg.de/, retrieved in November 2023

[4] https://innovation.desy.de/ueber_uns/projekte/dif/index_ger.html, retrieved in November 2023

[5] https://www.homeport.hamburg/spaces/landtestflaechen, retrieved in November 2023

[6] https://www.responsible.ai/who-we-are#:~:text=The%20Responsible%20AI%20Institute%20%28RAI%20Institute%29%20is%20a,landscape%20of%20creating%2C%20selling%20or%20buying%20AI%20products., retrieved in November 2023

[7] https://plot4.ai/, retrieved in November 2023

	Partner	Title
1.	HITeC	An insight into the field of HPC
2.	HITeC	An introduction to cyber security
3.	HITeC	AI for deciders
4.	HITeC	An introduction to Machine Learning
5.	HITeC	Convolutional Neural Networks
6.	HITeC	AutoML and Hyperparameter Optimisation
7.	HITeC	Embedded AI
8.	HITeC	An introduction to Image Generation with AI
9.	HITeC	Test Management
10.	HITeC	Enabling the realization of own innovations
11.	HAW	Search engine optimization: Becoming more visible on the web
12.	HAW	Data as the basis for business decisions – Data Driven Business
13.	HAW	Digitalization of intralogistics – collect and use data directly from the material flow
14.	HAW	OGD – Public data is there to be used
15.	HAW	Turning old into new: how can machines be digitized at low cost?
16.	HAW	Creating customer favourites: with data to a better product
17.	HAW	Prompt Engineering – Better results when using ChatGPT and Stable Diffusion (Webinar)
18.	HAW	Beyond reality: the Metaverse and its possibilities
19.	HAW	AI-supported search engine optimization for SMEs
20.	HAW	Prompt Engineering – Better results when using ChatGPT and Stable Diffusion (Workshop)
21.	TUHH	Workshops using the LEGO® SERIOUS PLAY® method (“Qualification”)
22.	TUHH	From linear to circular – Sustainable transformation of business models
23.	TUHH	Developing a future oriented business model – but how?
24.	TUHH	Digital technologies to enhance scope 3 carbon accounting
25.	TUHH	Machine Learning basics: how to create value with ML
26.	TUHH, HAW	The smart supply chain – More Transparency through IoT and decentralised networks (“Demonstration”)
27.	HWK	Current topics in digital transformation (“Info event”)
28.	HWK	Current topics in digital transformation (“Experience exchange”)
29.	HWK	Digitalization Consultation
30.	ARIC	ARIC Insights
31.	ARIC	LLMs in logistics – opportunities and risks of Bard, ChatGPT & Co
32.	ARIC	Workshop for Startup Support Programs: How to identify AI in Startups?

Table 1: Skills & Training services catalogue

2.3 Skills & Training Services Content

Partner: HITeC	**Title:** An Insight into the Field of HPC	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: Webinar	**Focused on key technologies:** HPC	**Status:** ready to offer
Stakeholder from SME/PAs side: those with a need for HPC		
Requirements for participation: strong IT affinity		
est. Duration: 60 - 120 minutes		

Description of *"An Insight into the Field of HPC"*:

HPC (High-Performance Computing) systems are used when a simple PC or a single workstation is no longer capable of performing the required computations or analyses of big data volumes in a reasonable amount of time. In traditional HPC, a corresponding task is split and processed in parallel on the compute nodes of an HPC system, which shortens the runtimes. A single compute node is roughly comparable to a powerful PC. Simply put, many compute nodes are then connected via a high-speed network to build an HPC cluster system. HPC represents a key technology for solving complex problems. In the context of the presentation, examples are given of typical tasks that are processed with an HPC cluster.

The impressive progress of the performance (measured in Floating Point Operations per Second (FLOPs)) of HPC systems will be shown with the evolution of the Top500 list[8] (established in 1993) of the most powerful supercomputers, which is updated twice a year. The typical architecture of current HPC cluster systems is described at a basic level. A further topic of the presentation will be the execution of parallel programs on a cluster system. Unlike using a simple PC, the users of HPC systems compete for the expensive resources of the cluster. Workload managers are meant to manage these resources with an appropriate scheduling so that users are treated fairly. The concept of the presentation is based on ideas for the HPC-Führerschein ("HPC Driving License" in English) from the PeCoH (Performance Conscious HPC) project[9] and on ideas presented on the EDIH Network eLearning platform in a webinar[10] by Laura Morselli.

Value of service:

The participants of the training will acquire skills and will learn about

- the hardware components of an HPC cluster and their functions
- parallel computer architectures, in particular: the distinction between shared and distributed memory systems
- I/O architectures used in HPC environments: local, distributed, parallel and hierarchical file systems
- how the performance of parallel programs may be assessed
- FLOPS which is the key measurement unit for the performance of HPC systems, and its pitfalls
- Moore's law and its significance for performance frontiers in modern HPC
- the definitions for key terms: speedup, efficiency, and scalability

[8] TOP 500 – The List, www.top500.org, retrieved in November 2023

[9] Performance Conscious HPC, www.hhcc.uni-hamburg.de/pecoh.html, retrieved in November 2023

[10] Available at https://elearning.edihnetwork.eu/user/view.php?id=79&course=10, retrieved in November 2023

- Amdahl's law and its significance for performance frontiers in modern HPC
- overheads for communication and synchronization that are introduced by parallelization
- other sources of parallel inefficiency: load imbalances, hardware effects
- how workload managers control the unattended background execution of programs or jobs, respectively, by the help of job queues
- typical scheduling principles (e.g., first come first served, shortest job first) to achieve objectives like minimizing the averaged elapsed program runtimes, and maximizing the utilization of the available HPC resources

Learning methods used: lecture

List of references and/or learning resources: Kai Himstedt worked in the Project PeCoH and can contribute the topics developed in the EDIH project[11]. The contents were a joint effort by Nathanael Hübbe, Hinnerk Stüben and Kai Himstedt.

Furthermore, Laura Morselli's slides from the train-the-trainer event with the section "Introduction to HPC" on the EU's online eLearning platform[12] have received attention for further development.

Overview slides: see Annex 1.

Partner: HITeC	**Title:** An introduction to cyber security	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: Webinar	**Focused on key technologies:** Cyber Security	**Status:** planned /in preparation
Stakeholder from SME/PAs side: those with a need for improving the security of their IT systems and workflows		
Requirements for participation: none		
est. Duration: 60 - 120 minutes		

Description of *"An introduction to cyber security"*:

Cybersecurity is important to protect sensitive information and privacy. The aim is to improve trust and to avoid financial losses (for example, due to phishing or ransomware). Cybersecurity is a cornerstone of Europe's digital connectivity and a priority for the EU. Humans are considered the "weakest link in the chain" when it comes to preventing the spread of computer viruses, for example. The presentation is intended to raise the awareness of the participants for security topics by means of examples and to transfer corresponding best practices.

Besides physical security, topics such as password policies, SPAM, phishing, trojans, ransomware, VPNs (Virtual Private Networks), and backups will be covered. Furthermore, the basics of a PKI (Public Key Infrastructure) are discussed, where digital certificates and cryptographic algorithms are used to ensure the confidentiality, integrity and authenticity of information (e.g., of emails) transmitted via public networks. The concept of the presentation

[11] Performance Conscious HPC, www.hhcc.uni-hamburg.de/pecoh.html, retrieved in November 2023

[12] https://european-digital-innovation-hubs.ec.europa.eu/knowledge-hub/edih-train-trainer-courses/introduction-hpc, retrieved in November 2023

is also based on ideas presented on the EDIH Network eLearning platform in a webinar[13] by Darius Bufnea and Alexandru Kiraly.

Value of service:

The participants of the training will acquire skills and learn about

- why cybersecurity is important
- viruses, trojans, malware, ransomware, malicious links, fake links, spoofing attacks, etc. and why the careless clicking and careless running of programs can be dangerous
- identifying suspect files
- that non-malicious software can contain (human) bugs, which can be exploited in a malicious way
- how disk encryption protects the stored information in case of loss or theft (e.g., of a notebook) from foreign access
- locking the computer before leaving it unattended
- password policies to create strong passwords and the benefits of 2FA (Two-Factor Authentication)
- never using the same password for different systems/services
- regular updating of apps and the operating system to improve the security of the environment
- why VPNs are not protecting privacy and are not a security improvement per se
- how virtual machines can improve security
- using email certificates to digitally sign emails and prevent email fraud
- how important it is to create and keep backups

Learning methods used: lecture.

List of references and/or learning resources:

The basis for the course is, among other things, the train the trainer format[14] "How to design your hands-on cybersecurity training". In addition, handouts and recommendations from the Federal Office for Information Security are being taken into account in the current development of the offer[15]. The contents of the CARE survey are also included in the format[16].

Overview slides: to be developed.

[13] Available at https://elearning.edihnetwork.eu/user/view.php?id=79&course=9 , retrieved in November 2023

[14] Available at https://elearning.edihnetwork.eu/user/view.php?id=529&course=35, retrieved in November 2023

[15] Available at https://www.bsi.bund.de/DE/Themen/Unternehmen-und-Organisationen/Informationen-und-Empfehlungen/KMU/KMU_node.html, retrieved in November 2023

[16] Available at https://www.cybercrime-forschung.de/care, retrieved in November 2023

Partner: HITeC	**Title:** AI for deciders	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: Webinar	**Focused on key technologies:** AI	**Status:** ready to offer
Stakeholder from SME/PAs side: for those who are deciders in SMEs		
Requirements for participation: none		
est. Duration: 75 minutes		

Description of *"AI for deciders"*:

The workshop aims explicitly at people without a computer science background, and there especially deciders, CEOs (Chief Executive Officer), marketing experts, or generally all future users, who want to learn about the general principles and methods of Machine Learning and data-driven Artificial Intelligence (AI). It is for those who are not developers and have no experience with AI or AI-projects, but want to/have to discuss using AI in your company or to decide about AI projects. Participants are going to learn about the basic concepts of AI and Machine Learning, especially how it works, what they need to implement successful AI projects, and what data they need to achieve good results. The workshop conveys the needed vocabulary to talk to others and to understand problems.

The workshop introduces the basic concepts behind data-driven AI and Machine Learning. The main aim is for all participants to develop a basic understanding of the general process and all important keywords along the way, without delving into technical details. At the end of the workshop, all participants should be able to answer the following questions (among others): How does an AI system learn? What kind of data do I need and how much? What problems can I solve with AI? Which competencies do I need in my team to implement a successful AI project?

The workshop consists of a presentation where all the concepts will be explained, and a second part where 1-2 use cases are discussed, to show how AI projects can be successfully implemented.

The format language can be German or English (depending on participants).

Value of service:

The participants of the training will acquire skills and learn about

- general principles, terms and concepts of AI
- AI buzzwords
- which problems ML can solve
- what requirements data must satisfy
- bias
- overfitting
- AI project requirements
- best practices

Learning methods used: lecture.

Overview slides: see Annex 2.

Partner: HITeC	**Title:** An introduction to Machine Learning	
Service: ST-1 /ST-2	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: Workshop & Training	**Focused on key technologies:** AI	**Status:** ready to offer
Stakeholder from SME/PAs side: Beginners with an affinity for development		
Requirements for participation: beginners with Python knowledge or at least programming knowledge		
est. Duration: 3 Sessions, 180 minutes each		

Description of *"An introduction to Machine Learning"*:

This applied workshop aims at beginners with Python experience, or at least general programming skills, who want to get a practical introduction to the topic of AI and Machine Learning.

The workshop consists of three sessions for the three different main learning paradigms of data-driven AI: Supervised, unsupervised, and Reinforcement Learning. In each session, first, the basic principles of the learning paradigm and its use cases will be explained. The participants will learn about 1-2 representative methods for each paradigm: k-means and DBSCAN (Density-Based Spatial Clustering of Applications with Noise, unsupervised), Regression and Multi-Layer Perceptron Network (MLP, supervised), and Q-Learning (Reinforcement Learning). The selection of those methods was done according to didactic as well as application-oriented criteria, i.e., they are simple enough to quickly grasp the underlying principles, but are also the foundation on which many applied methods are based on.

Each session contains both a theoretical part, in which the basic principles and methods will be introduced to build a solid foundation and a hands-on part, in which prepared tasks will be implemented together and discussed after the theoretical concepts have been understood. The understanding of the theoretical principles will be thus deepened, while all participants gain hands-on experience with the respective methods. The chosen examples all are based on freely available data and software frameworks, to enable everybody to continue learning after each session independently. By this, we want to ensure that each participant has the possibility to easily transfer and expand their knowledge towards their own problem cases after the workshop ends.

Since the hands-on session is done with Python code, basic programming skills are needed (optimally already in Python). The programming tasks will be done online through Google Collaboratory, so the participant would need a working Google account. Basic mathematical skills (robust school knowledge) are beneficial to understand the mathematical underpinnings of each method.

In classical simulation systems, a code-driven approach is usually in the foreground, with which a large number of equations, as they are typically created for the models of real-life problems, are solved with the help of numerical methods. Machine Learning (ML) is a subset of AI (Artificial Intelligence) that, in contrast, is based on a data-driven approach generating knowledge from experience, so to speak, and recognizing patterns after a training phase on representative sample data. These patterns are then transferred in the sense of a generalization for the analysis of further unknown input data, for example for decision-making or classification.

Deep Learning, a major topic of the workshop, is a subset of ML and is based on neural networks to mimic the learning of the human brain with corresponding algorithms. Three training types can be distinguished: a) Unsupervised learning to automatically group data by

their correlated properties, b) supervised learning to handle labeled data by explicitly assigning properties in the training phase to the current input (e.g. for classification), and c) reinforcement learning based not on data sets but on rewards for "good actions" in the interaction with the environment during the training phase.

Value of service:

The participants of the training will acquire skills and learn about

- learning paradigms of AI
- data-driven AI
- which problems ML can solve
- what requirements data must satisfy
- evaluating the results after training and validation
- overfitting of parameters, which leads to the loss of generalization capability
- supervised/unsupervised learning
- reinforcement learning
- k-means
- DBSCAN
- Regression
- MLP
- Q-Learning.

Learning methods used: lecture and hands-on part

List of references and/or learning resources: The concept of the workshop is based on ideas for an AI training course held earlier at HITeC and covers also ideas presented on the EDIH Network eLearning platform in a train-the-trainer webinar[17].

Overview slides: see Annex 3.

Partner: HITeC	**Title:** Convolutional Neural Networks	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: Hands-on session	**Focused on key technologies:** AI	**Status:** ready to offer
Stakeholder from SME/PAs side: intermediates with an affinity with neural network/learning		
Requirements for participation: intermediates with Python knowledge/programming knowledge		
est. Duration: 180 minutes		

Description of *"Convolutional Neural Networks"*:

This session is for intermediates (advanced beginners) who already have experience with neural networks and supervised learning.

This workshop deals with a special class of neural networks that are partly responsible for the quick rise of deep learning: Convolutional Neural Networks (CNN). This type of network is specifically well suited for pattern recognition and is for many years now the state of the art in image processing. This class is often also part of neural processing chains, where high-

[17] Available at https://elearning.edihnetwork.eu/course/view.php?id=23 , retrieved in May 2023

dimensional, complex inputs have to be transformed to higher-level, more abstract representations for further processing. The goal for this workshop is to teach the specific features of this network type, especially in comparison to the Multi-Layer Perceptron, as a typical representative of supervised neural learning. The common hyperparameters will be discussed and their effects demonstrated within a realistic application example.

After a theoretical part, in which the basic principles and features will be introduced, prepared tasks will be implemented together and discussed in a hands-on fashion. Therefore, the understanding of the theoretical principles will be deepened, while all participants gain hands-on experience with the effects of different design decisions and hyperparameters. The chosen examples all are based on freely available data and software frameworks, to enable everybody to continue learning after each session independently. By this, we want to ensure that each participant has the possibility to easily transfer and expand their knowledge towards their own problem cases after the workshop ends.

Knowledge about general neural processing and supervised learning will be assumed. Optimally, all participants should have completed the first and second part of the workshop series *"An introduction to Machine Learning"*.

Since the hands-on session is done with Python code, basic programming skills are needed (optimally already in Python). The programming tasks will be done online through Google Collaboratory, so participants need a working Google account. Basic mathematical skills (robust school knowledge) are beneficial to understand the mathematical underpinnings of each method.

Value of service:

The participants of the training will acquire skills and learn about

- Image Processing
- CNN
- Pattern recognition.

Learning methods used: lecture and hands-on part.

Overview slides: see Annex 4.

Partner: HITeC	**Title**: AutoML and Hyperparameter Optimisation	
Service: ST-2	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: Workshop and Training	**Focused on key technologies:** AI	**Status:** ready to offer
Stakeholder from SME/PAs side: for those who are developers in SMEs		
Requirements for participation: Participants with practical experience with neural networks and supervised learning		
est. Duration: 180 minutes		

Description of *"AutoML and Hyperparameter Optimisation"*:

This workshop aims at advanced users who have already practical experience with neural networks (especially MLP and CNN) and supervised learning and are now interested to optimize them.

A big issue with current deep learning approaches is finding optimal hyperparameters (e.g. network structure, learning rate, activation function, etc.) for a given problem case. Because of a long list of possible parameters, their possible interactions, and the often still missing knowledge on optimal parameters in the given domain, often automatic search in the parameter space is the tool of choice. This workshop introduces the general ideas and principles in two steps: First, the basic process is shown by optimizing an MLP for a simple regression problem. Then, in a second step, the effects of different methods and parametrizations are demonstrated on a more complex and realistic classification problem for a CNN. At the end of the workshop, all participants will have gained an overview of currently used optimization methods and practical knowledge on at least one state-of-the-art approach.

Each session contains both a theoretical part, in which the basic principles and methods will be introduced, and a hands-on part, in which prepared tasks will be implemented together and discussed. Therefore, the understanding of the theoretical principles will be deepened, while all participants gain hands-on experience with the respective methods. The chosen examples all are based on freely available data and software frameworks, to enable everybody to continue learning after each session independently. By this, we want to ensure that each participant has the possibility to easily transfer and expand their knowledge towards their own problem cases after the workshop ends.

Practical experience with neural network programming in Python is expected. Optimally, all participants should have already completed the three sections of *"An introduction to Machine Learning"*, in which that knowledge is taught. This workshop seamlessly builds on *"An introduction to Machine Learning"* in terms of use cases and examples and thus is the ideal continuation.

Since the hands-on session is done with Python code, basic programming skills are needed (optimally already in Python). The programming tasks will be done online through Google Collaboratory, participants need a Google account.

The format language is English only at the moment.

Value of service:

The participants of the training will acquire skills and learn about

- Advanced Neural Learning
- Optimization of MLP
- CNN
- Hyperparameter
- Optimization.

Learning methods used: lecture and hands-on part

Overview slides: see Annex 5.

Partner: HITeC	Title: Embedded AI	
Service: ST-2	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: Workshop and Training	**Focused on key technologies:** AI	**Status:** in preparation
Stakeholder from SME/PAs side: for those who are developers in SMEs		
Requirements for participation: Participants with practical experience with neural networks and supervised learning		
est. Duration: two sessions, each 120 minutes		

Description of *"Embedded AI"*:

This workshop aims at advanced users with practical experience with neural networks (especially MLP and CNN) and supervised learning and are now interested in deploying them in an embedded system.

Embedded AI has many applications in healthcare, the automotive industry, and smart homes. One issue is finding suitable embedded hardware for a particular application. Many factors should be considered when designing an embedded system, such as accuracy, cost, memory, programming efforts, and power consumption. Depending on the application, one may have different priorities. This workshop first introduces applications and decision-making factors. It is also demonstrated how embedded hardware can be programmed. Different neural networks and applications will be shown in this workshop.

The session contains both a theoretical part, in which the basic principles and methods will be introduced, and a demonstration part, in which the instructor implements and demonstrates a trained model on the embedded device. Therefore, the understanding of the theoretical principles will be deepened while all participants get a closer look at how it is done in practice. The chosen examples are all based on freely available data and software frameworks to enable everybody to continue learning after each session independently. By this, we want to ensure that each participant has the possibility to easily transfer and expand their knowledge towards their own problem cases after the workshop ends.

Practical experience with neural network programming in Python is expected. Optimally, all participants should have already completed all sessions of *"An introduction in Machine Learning"*.

The format language is English only at the moment.

Value of service:

The participants of the training will acquire skills and learn about

- Embedded devices/systems
- Programming embedded systems
- Examples in NN

Learning methods used: lecture and hands-on part

Overview slides: see Annex 6.

Partner: HITeC	**Title:** An introduction to Image Generation with AI	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry	
Format: Workshop	**Focused on key technologies:** AI	**Status:** planned /in preparation
Stakeholder from SME/PAs side: for those with a need for AI based image generation		
Requirements for participation: none		
est. Duration: 120 - 240 minutes		

Description of *An introduction to Image Generation with AI:*

Image generation with AI has made significant progress in recent months. Diffusion-based AI models can generate or alter images based on prompts formulated in natural language. This technology enables to generate unique visuals, artworks, and designs with the help of intelligent algorithms, even without extensive artistic skills. AI-driven image generation offers many practical benefits. It allows for the rapid creation of diverse and high-quality visual content for designing product prototypes, marketing materials, enhancing digital presence and creating engaging social media content

The workshop will give a comprehensive introduction to the theoretical basics of image generation with diffusion models. Next, different use-cases and techniques will be covered with hands-on examples: Image generation from prompts, altering existing image based on prompts, Inpainting, Outpainting, using simple 3D models as a basis for images and using generative language models for prompt generation. The workshop will also cover advanced topics like using Low-Rank Adaptation to tune existing models towards desired styles or image content.

The concept of the workshop is based on practical experience, best-practices and tutorials from the generative AI art community.

Value of service:

The participants of the training will acquire skills and learn about

- terminology and concepts of AI for image generation
- an overview of image generation with diffusion models
- possible use cases and application of image generation
- workflows and best practices for typical tasks in AI-based image generation
- tuning generative models for specific tasks
- examples of using large language models for automating prompt generation
- limitations and challenges of AI-based image generation

Learning methods used: lecture with best-practices

Overview slides: to be developed.

Partner: HITeC	**Title**: Test Management – Recommendation and Best Practices of Software Testing from Industry & Research	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: Lecture	**Focused on key technologies:** Digitisation	**Status:** ready to offer
Stakeholder from SME/PAs side: for those who are developers in SMEs		
Requirements for participation: none		
est. Duration: 45 minutes		

Description of *"Test Management – Recommendation and Best Practices"*:

The lecture is to give audience an overview of software testing. It covers the state-of-the-art testing techniques and methodologies such as test automation, continuous testing, and agile testing. Furthermore, some topics of AI-based testing have been touched. Finally, it shows a learning path for software testing based on the International Software Testing Qualifications Board (ISTQB) certifications.

Due to undefined testing background and experiences of audience, this presentation is focusing mainly on the fundamental testing techniques. Therefore, no prior knowledge of software testing is required. However, listeners are expected to bring their own questions from daily testing practices, so that we can organize follow-up sessions to cover their expectations explicitly.

The talking time is about 30 minutes, excluding 15 minutes Q&A.

Value of service:

The participants of the lecture will acquire skills and learn about

- Why testing?
- Relationship between cost and quality
- Test Strategy and Test Concept
- Continuous testing
- Manual test vs test automation
- Agile testing
- Cross platform testing
- AI-based testing
- Certification for testing.

Learning methods used: lecture

Overview slides: see Annex 7.

Partner: HITeC	**Title:** Enabling the realization of own innovations	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: Hands-on workshop	**Focused on key technologies:** all	**Status:** in preparation
Stakeholder from SME/PAs side: for those with a need to work out and implement innovations		
Requirements for participation: none		
est. Duration: 120 - 240 minutes		

Description of *"Enabling the realization of own innovations"*:

The format for enabling the realization of own innovations is aimed at EDIH customers to provide them with the necessary skills to independently develop and implement use cases for their specific business requirements.

The target groups for this service are from various industries or disciplines that want to improve their understanding of the development and implementation of use cases in the context of digital transformation and innovation. This workshop deals with the following areas:

- Introduction to use cases:
  - Basics and definition of use cases in the corporate context
  - Importance and benefits of use cases for business development and innovation
- Use case identification:
  - Methods for identifying relevant use cases for their organisation
  - Analysis of company processes to identify potential use cases
- Use case development:
  - Steps and best practices for developing use cases
  - Creation of use case scenarios, user interactions and use cases
- Use case prioritization and evaluation:
  - Criteria for prioritizing use cases based on organisation goals and resources
  - Methods for evaluating the feasibility, profitability and practicability of use cases
- Prototyping and validation:
  - Creation of prototypes for selected use cases
  - Methods for validating and reviewing prototypes in collaboration with relevant stakeholders
- Implementation and scaling:
  - Strategies for implementing successful use cases in the organization
  - Approaches to scaling successful use cases for broader application

This will be a hands-on workshop with interactive sessions where representatives will actively learn methodologies of developing use cases for their own organization.

Case studies and real-life examples to illustrate concrete use cases and solutions.

EDIH customers will receive support from an experienced software development expert in the field of use case development.

Value of service:

After completing the format, participants will be able to independently identify, develop, evaluate and successfully implement use cases in their organization in order to improve their business or organization processes and implement innovative solutions.

Learning methods used: hands-on workshop with interactive session

Overview slides: see Annex 8.

Partner: HAW		**Title:** Search engine optimization: Becoming more visible on the web	
Service: ST-1	**Target Group:** all		
Format: webinar		**Focused on key technologies:** digital marketing	**Status:** in operation
Stakeholder from SME/PAs side: for those who want to augment their visibility online			
Requirements for participation: none			
Duration: 60 minutes			

Description of *"Search engine optimization: Becoming more visible on the web"*:

In today's digital world, being visible online is crucial. But how can a company improve its presence in popular search engines? This event offers practical insights and proven strategies to successfully position a company in the digital space. The participants learn how to use targeted Search Engine Optimization (SEO) measures to increase visibility, drive more qualified traffic to a website and ultimately increase sales. From choosing the right keywords to optimizing a website for better rankings, participants learn how to harness the power of search engines for their business.

Value of service:

What to expect:

- An understanding of the basics of Search Engine Optimization (SEO)
- Practical tips for selecting and using relevant keywords
- Optimization of websites for better visibility in search results
- Success strategies to increase the online presence and conversions
- Practical examples: success stories from SMEs that use SEO successfully
- Tools that help with the implementation of a targeted SEO strategy

Learning methods used: lecture.

List of references and/or learning resources:

Suchmaschinen-Optimierung: Das umfassende Handbuch, Sebastian Erlhofer, 10. Aktualisierte Auflage, Rheinwerk Computing.

Overview slides: see Annex 9.

Partner: HAW	**Title:** Data as the basis for business decisions – Data Driven Business	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: webinar	**Focused on key technologies:** all	**Status:** in operation
Stakeholder from SME/PAs side: for those who want to implement Data in their Business Modell		
Requirements for participation: none		
Duration: 60 minutes		

Description of *"Data as the basis for business decisions – Data Driven Business"*:

Digitalization has sparked a data revolution that has fundamentally changed the way companies operate today. Data is collected in almost all areas of business, from customer interactions to production processes and supply chains. If a company know how to not only collect this data, but also analyze it in a targeted manner and turn it into actionable insights, it will gain a decisive competitive advantage.

Value of service:

- How to transform a business into a data driven business
- Which data can be used?
- Which opportunities for data usage can arise
- Which difficulties can occur?

Learning methods used: lecture.

Overview slides: see Annex 10.

Partner: HAW	**Title:** Digitalization of intralogistics – collect and use data directly from the material flow	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: webinar	**Focused on key technologies:** digitalization	**Status:** in operation
Stakeholder from SME/PAs side: for those who want to implement data in their business model		
Requirements for participation: none		
Duration: 60 minutes		

Description of *"Digitalization of intralogistics – collect and use data directly from the material flow"*:

Data and key figures drive logistics like no other industry. Optimizing logistics processes contributes directly to increasing efficiency and improving competitiveness. But how can digitalization help to get even more out of intralogistics?

What opportunities lie in the consistent collection and utilization of data, illustrated by intralogistics as an example? While it is common to concentrate on data from the information flow due to its accessibility and structured form in IT systems, it is crucial to recognize that valuable insights can also be derived from the material flow, which often does not receive sufficient attention for technical reasons.

Value of service: In this course, the participants will learn about technologies that can be used to turn logistical objects into data sources for optimizing processes.

Learning methods used: lecture.

Overview slides: see Annex 11.

Partner: HAW	**Title:** OGD – Public data is here to be used	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: webinar	**Focused on key technologies:** all	**Status:** in operation
Stakeholder from SME/PAs side: for those who want to make use of public data		
Requirements for participation: none		
Duration: 90 minutes		

Description of *"OGD – Public data is here to be used"*:

The development of business models and products and the development of new target groups is often rather random. The use of freely available public data enables more systematic work and better targeting of potential customers. Using examples, experts will show participants how they can use OGD (Open Government Data) to systematically develop business models and customer approaches. In addition to an introduction to the topic of OGD, experts will show the participants how to identify and use possible data sources.

Value of service:

- Participants will learn what different kinds of openly accessible data there is and what the advantages and disadvantages compared to private data are
- Participants will learn how to acquire publicly accessible (government) data
- Through use cases, participants will know, how the usage of public accessible data can help them assessing potential, support them in forecasting and improve business planning.

Learning methods used: lecture.

Overview slides: see Annex 12.

Partner: HAW	**Title:** Turning old into new: how can machines be digitized at low cost?	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: webinar	**Focused on key technologies:** Retrofitting	**Status:** in operation
Stakeholder from SME/PAs side: for those who wants to digitize existing machines at low cost		
Requirements for participation: none		
Duration: 90 minutes		

Description of *"Turning old into new: how can machines be digitized at low cost?"*:

Nowadays, the use of innovative technologies is essential for a company's competitiveness. But how can your company bring old machines into the digital age? Retrofitting offers a cost-effective alternative for converting analog systems into networked and intelligent devices.

Questions we want to answer:

- What are the benefits of retrofitting?
- What are the requirements that my company must meet?
- What does retrofitting look like in practice?
- What steps should I follow to retrofit my system?

Value of service:

- Participants will have a deeper understanding of the benefits of retrofitting.
- Participants will know what to do to digitalize their analog systems.

Learning methods used: lecture.

Overview slides: see Annex 13.

Partner: HAW	**Title:** Creating customer favorites: with data to a better product	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: webinar	**Focused on key technologies:** Weibull Analysis	**Status:** in preparation
Stakeholder from SME/PAs side: for those who want to make improvements through data		
Requirements for participation: none		
Duration: 90 minutes		

Description of *"Creating customer favorites: with data to a better product"*:

The Weibull analysis is introduced and the participants will learn how it can be used to optimize the maintenance strategies. Products can be improved and thereby increase customer satisfaction.

It will be explained which requirements need to be met when introducing it into the company and what benefits can be expected in the long term if it is successfully implemented. The tool provided enables the participants to carry out their own subsequent analyses themselves.

Why: To demonstrate the benefits of data in the manufacturing industry.

What: Application-oriented introduction to the subject area and concrete practical examples for the application of reliability.

How: Presentation of the most important requirements for the analysis and presentation of an app for implementation.

Value of service:

Participants will understand the potential of Weibull analysis.

Learning methods used: lecture.

Overview slides: to be developed.

Partner: HAW+TUHH	**Title:** Prompt Engineering: Better results when using ChatGPT and Stable Diffusion (Webinar)	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: webinar	**Focused on key technologies:** Prompt Engineering	**Status:** in operation
Stakeholder from SME/PAs side: for those who want to improve their knowledge & skills when using generative AI tools		
Requirements for participation: none		
Duration: 60 minutes		

Description of *"Prompt Engineering: Better results when using ChatGPT and Stable Diffusion (Webinar)*":

This webinar is dedicated to improving the results of using ChatGPT and Stable Diffusion specifically for SMEs. Participants learn how to optimize the performance of ChatGPT and Stable Diffusion by cleverly formulation requests (prompts). Experts will share real-world examples and best practices to get better and more accurate answers from ChatGPT and Stable Diffusion.

Value of service:

- Participants will get a good understanding of text- and photo-generating AI
- Participants will learn the differences between several prompt engineering techniques
- Participants will learn what outcomes can be expected when using different prompt techniques
- Participants will learn the limitations of ChatGPT and Stable Diffusion.

Learning methods used: lecture.

Overview slides: see Annex 14.

Partner: HAW	**Title:** Beyond reality: the Metaverse and its possibilities	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: webinar	**Focused on key technologies:** Virtual Reality (VR)	**Status:** planned
Stakeholder from SME/PAs side: for those who want to implement virtual reality into their marketing		
Requirements for participation: none		
Duration: 60 minutes		

Description of *"Beyond reality: the Metaverse and its possibilities"*:

Metaverse enables companies to get to know their customers perfectly. The Metaverse is a "wonderful galaxy" full of possibilities. In this webinar, participants dive into the future of marketing. Experts will teach them the basic technologies, tell them where the term comes from and take them on a journey to value-adding applications for their business.

Value of service:

Participants will get an understanding of

- Metaverse
- how to "use" the Metaverse for marketing
- how to generate added value for their business by using VR.

Learning methods used: lecture.

Overview slides: to be developed.

Partner: HAW	**Title:** AI-supported search engine optimization for SMEs	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: 4-part workshop	**Focused on key technologies:** (generative) AI, Search Engine Optimization (SEO)	**Status:** planned
Stakeholder from SME/PAs side: for those who want to learn hands-on how to use SEO and want to learn which AI-supported tools they can use to augment their SEO strategy		
Requirements for participation: none		
Duration: 120 - 180 minutes		

Description of *"AI-supported search engine optimization for SMEs"*:

Workshop 1: Fundamentals of SEO for SMBs

- Introduction to SEO for SMBs: In this part, experts will explain the basic benefits of SEO for small and medium-sized businesses and why it is important to be found in search results.
- Keyword research and audience definition: Different techniques for choosing the right keywords for your business and target audience will be covered, as well as the importance of long-tail keywords and local SEO.
- On-page optimization: Here, a closer look is taken at optimizing meta tags, headings, images, and the importance of a clear page structure.

Workshop 2: Off-Page Optimization and Content Strategies

- Link building strategies for SMBs: The experts will discuss how participants can generate high-quality backlinks and what practices should be avoided.
- Content marketing for SMBs: This covers the creation of relevant and informative content that appeals to the target audience of SMEs and helps improve their visibility.
- Leveraging AI for Content Optimization: It is covered how AI can support content creation and optimization to be more efficient and targeted.

Workshop 3: Technical SEO and Website Performance

- Mobile optimization: The critical importance of mobile optimization for SEO and practical tips on how to ensure a website is mobile-friendly will be discussed.
- Structured Data and Rich Snippets: This part will explain how SMEs can implement structured data on their website to get better search results with rich snippets.
- Using AI for technical optimization: It will be shown how AI tools can help to analyze and optimize technical aspects such as load times and server configurations.

Workshop 4: AI-Powered SEO Tools and Analytics

- Overview of leading AI tools: A selection of powerful AI-powered SEO tools will be presented that can help SMEs with analysis, keyword research, and competitor analysis.
- Data-Driven SEO and Decision Making: It will be shown how to effectively use data to improve SEO strategies and make informed decisions.
- Success measurement and reporting: It will be discussed which Key Performance Indicators (KPIs) should be tracked to measure the success of SEO efforts and how to create meaningful reports.

Value of service: Participants will learn hands-on how to use SEO and which AI-supported tools they can use to augment their SEO strategy.

Learning methods used: Each workshop will include a mix of presentations, practical exercises and discussions to ensure that the participants can directly apply what they have learned and that individual questions are answered.

List of references and/or learning resources: *Suchmaschinen-Optimierung: Das umfassende Handbuch*, Sebastian Erlhofer, 10. Aktualisierte Auflage, Rheinwerk Computing.

Overview slides: to be developed.

<table>
<tr><td colspan="2">Partner: HAW+TUHH</td><td colspan="2">Title: Prompt Engineering – better results when using ChatGPT and Stable Diffusion (Workshop)</td></tr>
<tr><td>Service: ST-1</td><td colspan="3">Target Group: all (Startups, Craft, Public, Administration, Logistics, Industry)</td></tr>
<tr><td colspan="2">Format: workshop</td><td>Focused on key technologies: generative AI</td><td>Status: planned</td></tr>
<tr><td colspan="4">Stakeholder from SME/PAs side: for those who want to learn hands-on how to use generative AI for their business</td></tr>
<tr><td colspan="4">Requirements for participation: none</td></tr>
<tr><td colspan="4">Duration: 240 minutes</td></tr>
</table>

Description of *"Prompt Engineering – better results when using ChatGPT and Stable Diffusion (Workshop)"*:

This workshop is dedicated to improving the results of using ChatGPT and Stable Diffusion specifically for SMEs. It is a co-format to "*Prompt Engineering: Better results when using ChatGPT and Stable Diffusion (Webinar)*" introduced above, however, goes into the subject in greater depth due to the length. Participants learn how to optimize the performance of ChatGPT and Stable Diffusion by cleverly formulation requests (prompts). Experts will share real-world examples and best practices to get better and more accurate answers from ChatGPT and Stable Diffusion.

Value of service:

- Participants will get a good understanding of text- and photo-generating AI
- Participants will learn the differences between several prompt engineering techniques
- Participants will learn what outcomes can be expected when using different prompt techniques
- Participants will learn the limitations of ChatGPT and Stable Diffusion

- Participants will have the ability, to use different prompt techniques and understand the chances and limitations of prompt engineering.

Learning methods used: discussion, practical exercises, demonstrations.

Overview slides: to be developed.

Partner: TUHH	**Title:** Workshops using the LEGO® SERIOUS PLAY® (LSP) method ("Qualification")	
Service: ST-2	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: "Qualification"	**Focused on key technologies:** Method work, work 4.0, new work	**Status:** planned /in preparation
Stakeholder from SME/PAs side: for those who want to get to know the benefits of using methods for their company & explicitly the LEGO(R) SERIOUS PLAY(R) method.		
Requirements for participation: none		
est. Duration: 60 - 480 minutes		

Description of *"Workshops using the LEGO® SERIOUS PLAY® method"*:

The improvement that can be achieved through the targeted use of methods is often underestimated, not only in SMEs. Among the numerous available methods, the LEGO® SERIOUS PLAY® (LSP) method stands out due to its versatility and ability to yield excellent results when used correctly. This method can be effectively applied to various topics such as team building, promoting creative and innovative thinking, product development, and strategy development. Depending on the workshop's specific focus, participants work on either a case study or a specific problem within their company. The duration of a workshop varies depending on the circumstances, ranging from a brief introduction lasting 60 minutes to multi-day events.

Value of service:

- Participants understand the benefits that the usage of methods – not only LSP – offer their organisation.
- The structure and procedure of a workshop using the LSP method are explained. The focus is on experience, which makes the method easier to understand.
- Participants go through a workshop with the LSP method.
- The principles used by the LSP method are explained:
  - Rapid Prototyping
  - Constructionism
  - Storytelling & Metaphors
  - Flow Theory
- It is shown when a workshop with the LSP method can and cannot be used.

Learning methods used: presentation, discussion and practical exercise.

List of references and/or learning resources:

LEGO® (2010): *Open-source: Introduction to LEGO® SERIOUS PLAY®*[18].

Overview slides: to be developed.

Partner: TUHH	**Title:** From linear to circular – Sustainable transformation of business models	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: "Qualification"	**Focused on key technologies:** Digitization	**Status:** planned /in operation
Stakeholder from SME/PAs side: for those with a need for improving their business model and transforming it to a circular one		
Requirements for participation: none		
est. Duration: 90 - 240 minutes		

Description of *"From linear to circular – Sustainable transformation of business models"*:

In the face of growing regulatory requirements, changing societal expectations and material shortages, SMEs increasingly feel pressure to transform their business model in a sustainable way. Manufacturers in particular need to start integrating the principles of the circular economy and thus change or even rethink their business model. This interactive format offers insights on what the circular economy is, which circular business models exist and might be suitable and possible starting points for transforming SMEs' business model into a more sustainable circular model. Moreover, it will provide the opportunity to exchange ideas with other companies that also want to take the path to a circular business model.

Value of service:

- Introduction to the circular economy and circular strategies
- Analysis of current position of SMEs business models in the circular context
- Analysis of suitable cooperation and partnerships that SMEs need when transforming their business model
- Discussion of arising opportunities and challenges
- Determination of further steps to take to develop a circular business model.

Learning methods used: presentation, discussion and practical exercise using a micro board.

List of references and/or learning resources:

1. Achterberg, E.; Hinfelaar, J.; Bocken, N. (2016): *Master circular business with the value hill*.[19]

[18] https://www.lego.com/cdn/cs/set/assets/blt8ec1d6ff766ddfd4/LEGO_SERIOUS_PLAY_OpenSource_14mb.pdf retrieved in Oktober 2023

[19] https://assets.website-files.com/5d26d80e8836af2d12ed1269/5dea74fe88e8a5c63e2c7121_finance-white-paper-20160923.pdf, retrieved on 02.11.2023.

2. Ellen MacArthur Foundation (2015): *Towards a Circular Economy: Business Rationale for an Accelerated Transition*.[20]
3. Europäische Kommission (2023): *Ökodesign für nachhaltige Produkte*.[21]
4. Fennemann, V.; Hohaus, C.; Kopka, J.-P. (2018): *Circular Economy Logistics: Für eine Kreislaufwirtschaft 4.0*.[22]
5. Lichtenthäler, S.; Neligan, A.: *How Circular Are Businesses in Germany?* in: Intereconomics, Vol. 58, No. 2, pp. 79-86 (2023).

Overview slides: see Annex 21.

Partner: TUHH	**Title:** Developing a future oriented business model – but how?	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: "Qualification"	**Focused on key technologies:** Digitization	**Status:** planned /in operation
Stakeholder from SME/PAs side: for those who want to shape their business model for a long-term successful competitive advantage		
Requirements for participation: none		
est. Duration: 2 x 5 hours (Modular structure and customizable)		

Description of *"Developing a future oriented business model – but how?"*:

In the age of societal changes (e.g., health, sustainability), ever new technologies (e.g., AI, quantum computing) and new market entrants, competition is getting faster and tougher. The behavior and needs of customers have also changed in recent years as a result of new technologies and new providers on the market. The common denominator in these topics is the business model because this is where corporate strategy and business processes meet. By combining technologies in old or new application fields, industry logics can be broken, and new business model innovations can be developed.

Value of service:

- Introduction to business models
- Analysis of the current business model (Business Model Canvas)
- Developing a picture of the future – What will influence me, my customers, and my business in the future?
- Introduction of digital technologies in SMEs (Technology Evaluation Canvas)
- Develop value proposition (Value Proposition Canvas)
- Exploitation portfolio and exploration portfolio (Portfolio map)
- Innovate business model (Business Model Navigator).

Learning methods used: presentation, discussion and practical exercise.

[20] https://www.ellenmacarthurfoundation.org/towards-a-circular-economy-business-rationale-for-an-accelerated-transition, retrieved on 02.11.2023.

[21] https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/sustainable-products/ecodesign-sustainable-products_de, retrieved on 02.11.2023.

[22] https://www.innovationslabor-logistik.de/wp-content/uploads/2017/10/07_Whitepaper_CE_WEB.pdf, retrieved on 27.10.2023.

List of references:

1. Gassmann, O.; Frankenberger, K. & Csik, M. (2017): *Geschäftsmodelle entwickeln: 55 innovative Konzepte mit dem St. Galler Business Model Navigator*. 2. Aufl., München: Hanser.
2. Linssen, O, Mikusz, M, Yigitbas, E, Volland, A, Engstler, M, Fazal-Baqaie, M & Kuhrmann, M (Hrsg.) (2019): *Einführung von digitalen Technologien in KMU – Vorgehensmodell und Technology Evaluation Canvas, Neue Vorgehensmodelle in Projekten – Führung, Kulturen und Infrastrukturen im Wandel*. gemeinsame Tagung der Fachgruppen Projektmanagement (WI-PM), Vorgehensmodelle (WI-VM) und Software Produktmanagement (WI-ProdM) im Fachgebiet Wirtschaftsinformatik der Gesellschaft für Informatik e.V. in Kooperation mit der Fachgruppe IT-Projektmanagement der GPM e.V.: 24. und 25. Oktober 2019 in Lörrach
3. Osterwalder, A. & Pigneur, Y. (2010): *Business model generation: A handbook for visionaries, game changers, and challengers.* Hoboken, NJ: Wiley.
4. Osterwalder, et al. (2014): *Value proposition design: how to create products and services customers want*. Hoboken, NJ: Wiley.
5. Rüger et al. (2018): *Geschäftsmodell-Innovationen richtig umsetzen. Vom Technologiemarkt zum Markterfolg*. Stuttgart: Fraunhofer Institut für Arbeitswirtschaft und Organisation.
6. Schallmo, D. & Lohse, J. (2020): *Digitalstrategien erfolgreich entwickeln. Grundlagen, Ansätze und Vorgehensweise.* Wiesbaden: Springer Gabler.

Overview slides: see Annex 15 (English) and 16 (German).

<table>
<tr><td colspan="2">Partner: TUHH</td><td colspan="2">Title: Digital technologies to enhance scope 3 carbon accounting</td></tr>
<tr><td>Service: ST-1</td><td colspan="3">Target Group: all (Startups, Craft, Public, Administration, Logistics, Industry)</td></tr>
<tr><td colspan="2">Format: “Qualification”</td><td>Focused on key technologies: Digitization, Blockchain, Cloud</td><td>Status: planned / in operation</td></tr>
<tr><td colspan="4">Stakeholder from SME/PAs side: for those with a need for digital technologies to support scope 3 carbon accounting</td></tr>
<tr><td colspan="4">Requirements for participation: none</td></tr>
<tr><td colspan="4">est. Duration: 90 - 240 minutes</td></tr>
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Description of *“Digital technologies to enhance scope 3 carbon accounting?”*:

Complex and sometimes non-transparent supply chain structures make it difficult to fully capture emissions. To date, the lack of resources and expertise in particular have prevented companies from establishing such climate issues strategically and operationally. By using digital technologies for scope 3 carbon accounting, companies and their value creation partners have completely new possibilities to present and evaluate emission shares in a holistic way. In this format, the topic of emissions accounting as well as possibilities for calculating the CO2 footprint will be introduced.

Subsequently, a decision support tool for the implementation of scope 3 carbon accounting will be presented. In the form of an interactive guide this tool aims to support SMEs in their decision on the target-oriented integration of digital technologies into scope 3 carbon accounting and to

provide helpful tips. Based on this, SMEs can generate new impulses for addressing challenges concerning carbon accounting in their company.

Value of service:

- Introduction to the carbon footprint and its importance for SMEs
- Calculation options for the carbon footprint
- Presentation and discussion of supporting technologies for scope 3 carbon accounting
- Demonstration of the decision support tool and its purpose and application. How does it work? Which solutions can be generated using the tool and how can it support decision making?

Learning methods used: presentation, discussion and practical exercise using a micro board.

List of references:

1. Csutora, M.; Harangozo, G.: *Twenty years of carbon accounting and auditing – a review and outlook.* In: Society and Economy 39 (2017) 4, pp. 459–80.
2. Garrido-Hidalgo, C.; Olivares, T.; Ramirez, F. J.; Roda-Sanchez, L.: *An end-to-end Internet of Things solution for Reverse Supply Chain Management in Industry 4.0.* In: Computers in Industry 112 (2019), pp. 103127.
3. Huang, Y. A.; Weber, C. L.; Matthews, H. S.: *Categorization of Scope 3 emissions for streamlined enterprise carbon footprinting.* In: Environmental science & technology 43 (2009) 22, pp. 8509–15.
4. Lee, S.-Y.: Drivers for the participation of small and medium-sized suppliers in green supply chain initiatives. In: Supply Chain Management: An International Journal 13 (2008) 3, pp. 185–98.
5. Patchell, J.: *Can the implications of the GHG Protocol's scope 3 standard be realized?* In: Journal of Cleaner Production 185 (2018), pp. 941–58.
6. Royo, B.: *Measuring and Allocating Scope 3 GHG Emissions.* In: Müller, B.; Meyer, G. (Hrsg.): Towards User-Centric Transport in Europe 2. Enablers of Inclusive, Seamless and Sustainable Mobility. Cham 2020.
7. Rusch, M.; Schöggl, J.-P.; Baumgartner, R. J.: *Application of digital technologies for sustainable product management in a circular economy: A review.* In: Business Strategy and the Environment (2022).
8. Schmidt, M.; Nill, M.; Scholz, J.: *Die Bedeutung der Lieferkette für den Klimafußabdruck von Unternehmen.* In: Chemie Ingenieur Technik 93 (2021) 11, pp. 1692–706.
9. Talbot, D.; Boiral, O.: *GHG Reporting and Impression Management: An Assessment of Sustainability Reports from the Energy Sector*. In: Journal of Business Ethics 147 (2018) 2, pp. 367–83.
10. WBCSD: *Pathfinder Framework. Guidance for the Accounting and Exchange of Product Life Cycle Emissions*.[23]
11. WRI; WBCSD: *Corporate Value Chain (Scope 3) Accounting and Reporting Standard.*[24]

Overview slides: see Annex 17 (English) and 18 (German).

[23] URL: https://www.wbcsd.org/contentwbc/download/13299/194600/1, retrieved on 06.11.2022.

[24] URL: https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf, retrieved on 09.11.2022.

Partner: TUHH	**Title:** Machine Learning basics: how to create value with ML	
Service: ST-1	**Target Group:** all, focus on production companies	
Format: "Qualification"	**Focused on key technologies:** Machine Learning	**Status:** in operation
Stakeholder from SME/PAs side: everyone who can use Machine Learning to improve productivity		
Requirements for participation: none		
Duration: about 120 to 150 minutes depending on group size		

Description of *"Machine Learning basics: how to create value with ML"*:

The workshop consists of a presentation and two practical sessions. The presentation briefly explains the concepts of AI and ML and the differences between the two. During the first practical session small groups work through four examples that are meant to highlight the difference between the two concepts. This session mainly serves as a warmup exercise and to get to know (some) of the other participants.

The presentation continues with practical examples how to use ML in production, logistics, and product development. At that point every participant is asked to either pick one of the examples or come up with their own use case. After that the presentation goes into more detail and explains more technical concepts of AI. The idea is to start from a practical use case and then step by step increasing the resolution, effectively turning the usually method of frontal teaching upside down. Allegorically: instead of teaching letters, then words, then sentences, this presentation first shows sentences as eye catchers, then teaches words, and finally the letters. The rationale behind this being that the motivation is highest when people have in front of their eyes why they need to understand (technical) concepts.

Finally, the presentation summarizes all of the taught concepts and finishes with the final practical session, in which small groups are to create their own ML/digitalization roadmap, which will later be presented to the entire group. Participants often choose their own company for their ML example.

Value of service:

- Understanding the difference between AI in general and ML in specific
- Awareness of possibilities for ML applications in the business world
- Knowing the difference between supervised, unsupervised, and reinforcement learning
- Understanding the basic statistical principles underlying ML
- Low resolution ML implementation roadmap

Learning methods used: presentation, practical exercises, group discussions.

Overview slides: see Annex 19 (English) and 20 (German).

Partner: TUHH, HAW		**Title:** The smart supply chain – more transparency through IoT and decentralised networks	
Service: ST-5	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)		
Format: "Demonstration"		**Focused on key technologies:** Digitization, IoT, Cloud, and Logistics	**Status:** in operation
Stakeholder from SME/PAs side: for those with a need for improving their skills in Digitization and Logistics			
Requirements for participation: none			
est. Duration: 45 - 120 minutes			

Description of *"The smart supply chain – more transparency through IoT and decentralised networks"*:

Transparency and automation are playing an increasingly important role in increasing efficiency, resilience, and sustainability in supply chains. A key to this is the integration of supply chains through digital technologies such as cloud computing, blockchain, RFID or sensor technology.

Within the format, an interactive demonstrator is used to show an approach for integrating shippers, logistics service providers and shipping companies on a decentralized data platform. The stakeholders can exchange data, view stored data and use it for data-driven decision-making processes with the help of data analysis and AI. The platform provides standardized interfaces for integration into the companies' own ERP (Enterprise Resource Planning) systems or TMSs (Transportation Management Systems).

An interactive web application and a model train are used to provide a better understanding of the interaction between the flow of goods, sensors, and the data platform.

Value of service:

- Goals and requirements in today's supply chains
- Areas of application for Information and Communication Technologies (ICT) in logistics
- Overview of application areas and functioning of digital technologies in logistics
- Forms of communication in global supply chains
- Requirements and objectives for the use of digital technologies
- Implementation example based on a case study in the maritime supply chain.

Learning methods used: Presentation, Demonstration, Discussion, Case study.

List of references and/or learning resources:

1. Bousonville, T. (2017). Logistik 4.0: *Die digitale Transformation der Wertschöpfungskette.* Wiesbaden: Springer Gabler.
2. Behdani, Behzad; Fan, Yun; Bloemhof, Jacqueline M. (2019): *Cool chain and temperature-controlled transport: An overview of concepts, challenges, and technologies.* In: Riccardo Accorsi und Riccardo Manzini (Hg.): Sustainable Food Supply Chains: Elsevier, pp. 167-183.
3. Otto, Boris; Jürjens, Jan; Schon, Jochen; Auer, Sören; Menz, Nadja; Wenzel, Sven; Cirullies (2016): *INDUSTRIAL DATA SPACE. DIGITALE SOUVERÄNITÄT ÜBER DATEN.* Hg. v. Fraunhofer Gesellschaft und Industrial Data Space e.V.

4. Sony Network Communications Europe BV. (Hg.) (2021): *Tracking technologies for supply chain visibility. A guide to help supply chain managers find the perfect fit.*
5. Teucke, M.; Broda, E.; Freitag, M. (2022): *An Inter organizational Digital Platform for Efficient Container Transportation.* In: Lecture Notes in Logistics, pp. 290-300.

Overview slides: see Annex 22.

Partner: HWK		**Title:** Current topics in digital transformation (Info event)	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)		
Format: "Info event" (online/in presence)		**Focused on key technologies:** AI, Digitisation, Cybersecurity	**Status:** in operation
Stakeholder from SME/PAs side: for those with a need for improving their skills in current topics of digital transformation			
Requirements for participation: none			
est. Duration: 60 - 120 minutes			

Description of *"Current topics in digital transformation – Info event"*:

The information events are specifically designed to provide small and medium-sized enterprises with a low-barrier entry to digitalization topics. The scope of topics covered in these events is wide-ranging and dynamic, reflecting the evolving nature of digital technologies and their application in business processes. The info events are designed to keep businesses informed about the latest developments in digitalization, offering practical solutions to implement these technologies in their operations. This service not only helps SMEs keep pace with the digital era but also provides the necessary tools and knowledge to excel in it.

Value of service:

The HWK information events service aims to offer quick and efficient overviews of relevant digitalization topics in an engaging manner. Not only do these events provide valuable insights, but they also create an open platform for SMEs to discuss and exchange ideas, fostering a collaborative environment to drive digital transformation. Examples of the areas covered include:

- Paperless office transformation
- Implementation of ERP (Enterprise Resource Planning), CRM (Customer Relationship Management) and DMS (Document Management System) software
- Agile project management
- Automation of office tasks such as automated billing, digital fabrication including 3D printing, and AI usage in office tasks

By attending these events, companies can enhance their digital competency, improve operational efficiency, and gain a competitive edge in today's digital marketplace.

Overview slides: not published here

Partner: HWK	**Title:** Current topics in digital transformation (Experience Exchange)	
Service: ST-1	**Target Group:** all (Startups, Craft, Public, Administration, Logistics, Industry)	
Format: "Experience Exchange" (in presence)	**Focused on key technologies:** AI, Digitisation, Cybersecurity	**Status:** in operation
Stakeholder from SME/PAs side: for those with a need for improving their skills in current topics of digital transformation		
Requirements for participation: none		
est. Duration: 1 - 3 hours		

Description of *"Current topics in digital transformation – Experience Exchange"*:

Experience Exchange creates a valuable forum for small and medium-sized enterprises (SMEs) and craftspeople to share insights, ideas, and best practices around digitization topics. The service is designed to facilitate the sharing of knowledge and experiences in the context of digital transformation. It presents a unique opportunity for businesses to discuss common interests, challenges, and potential projects while networking with like-minded peers in their sector.

Value of service:

The Experience Exchange Service covers a wide variety of digitalization topics, allowing participants to delve into specific areas of interest or explore new digital trends. The format typically involves in-person meetings with around 20 attendees, primarily targeting crafts businesses, often represented by their managing directors. During the 2-3 hour event, participants are engaged through a variety of interactive formats. They may be challenged with provocative ideas, prompted to take a stance on various statements, or participate in a "World Café" setting where different tables host discussions on distinct topics. These methods are designed to provoke thought, foster debate, and ensure active participation. Whether the discussion revolves around the implementation of AI in office tasks, the transformation towards a paperless office, or the integration of digital fabrication techniques such as 3D printing, this platform provides a vibrant space for collaborative learning and idea generation. Moreover, these events enable participants to learn more about the range of services and resources available as part of the EDIH project. By facilitating direct exchanges within the community of SMEs and craftspeople, this service fosters a community of digital learners and innovators. Ultimately, the goal of the Experience Exchange Service is to support businesses in their digital journey by providing a platform where they can gain insights, share experiences, and collectively contribute to the evolving narrative of digital transformation in the SME and craft sectors.

Learning methods used: Discussion.

Source: Mittelstand-Digital Zentrum (MDZ) Hamburg[25].

Materials: Example Service Experience Exchange with the topic time recording software (see Annex 23).

[25] https://www.kompetenzzentrum-hamburg.digital, retrieved November 2023

Partner: HWK	**Title:** Digitalization Consultation	
Service: ST-1	**Target Group:** Small and medium-sized enterprises (SME), Crafts-people	
Format: Consultation/Coaching	**Focused on key technologies:** broad spectrum of topics	**Status:** in operation
Stakeholder from SME/PAs side: managers		
Requirements for participation: none		
Duration: 4 - 18 hours		

Description of *"Digitalization Consultation"*:

The Hamburg Chamber of Skilled Crafts (HWK) offers tailored digitalization consultations. These consultations aim to help craft businesses optimize and streamline their digital transformation. The digitalization consultations cover a broad spectrum of topics, including enhancing the digital basic skills of employees, the introduction of a paperless office, digital time recording, improved file management, IT security, data protection, resource management through ERP systems, CRM systems, file management DMS systems, and substitutive scanning. Furthermore, the use of AI products in administration and digital and additive manufacturing, including 3D printing, CAD (Computer Aided Design), and 3D scanning, are considered.

The consultations are tailored to the individual needs of the businesses and follow a "help to self-help" approach, adapting flexibly to the diverse range of business models and sizes within the SME spectrum. After an initial discussion with the SME to understand their vision and challenges, a comprehensive mind map of the business structure is created, which visually organizes the main processes and outlines the project scope. This step is crucial as it provides a clear blueprint of the business's operations and identifies key areas for digital enhancement.

Given that many SMEs may not be accustomed to project-based communication, a structured project plan based on the waterfall model is usually recommended for collaboration. This traditional project management approach offers a linear, straightforward progression that can be easier for SMEs to follow, ensuring clarity and predictability in project milestones.

Once the initial interview is conducted and the project plan is laid out, a thorough research phase is undertaken to identify solutions that are sensitive to the size of the SME. It is acknowledged that a smaller company, for instance with fewer than 20 employees, will have different resources and capacities compared to larger ones. Their processes tend to be more organic and potentially less efficient, thus any proposed software or digitalization measures need to be carefully calibrated to enhance efficiency without overwhelming the existing business infrastructure. In this way, our digitalization consultations ensure that the recommended strategies are not only technically sound but also realistically implementable, respecting the unique operational rhythms and cultural dynamics of each SME.

Over time, after offering a comprehensive range of digitalization topics, trends have been observed in the areas most frequently sought after by SMEs: Key topics that have emerged as in-demand include ERP software selection and implementation, digital time recording solutions, additive manufacturing, and IT security. In response to this demand, a collection of guides and instructional materials focusing on these primary fields was initiated and continuously refined. Among them, ERP software selection has taken precedence due to its critical role in optimizing business operations. In collaboration with a local partner, a three-part

workshop was developed specifically on the topic of ERP systems, which has since become a model for our other consulting services.

Understanding the constraints of SMEs, where it is often not feasible for staff to be absent for extended workshop durations, this workshop has been designed to integrate seamlessly into daily business activities. The structured plan of the workshop entails:

Example: ERP Software Consultation

1. Modeling Business Processes: Identifying and mapping out core business operations.
2. Identifying Pain Points: Analyzing the processes to pinpoint areas that could benefit from digital optimization.
3. Software Exploration: Generating a longlist of 5-8 potential ERP software suppliers based on the business's specific needs.
4. Detailed Research: Evaluating each software option in-depth to develop a shortlist of 2-4 candidates.
5. Live Demonstrations: Arranging for demonstrations from the shortlisted suppliers to offer insight into the software's functionality and compatibility with the SME's requirements.
6. Decision Making: Selecting the most suitable ERP package by weighing up its features against its cost.
7. Implementation Assistance: Facilitating the implementation process with the support of the chosen software supplier.

At the implementation phase, advice is often also provided on applying for external funding, which may be available through local funding programmes for digitalization in order to alleviate the financial burden for the SME. This comprehensive workshop structure and the consultation process ensure that the digital transformation is not only strategic but also economically viable for the SMEs.

Example: IT Security Consultation:

In the digital era, IT security is a critical aspect that underpins the integrity and reliability of business operations. As cyber threats evolve, it is crucial for SMEs to strengthen their digital resilience. An IT Security Consultation is designed to build robust defenses against such vulnerabilities through a comprehensive, step-by-step approach:

1. Risk Assessment: Conducting a thorough analysis of the business's current IT infrastructure to identify vulnerabilities.
2. Security Policy Development: Collaborating to develop or refine the company's IT security policies, ensuring they are comprehensive and up-to-date.
3. Solution Exploration: Creating an extensive list of IT security solutions tailored to the size and nature of the business.
4. Focused Research: Narrowing down the options to a curated selection of tools and services that align with the business's specific security needs.
5. Vendor Demonstrations: Arranging sessions with vendors to showcase how their solutions can safeguard the business's assets.
6. Strategic Selection: Assisting in choosing the most appropriate security measures considering both functionality and cost-efficiency.

7. Implementation Roadmap: Outlining a clear and structured plan for the integration of the selected IT security measures.
8. Training and Awareness: Offering workshops to increase employee awareness about security best practices and the importance of compliance.

Example: Additive Manufacturing Consultation:

Additive manufacturing stands at the forefront of industrial innovation, offering unparalleled flexibility in design and production. The consultation services in this field are aimed at harnessing the potential of 3D printing and related technologies to revolutionize SMEs' manufacturing processes, from concept to creation:

1. Technology Assessment: Evaluating the SME's current manufacturing processes to determine the applicability of additive technologies.
2. Design and Prototyping: Assisting in understanding the design constraints and possibilities of additive manufacturing, including material selection and product prototyping.
3. Equipment and Supplier Evaluation: Compiling a detailed list of appropriate additive manufacturing equipment and suppliers.
4. Cost-Benefit Analysis: Analyzing the potential ROI (Return on Investment) and the long-term benefits of adopting additive manufacturing technologies.
5. Practical Demonstrations: Facilitating demonstrations with technology providers to illustrate the capabilities of additive manufacturing in a real-world setting.
6. Strategic Planning: Developing a tailored strategy for integrating additive manufacturing into the SME's production line.
7. Funding and Incentives Guidance: Providing information on potential financial support options, such as government incentives for adopting new manufacturing technologies.
8. Ongoing Support and Training: Offering continuous support and training opportunities to ensure the SME can fully exploit the advantages of additive manufacturing.

Example: Digital Time Recording Software Consultation:

Digital time recording is an essential tool for enhancing the efficiency of SME operations, providing accurate insights into employee productivity and business time allocation. The consultations aim to implement intuitive and efficient time management systems, which are vital for contemporary workforce management:

1. Workflow Analysis: Mapping out the SME's workflow to understand the dynamics of time tracking requirements.
2. System Requirement Specification: Identifying key features needed in a time recording system based on the SME's operational needs.
3. Software Options Collation: Gathering a comprehensive list of digital time recording software that fits the identified criteria.
4. In-Depth Software Evaluation: Diving deeper into the functionalities of each system to ensure a good fit for the SME.
5. Interactive Software Demos: Organizing interactive demos to provide a hands-on experience with the shortlisted time recording solutions.
6. Decision Assistance: Helping the SME choose the most efficient and user-friendly system.
7. Setup and Customization: Aiding in the setup and customization of the chosen software to align with the SME's business processes.

8. Training Sessions: Conducting training sessions for employees to familiarize them with the new time recording system and ensuring a smooth transition.
9. Each sector-specific consultation is meticulously structured to enable SMEs to integrate new technologies effectively, ensuring they are well-positioned to meet the challenges of the digital landscape.

Value of service:

This service helps to strengthen the digital competencies of craft businesses and enables them to effectively master the challenges and opportunities of digitalization.

Learning methods used: Lecture, Discussion, Demonstration

Materials: Example Slide showing the consultation process (Annex 24), Infographic ERP Software selection (Annex 25), List process inventory for initial interview with SME (Annex 26).

Partner: ARIC	**Title:** ARIC Insights	
Service: ST-3	**Target Group:** all (Startups, Craft, Public Administration, Logistics, Industry)	
Format: Workshop	**Focused on key technologies:** AI	**Status:** in operation
Stakeholder from SME/PAs side: those with a need for improving their skills in current topics of AI		
Requirements for participation: none		
est. Duration: 120 - 240 minutes		

Description of *"ARIC Insights"*:

In this format a partner with deep insight holds a workshop in current AI topics and technologies and their applications. For conducting seminars on a specific topic, specialists and researchers in the relevant field are invited. The duration of each seminar is determined individually by its speaker based on the volume, content and complexity of the material being presented.

Value of service:

Insights are provided for a variety of relevant questions, e.g.:

- Ethics and AI Bias: Artificial intelligence has no prejudices, feelings or emotions and yet we hear again and again about AI systems that discriminate against or even favour groups of people. It seems that AI acts in a discriminatory and racist way, but where does this come from and how can it be changed? In this workshop, we will show you why AI is never completely unbiased, when a so-called bias is desired and when it is not. The workshop will highlight what can and must be done in AI projects to counteract unwanted bias and what else we need to consider to train as ethically as possible.
- ChatGPT[26]: Hardly any AI development in recent years has made as many waves as ChatGPT, the textbot developed by OpenAI[27] that is supposed to solve pretty much any task: whether it is school essays, technical lectures or the development of executable

[26] https://openai.com/blog/chatgpt, retrieved in May 2023

[27] https://openai.com, retrieved in May 2023

computer programs. The product promise, like any disruptive technology, borders on magic: A request is simply typed into the chat window and ChatGPT spits out the solution. Within the first 5 days of its release in November 22, 2022, over 1 million people worldwide signed up to rub shoulders with the magic lamp of knowledge for once and (another concomitant of mass success) caused the OpenAI servers to overload. Is this more than an ingenious marketing coup? Is the super chatbot that is supposed to open up the land of knowledge for us the expected breakthrough of an easy-to-use AI for the masses? And: Does OpenAI threaten the quasi-monopoly of global knowledge organization that Google has built up over the past decades? These are the questions that are addressed in the ARIC workshop: Is ChatGPT the ultimate disruption for Artificial Intelligence?

- Who is liable for AI errors? Even an AI can make mistakes. Under which circumstances the provider is liable has been controversial so far. The EU Commission has now presented a draft AI liability directive that should provide clarity. Experts explain the new set of rules and the consequences for companies.
- Framework conditions for AI projects: What executives need to know. What are the expectations and what is the understanding? Which tasks can be solved with AI and which are better left unsolved? What are the evolutionally steps, efforts and teams for AI Project? What are the principles and importance of each component of AI project: PoC (Proof of Concept), MVP (Minimal Valuable Product), Data, IT landscape, ROI (Return of Investment), 'Make or buy' strategic, etc.?
- The tension between AI and Cybersecurity: in the field of cybersecurity, both attackers and defenders utilize "artificial intelligence" to achieve their opposing goals. Additionally, AI systems themselves are vulnerable and need protection. What are the points of the intersection between AI and cybersecurity? What is the current state of research and development in this area?

Learning methods used: lecture, discussion, demonstration, case studies.

Slides and other materials: each seminar utilizes slides, demonstrators, and other proper materials provided by the seminar speaker.

Partner: ARIC	**Title:** LLMs in logistics – opportunities and risks of Bard, ChatGPT & Co	
Service: ST-3	**Target Group:** all (Startups, Craft, Public Administration, Logistics, Industry)	
Format: Masterclass	**Focused on key technologies:** AI	**Status:** in operation
Stakeholder from SME/PAs side: those with a need for improving their skills in current topics of AI		
Requirements for participation: none		
est. Duration: 30 minutes		

Description of *"LLMs in logistics – opportunities and risks of Bard, ChatGPT & Co"*:

This masterclass is designed to give an insight into why, where and how one can get started with AI in the company. It consists of four thematic parts:

- AI & LLMs – how does it actually work? (What are the foundational principles from computer science and statistics that form the basis of AI technology? How do these

principles contribute to the development and functionality of AI systems? How does ChatGPT work?)
- Where does AI make sense? (AI application domains: generation, recognition, prediction, optimization; use cases)
- Risks & recommendations. (Possible risks and issues when using AI; a check box for legal aspects of the implementation of AI; recommendations on "Why, where and how to start with AI in the company?")
- Discussion (The potential risks that companies must take into account when implementing AI and the best practices for responsibly integrating AI into their daily operations).

Value of service: This service helps to

- unlock the transformative power of LLMs in logistics industry
- explore the vast opportunities and potential risks associated with advanced technologies like Bard, ChatGPT, and others
- understand how these cutting-edge tools can revolutionize logistics operations
- gain insights into practical applications and navigate potential challenges.

Learning methods used: lecture, case studies.

Overview slides: see Annex 27.

Partner: ARIC	**Title:** Workshop for Startup Support Programs: How to identify AI in Startups?	
Service: ST-3	**Target Group:** Startups	
Format: workshop	**Focused on key technologies:** AI	**Status:** in operation
Stakeholder from SME/PAs side: those with a need for improving their skills in current topics of AI		
Requirements for participation: none		
Duration: 90 minutes		

Description of *"Workshop for Startup Support Programs: How to identify AI in Startups?"*:

This session supports institutions that are either accelerators, incubators or financing partners for startups by providing them with both technical as well as practical content. While more and more companies claim to have AI as a part of their business model, this is very often only used to please investors. The session will first give the target group (which usually have a good business background, but no technical experience) a hands-on overview of AI, followed by top 5 questions to ask companies to discover how far AI is being used by them. The workshop is designed for a basic level of knowledge on AI technology.

Value of service:

This service helps to:

- get known und understand the basic terms of AI technology
- explore variety of the AI types, tasks and learning methods

- get an overview of technical possibilities and ethical limitations of AI implementation
- understand how much useful AI is in an own startup.

Learning methods used: lecture, demonstration, role-playing.

Overview slides: see Annex 28.

2.4 General certificate of participation

Upon completion of the training, participants can receive a Certificate of Attendance issued by *EDIH Academy*. Certificate of attendance includes the following elements:

- Title of the course
- Full name of participant attending the course
- A clear statement confirming the participant's attendance at the specified training
- Name and logo of the institution providing the training
- Signature of an authorized representative of the organizing institution
- EDIH-Hamburg logo
- The date of issue of the certificate

An example of a certificate of attendance issued by *EDIH Academy* is given in Annex 33.

2.5 Continuous Improvement Process

To ensure the content and delivery methods of the Skills & Training formats developed remain relevant and effective, an iterative feedback loop will be undertaken. Tailoring training formats to the identified preferences and needs of the project's target groups, namely the SMEs and the private sector, aims to enhance the overall learning experience and encourage active engagement.

There are several stages in the process of iterative feedback loop:

1) Developing a questionnaire for the participants
2) Conducting surveys
3) Collecting and segregating the responses from participants
4) Processing and analysing the responses
5) Summarising the results and outcomes
6) Survey results integration

At the present stage, a questionnaire for the customer feedback is developed and given in Annex 29 (German) and 30 (English). The survey-management system *EUSurvey*[28] will be used to access the developed questionnaire. This will ensure that the feedback mechanism is user-friendly and easily accessible.

Other stages of the feedback loop will be conducted in the next year of the project implementation. The implementation of the survey will be carried out on the participants of the Skills & Training formats. Those attending will be asked to complete a questionnaire. The feedback data collected will be analysed to extract meaningful insights to be integrated into

[28] https://ec.europa.eu/eusurvey/, retrieved November 2023

EDIH Academy vision. This analysis will also help to understand which of the developed and provided Skills & Training formats have the potential to be transformed into a certified course.

3. Certificate Courses for Key Technologies

Rapid advances in technology require companies to adapt quickly. Many SMEs and PSOs may face a lack of skills and knowledge on actual key technologies within their workforce. Offering learning courses helps to address skills gaps by equipping employees with the knowledge they need to effectively implement innovative solutions that give organisations a competitive edge.

A certificate course will benefit from the application-oriented approach: problem and project-based learning helps to focus on transfer of knowledge, strengthening practical relevance and competencies that are needed in the real world.

After completing the course, its participants will be facilitated to implement each-one-teach-one and train-the-trainer methods for company empowerment. Each-one-teach-one method can contribute to the reinforcement and consolidation of the learning outcomes achieved.[29] Train-the-trainer method helps to disseminate knowledge and skills across the organisation, reduce training costs, and increase employee engagement and retention.[30]

3.1 Methodology of a Certificate Course

A certificate course offered by *EDIH Academy* will be based on blended-learning[31, 32] concept. It provides a well-rounded and adaptable approach to education, offering the benefits of both traditional and online learning.

Key features of blended learning include:

- Face-to-face sessions: traditional classroom sessions where students and instructors meet face-to-face for direct interaction and instruction.
- Online learning: the use of digital resources such as e-learning modules, videos, discussion forums and other online materials to supplement and enhance face-to-face instruction.
- Flexibility: blended learning offers flexibility in terms of time, place and pace of learning. Students can access online content at their convenience, while still attending scheduled face-to-face sessions.
- Individualised learning paths: the combination of face-to-face and online components allows for a more personalised learning experience that accommodates different learning styles and preferences.
- Technology integration: blended learning often incorporates technology tools and platforms to enhance the learning process.

The following structure of the training course with certification will be proposed:

I. General Introduction (Kick-off). This is the first session of the course where participants get to know each other, the trainer and the objectives of the course. The trainer will explain the course outline, learning objective, the expected outcomes and assessment

[29] https://nmssanctuaries.blob.core.windows.net/sanctuaries-prod/media/archive/management/pdfs/Day10_H8_Eachoneteachone.pdf, retrieved November 2023.

[30] https://www.sessionlab.com/blog/train-the-trainer-model/ retrieved November 2023

[31] Michael B. Horn and Heather Staker, *Blended: Using Disruptive Innovation to Improve Schools*: Jossey-Bass, 2014.

[32] Jennifer Hofmann, *Blended Learning*, in: What Works in Talent Development, ATD series, 2018.

criteria. Students will also have the opportunity to ask questions and share their motivations and goals for attending the course.

II. Essential material. The course content will be divided into several modules, each covering a specific topic or skill related to the course theme. The modules will consist of different learning materials such as videos, readings, quizzes and assignments.

Module 1: will contain the theoretical foundations of the topic. The trainer will state the name of the module, its aim, the key concepts and terms that will be used and the learning methods that will be employed (e.g. lecture, demonstration, discussion etc.), indicate how participants' understanding of this module (e.g. test, survey, exercise, etc.) will be assessed.

Module 2: will contain the practical application of the topic. The trainer will use the same format as for Module 1, but focus on activities that allow participants to apply their knowledge and skills to real-life situations (e.g. simulation, project, group work, etc.). The trainer will indicate the assessment of participants' performance for this module (e.g. feedback, portfolio, presentation, etc.).

III. Practical Exercises & Tasks with Solutions. In addition to the theoretical material, the course will also include practical exercises and tasks that will allow participants to apply what they have learned and demonstrate their competencies. The exercises and tasks are designed to simulate real-life scenarios and challenges related to the course topic. Participants will receive feedback and solutions from the trainer and their peers on their performance and progress.

IV. Examination & Certification. At the end of the course, participants will be required to take a final exam to assess their knowledge and skills acquired throughout the course. The exam consists of multiple choice questions, short answer questions and case studies. The exam is timed and proctored to ensure the validity and reliability of the results. Participants who pass the exam with a score of 60% or higher will receive a certificate of completion attesting to their proficiency and qualification in the course topic. The certificate will include the course name, date, duration and instructor.

V. Feedback & Reflection. After the exam, participants are asked to provide feedback on the course design, delivery and outcomes. They are also encouraged to reflect on their own learning experiences, achievements and challenges. The feedback and reflection will help the trainer and *EDIH Academy* to improve the quality and effectiveness of the course and identify areas for further development and improvement.

3.2 Testing of a Certificate Course

To equip project's target groups with the best tools to thrive in a digital age, one (or several) of available online courses with certification will be tested in *EDIH Academy* over the next year of the project.

The *EDIH Academy* will offer its target groups a testing certification course in one of the most relevant and fastest expanding technologies – AI. Why AI technologies? This choice of the topic is based on its relevance, examples of experience of rapid adaptation of acquired knowledge to practical application, and the availability of representatives of the AI expert community in the project partner organisations who can contribute to assess the quality of the proposed course. Access to AI training enables SMEs to remain competitive in a rapidly

evolving business landscape, whereas PSOs – to improve efficiency, optimise processes and gain to innovative solutions, that is in line with the goals of the project.

There is a range of commercial courses for key AI technologies with generally recognised certificates on the market. As a possible provider of a certificate course the following sources will be taken into consideration:

1.	MinnaLearn [33]
2.	Elements of AI[34]
3.	KI-Campus[35]
4.	HKBiS Handelskammer Hamburg Bildungs-Service[36]
5.	Initiative for Applied Artificial Intelligence[37]
6.	Udacity[38]
7.	Fraunhofer. Big Data AI[39]
8.	Iversity[40]
9.	edX[41]
10.	PUNK (by WBS)[42]
11.	Digital Learning Institute[43]

Table 2: Certificate courses sources

By considering these different sources, we are aiming to provide a well-rounded and time-relevant certificate course that meets the specific needs of the project's target groups, while ensuring the high quality of training in key AI technologies.

As a pilot certificate course offered by the *EDIH Academy*, one of the available commercial courses will be selected, made available to the project's target audience and evaluated for the relevance through a developed questionnaire (Annex 31 (German) and 32 (English)). This evaluation aims to analyse the actual AI training needs of the project's target groups, namely

[33] https://www.minnalearn.com/elements-of-ai-for-business/, retrieved in November 2023

[34] https://www.elementsofai.com/, retrieved in November 2023

[35] https://ki-campus.org/, retrieved November 2023

[36] https://hkbis.de/ihk-weiterbildung-kuenstliche-intelligenz/, retrieved in November 2023

[37] https://www.appliedai.de/loesungen-services/weiterbildung, retrieved in November 2023

[38] https://www.udacity.com/school/artificial-intelligence, retrieved in November 2023

[39] https://www.bigdata-ai.fraunhofer.de/de/data-scientist/schulungssuche/kompakteinstieg-kuenstliche-intelligenz.html, retrieved in November 2023

[40] https://iversity.org/de/courses/kunstliche-intelligenz-und-maschinelles-lernen, retrieved in November 2023

[41] https://www.edx.org/certificates/professional-certificate/databricks-large-language-models?irclickid=2L7R7K1QxxyPUa3TYZ22JS2OUkFQdvWlg28bWM0&utm_source=affiliate&utm_medium=Edukatico&utm_campaign=Online%20Tracking%20Link_&utm_content=ONLINE_TRACKING_LINK&irgwc=1, retrieved in November 2023

[42] https://www.punkbywbs.de/, retrieved in November 2023

[43] https://www.digitallearninginstitute.com/course/ai-for-learning-certificate/, retrieved in November 2023

the SMEs and the private sector, and will also help to understand which other formats may be worth developing and offering in the project at next project stage and could be demanded by the target group of the project.

The implementation of the survey will be carried out on the participants of the testing certificate course, those attending will be asked to complete a questionnaire. The developed questionnaire will be accessed by the course participants through survey management system *EUSurvey*[44], ensuring a user-friendly and easily accessible feedback mechanism.

The feedback data collected will be analysed to extract meaningful insights. Tailoring the courses to the identified preferences and needs of the project's target groups aims to ensure the provision of the most relevant and updated certified courses, give a positive learning experience and, as a result, increase confidence in the use of AI technologies, thereby giving organisations a competitive edge.

[44] https://ec.europa.eu/eusurvey/, retrieved November 2023

4. Summary

This document presents the overall curriculum of the developed formats for the pillar Skills & Training as well as concept of joint applied academy (*EDIH Academy*), which includes offering of application-oriented certificate courses for key technologies and the ST-formats developed. The format's concepts, topics, scope, objectives and especially the value of service for the participants are highlighted.

Most of ST-formats are already up and running, while others are still being planned. For services in trial and operation as well as for the testing certificate course we will collect and analyse feedback and go through a continuous service improvement process. The analysis of the real training needs of the project's target audience by means of the developed questionnaire will enable the project to deliver highly relevant, targeted and impactful training initiatives that promote the successful integration of key technologies into the routine work of companies.

Deliverable 4.3 will provide a final overview of the ST-formats developed in EDIH4UrbanSAVE after year two.

Glossary

Notions defined in this glossary are specific for this document only.

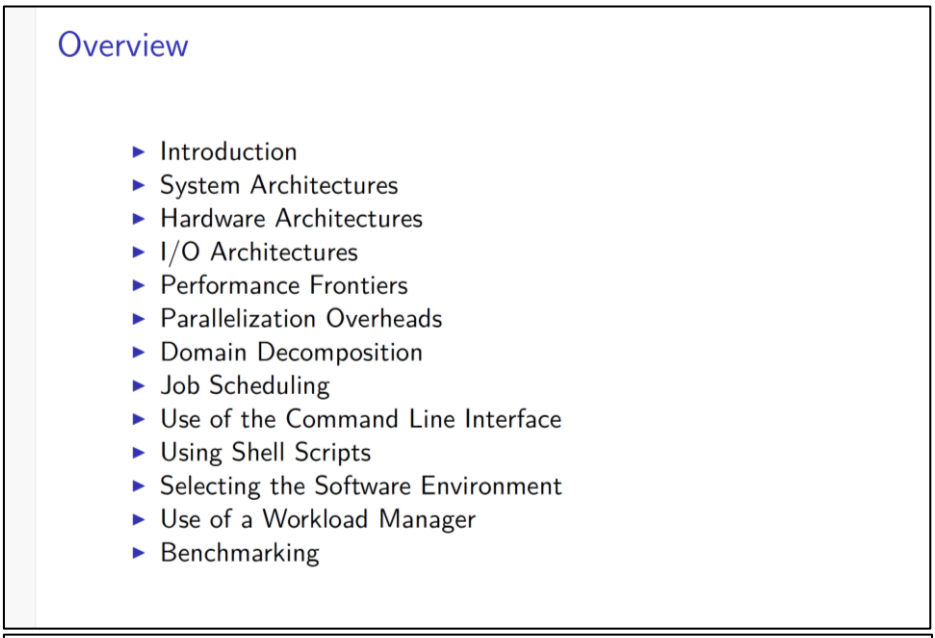
Notion	Meaning
ADCH	AI, Digitisation, Cybersecurity, and HPC
AI	Artificial Intelligence
AR	Augmented Reality
ARIC	Artificial Intelligence Center Hamburg
CAD	Computer Aided Design
CEO	Chief Executive Officer
ChatGPT	Chat Generative Pre-trained Transformer
CIP	Continuous Improvement Process
CNN	Convolutional Neural Networks
CRM	Customer Relationship Management
DBSCAN	Density-Based Spatial Clustering of Applications with Noise
DigiHub	Digital Hub Logistics GmbH
DMS	Document Management System
EDIH	European Digital Innovation Hub
EDIH4UrbanSAVE	European Digital Innovation Hub for urban interconnected supply and value Ecosystems
ERP	Enterprise Resource Planning
EU	European Union
FLOPS	Floating Point Operations Per Second
GA	Grant Agreement
HAW	University of Applied Science
HITeC	Hamburger Informatik Technologie-Center
HPC	High-Performance Computing
HWK	Handwerkskammer Hamburg
ICT	Information and Communication Technologies
ISTQB	International Software Testing Qualifications Board
KPI	Key Performance Indicator
LLM	Large Language Model
LSP	LEGO® SERIOUS PLAY®
MDZ	Mittelstand-Digital Zentrum
ML	Machine Learning
MLP	Multi Layer Perceptron Network
MVP	Minimal Valuable Product
OGD	Open Government Data
PA	Public Authority
PeCoH	Performance Conscious HPC
PKI	Public Key Infrastructure
PoC	Proof of Concept
PSO	Public Sector Organization
Q&A	Questions & Answers

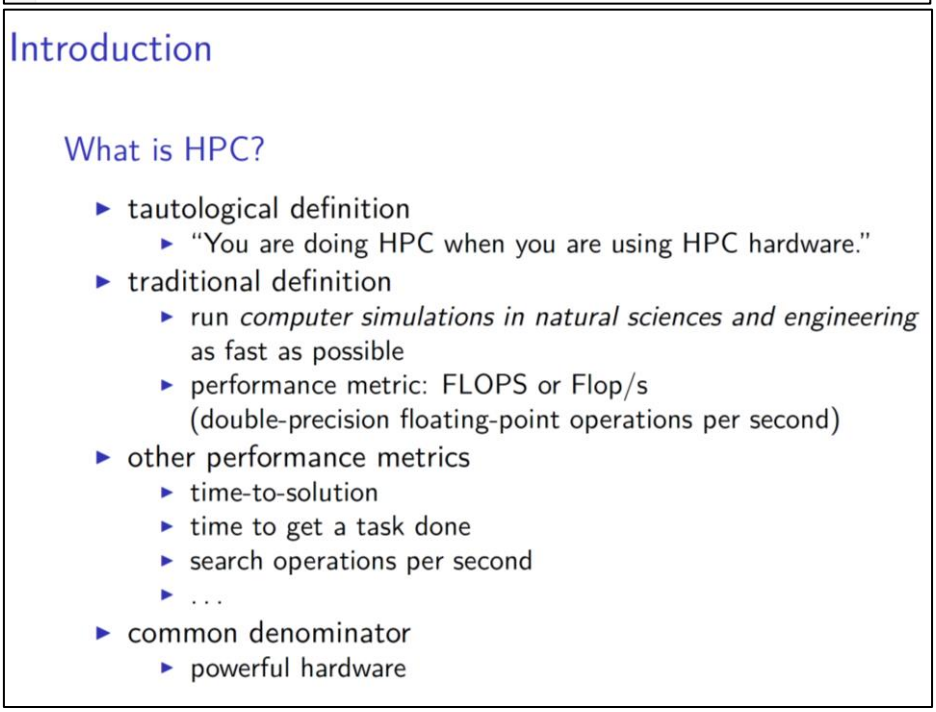
RFID	Radio Frequency Identification
ROI	Return of Investment
SEO	Search Engine Optimization
SME	Small and Medium Enterprises
ST	Skills & Training
TMS	Transportation Management System
TUHH	Technical University of Hamburg
VPN	Virtual Private Network
VR	Virtual reality
2FA	Two-Factor Authentication
3D	three-dimensional

Table 3: Glossary

Annex

Annex 1. Overview slides for *"An insight into the field of HPC"*





Introduction

HPC software environment

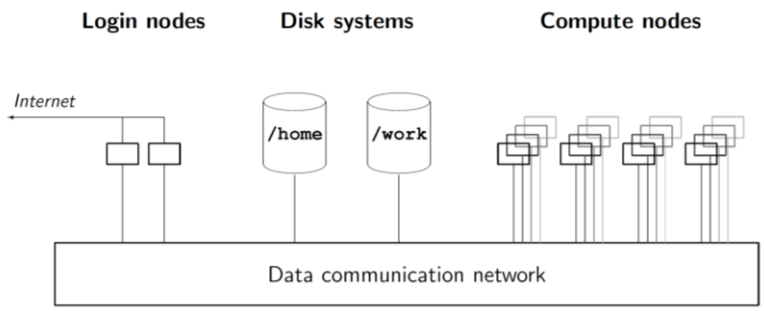
- the operating system is GNU/Linux
- interactive access is limited
  - graphical user interfaces are unusual
  - the command line has to be used
- a *batch system* has to be used
  - batch jobs are being prepared and managed from the command line
  - batch jobs have to be formulated as shell scripts
  - job inputs must be prepared beforehand

Introduction

Need for parallel processing

- *parallelization* is needed in order to significantly speed up computations
  - the basics of parallel computing must be understood
  - parallel performance needs to be checked: is the runtime (almost) *n* times shorter when *n* times as many compute cores are used?

HPC cluster architecture



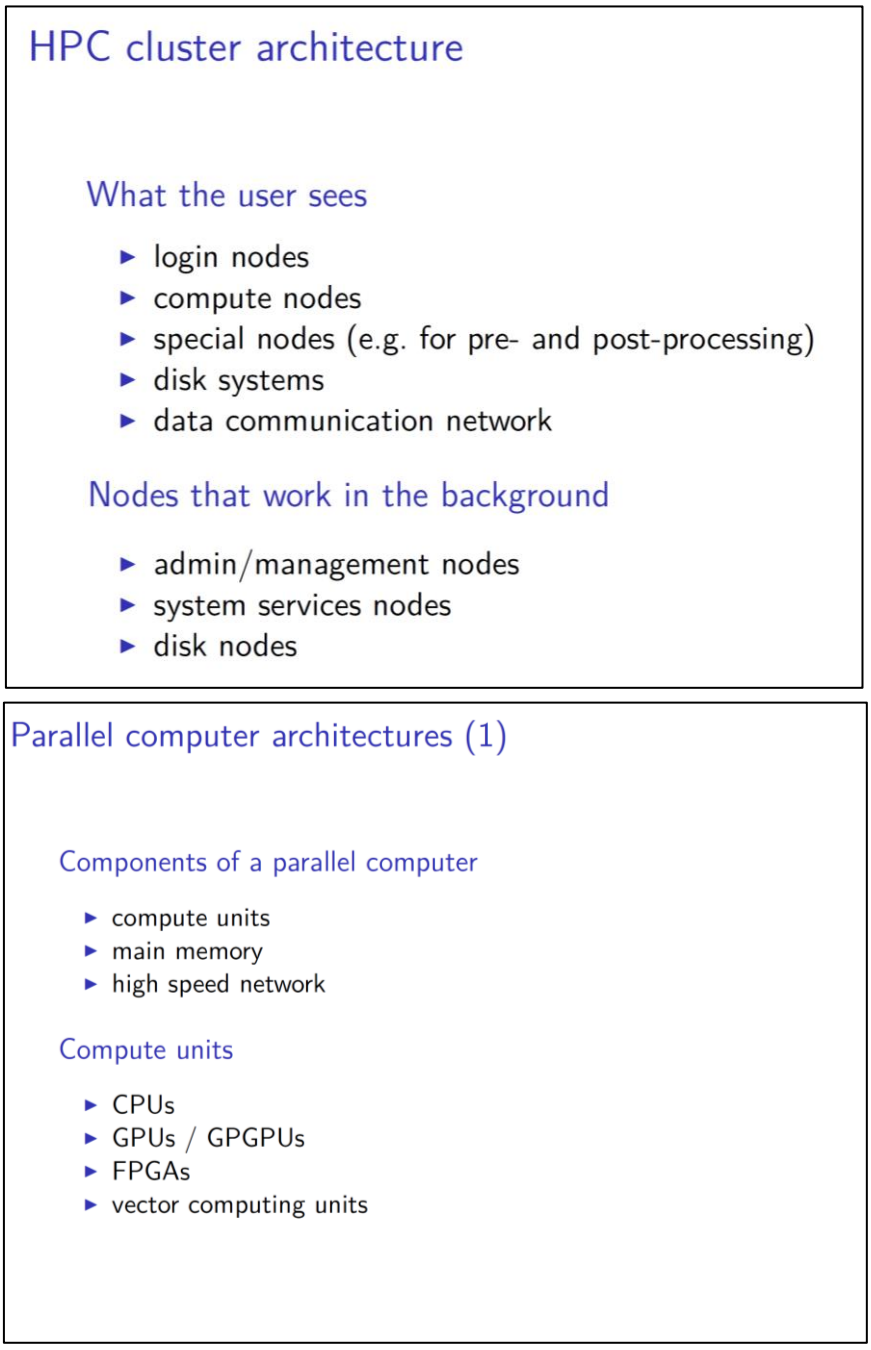
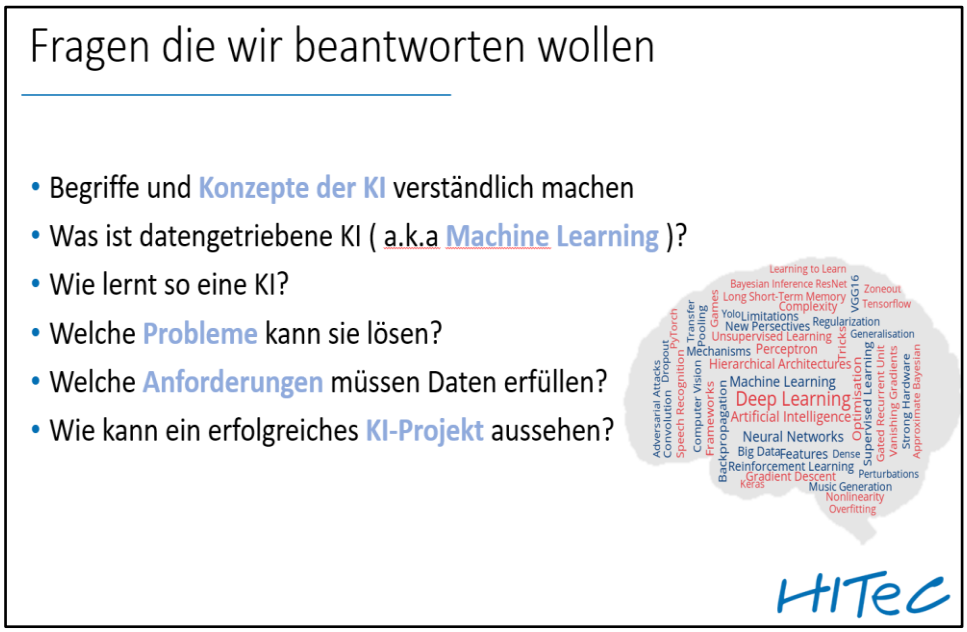
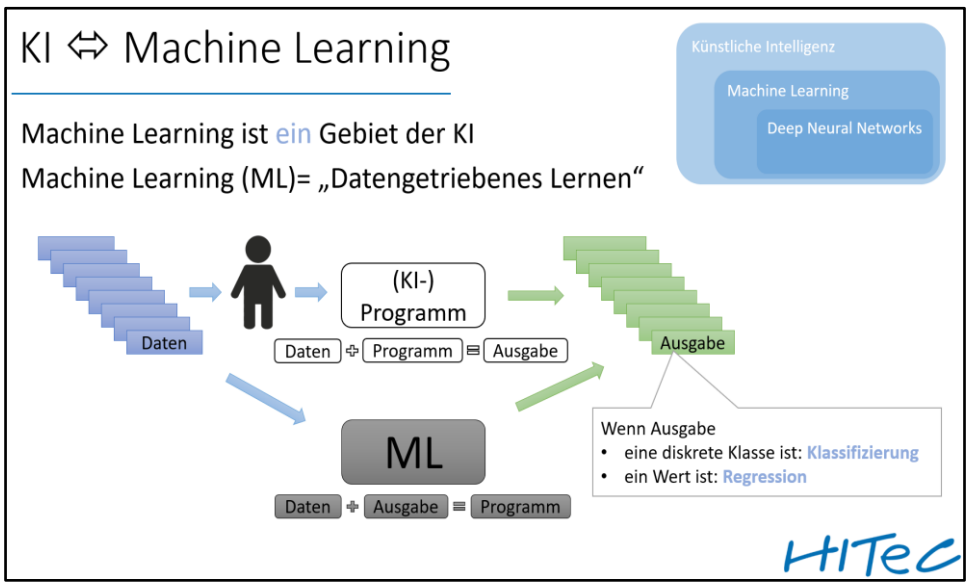
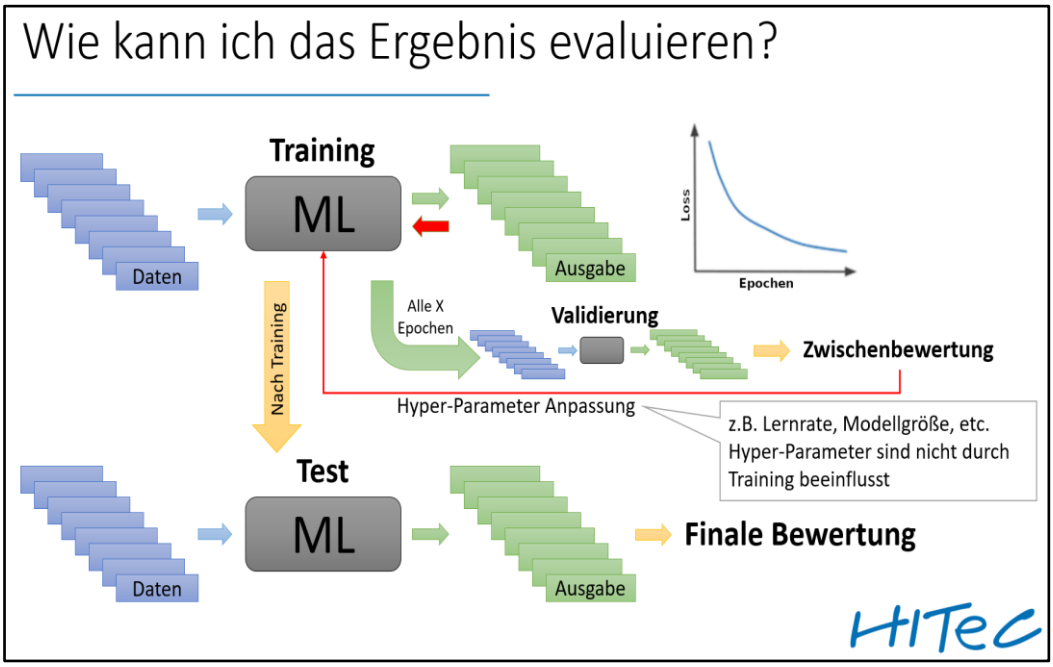


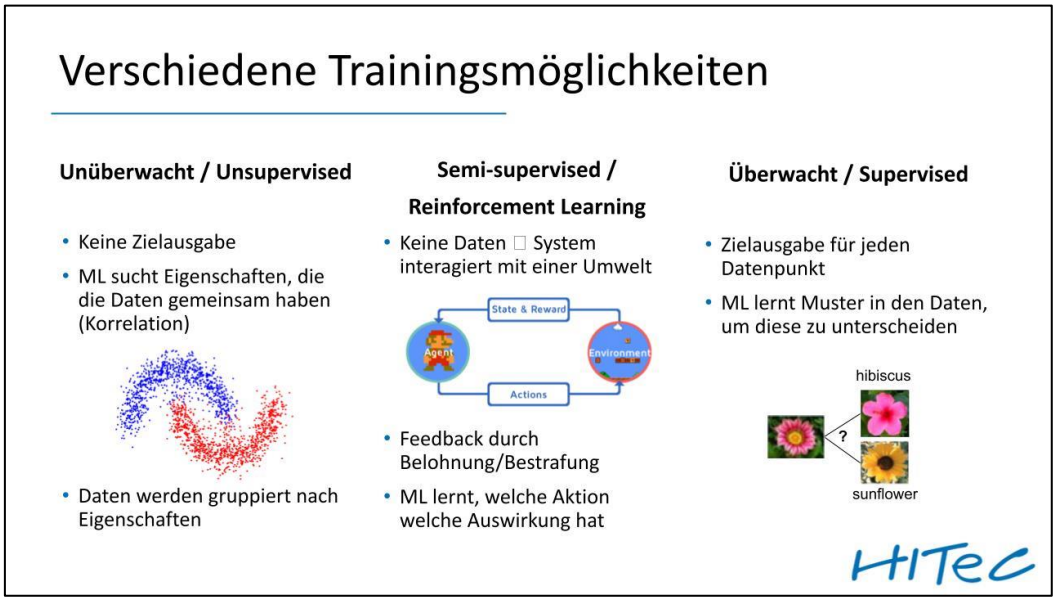
Figure 2: Slide insight into *"An insight into the field of HPC"*

Annex 2. Overview slides for *"AI for deciders"*






Wie kann ich das Ergebnis evaluieren?
Training
ML
Daten
Ausgabe
Loss
Epochen
Alle X Epochen
Validierung
Zwischenbewertung
Nach Training
Hyper-Parameter Anpassung
z.B. Lernrate, Modellgröße, etc. Hyper-Parameter sind nicht durch Training beeinflusst
Test
ML
Daten
Ausgabe
Finale Bewertung
HITeC


Verschiedene Trainingsmöglichkeiten
Unüberwacht / Unsupervised
• Keine Zielausgabe
• ML sucht Eigenschaften, die die Daten gemeinsam haben (Korrelation)
• Daten werden gruppiert nach Eigenschaften
Semi-supervised / Reinforcement Learning
• Keine Daten □ System interagiert mit einer Umwelt
State & Reward
Agent
Environment
Actions
• Feedback durch Belohnung/Bestrafung
• ML lernt, welche Aktion welche Auswirkung hat
Überwacht / Supervised
• Zielausgabe für jeden Datenpunkt
• ML lernt Muster in den Daten, um diese zu unterscheiden
hibiscus
?
sunflower
HITeC

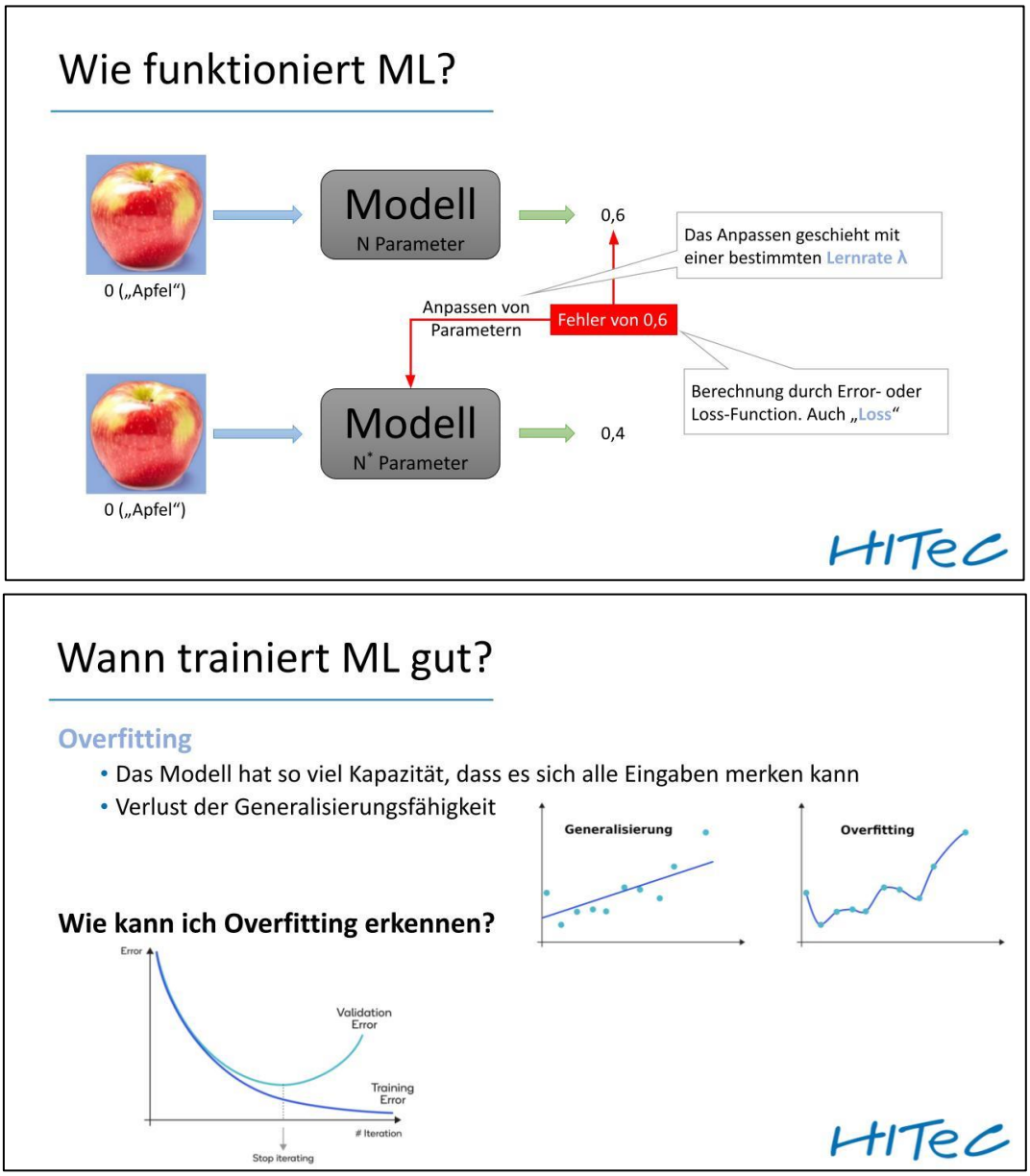
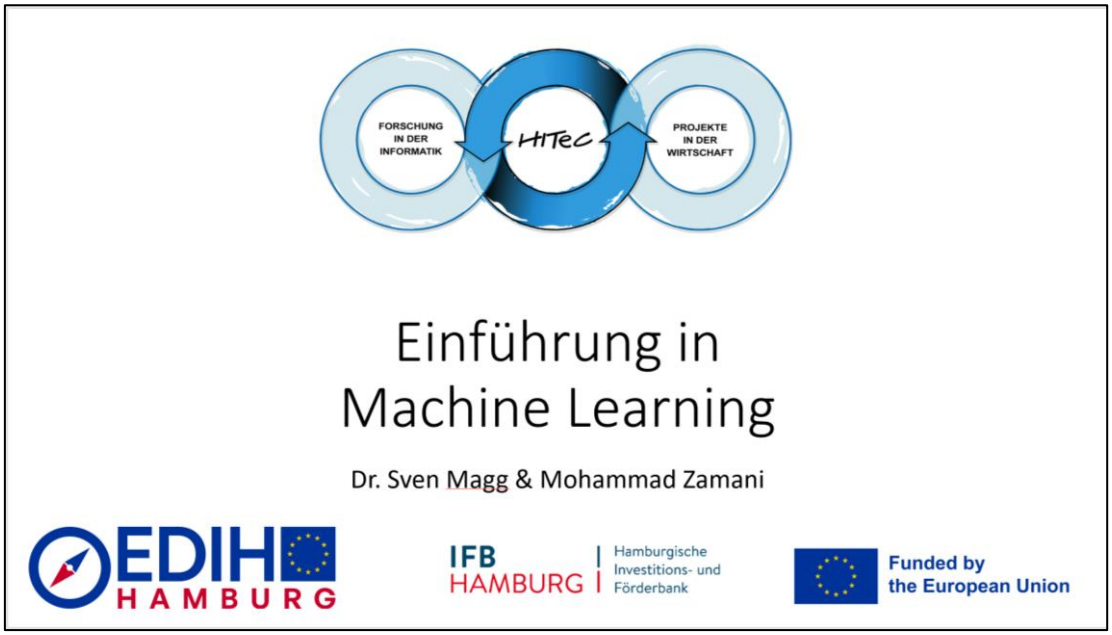
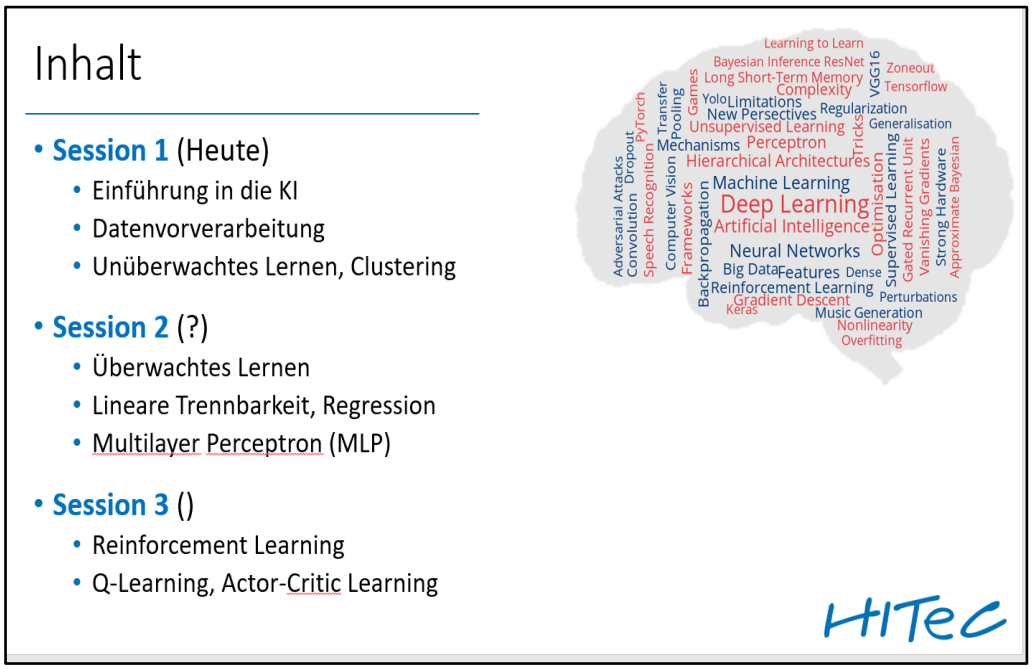


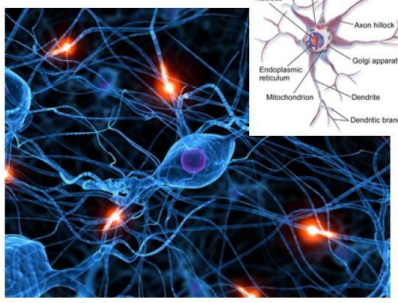
Figure 3: Slide insight into *"AI for Deciders"*

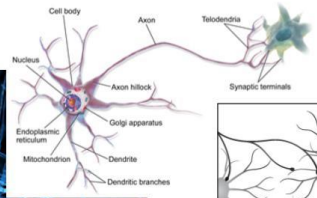
Annex 3. Overview slides for *"An introduction to Machine Learning"*

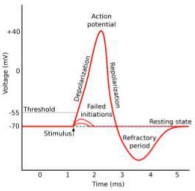


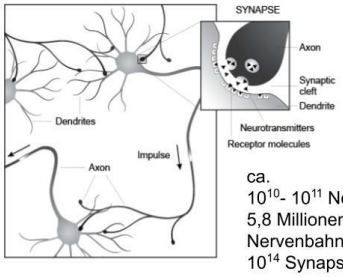


Vom biologischen Vorbild….







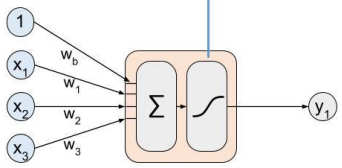


ca.
10^{10}- 10^{11} Nervenzellen
5,8 Millionen km Nervenbahnen
10^{14} Synapsen

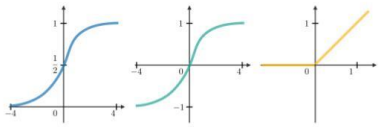
HITeC

…zum künstlichen Neuron

Das Perzeptron:



Aktivierungsfunktion, z.B.



$$y = f(\mathbf{X} \cdot \mathbf{W}) = \tanh\left(\sum_{k=1}^{n} x_k w_k + b_k\right)$$

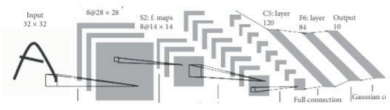
Eingabematrix
Gewichtsmatrix
Bias

HITeC

War war passiert….?

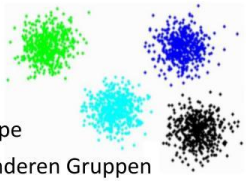
"Deep" learning war schon vor 2000 bekannt…..?

1. Mehrere Entwicklungen haben zusammen gefunden (Modelle, effizientere Lernverfahren, …)
2. Rechenpower durch GPU Computing
   - GPUs eignen sich hervorragend für die Berechnung von neuronalen Netzwerken
3. Frameworks
   - Effiziente Implementationen für GPUs und Parallelisierung
4. Daten! Viele, viele Daten….

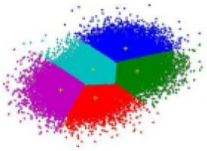


HITeC

Was ist Clustering?



- **Cluster:** Eine Gruppe von Datenobjekten
  - ähnlich (oder verwandt) zu Objekten der gleichen Gruppe
  - unterschiedlich (oder nicht verwandt) zu Objekten in anderen Gruppen
- Cluster Analyse
  - Finden von Ähnlichkeiten zwischen Daten anhand ihrer Charakteristika und Einordnen ähnlicher Objekte in „Cluster“



- **Unüberwachtes Lernen**: Keine vordefinierten Klassen
  - Die Anzahl der Klassen muss nicht vorher bekannt sein

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Partitionierung

Partitioniere einen Datensatz *D* von Objekten *x* in eine Menge von *k* Clustern und minimiere die Summe der quadrierten Distanzen zu den Durchschnitten m_i

Gesamtfehler

Zahl der Punkte in Cluster *i*

$$E = \sum_{}^{k} \sum_{}^{N_i} (x_p - m_i)^2$$

Quadrierte Distanz zu Clusterdurchschnitt

Summe über alle Cluster

Summe über alle Punkte in Cluster *i*

Gegeben *k* ***Zentroide***, finde eine Partitionierung in ***k Cluster*** ***die den Fehler E minimiert***

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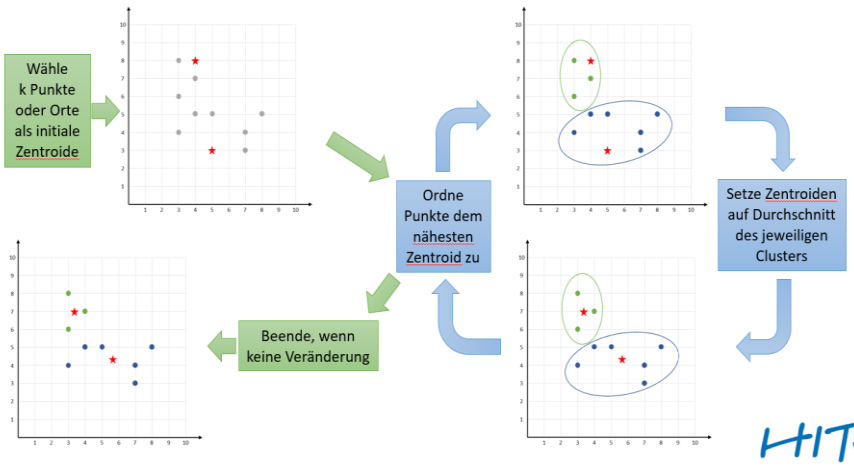
k-Means Clustering



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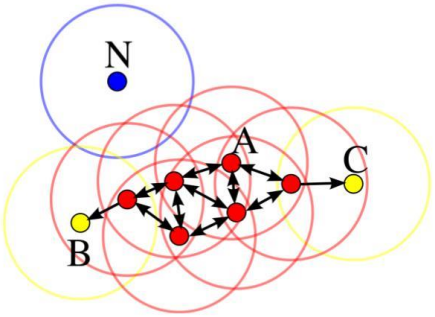
DBSCAN - Definitionen



Core Point: Ein Punkt *p* ist ein Core Point wenn *min_samples* Punkte innerhalb einer Distanz *eps* liegen

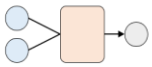
Ein Punkt *q* ist **erreichbar** von *p* wenn er innerhalb einer Distanz eps von p liegt, oder ein **erreichbarer Pfad** $p_1,\ldots,p_n,q$ existiert (=alle roten & gelben Punkte)

Alle Punkte die nicht von einem Core Point erreichbar sind, sind **Outlier**

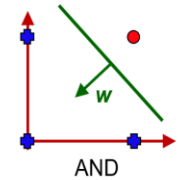
Zwei Punkte *p* and *q* sind **Dichte-verbunden** wenn beide von einem dritten Punkt *o erreichbar sind.*

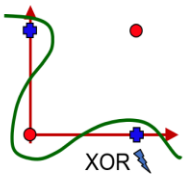
HITeC

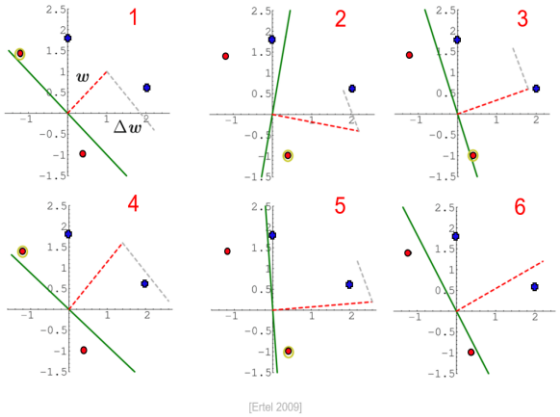
Was kann ein Perzeptron?



Lineare Klassifikation!



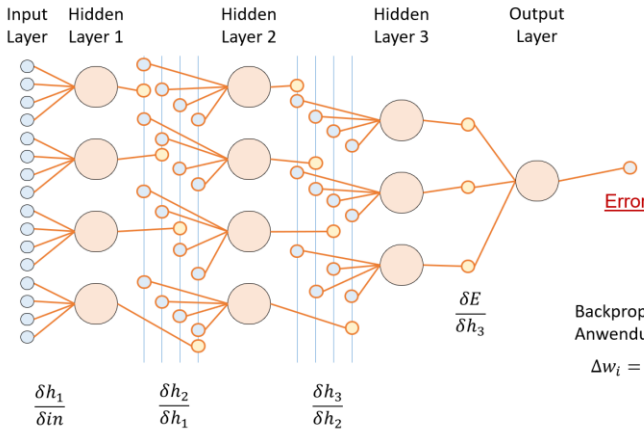




[Ertel 2009]

HITeC

Tiefe Netzwerke - Backpropagation

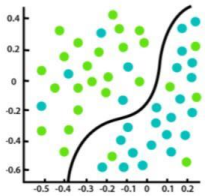


Backpropagation durch Anwendung der Kettenregel!

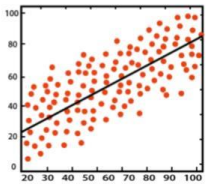
$$\Delta w_i = \lambda(t-y)f'(h)x_i$$

HITeC

Supervised Learning



- Datenpunkte sind Paare aus Eingabe und Ausgabe
- Welche Probleme kann ich damit lösen?
  - Klassifikation: Zuordnen von „Labels“ zu ungesehenen Datenpunkten
  - Regression: Vorhersage von Ausgabewerten für neue Eingaben



  - Transkription: Unstrukturiert -> Text (Spracherkennung)
  - Übersetzen: Sequenzen von Symbolen -> Andere Sequenz
  - De-Noising: Fehler in Bildern/Signalen ausbessern
  - Vorhersagen: Monitoring, Predictive Maintainance
  - …..

HITeC

Machine Learning - An Introduction
Reinforcement Learning

Mohammad Ali Zamani
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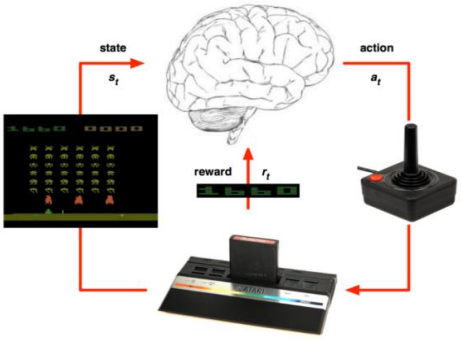
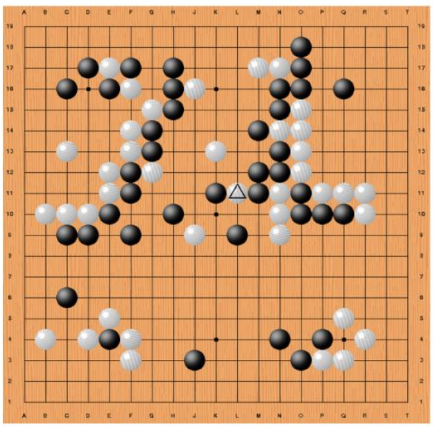
HITeC





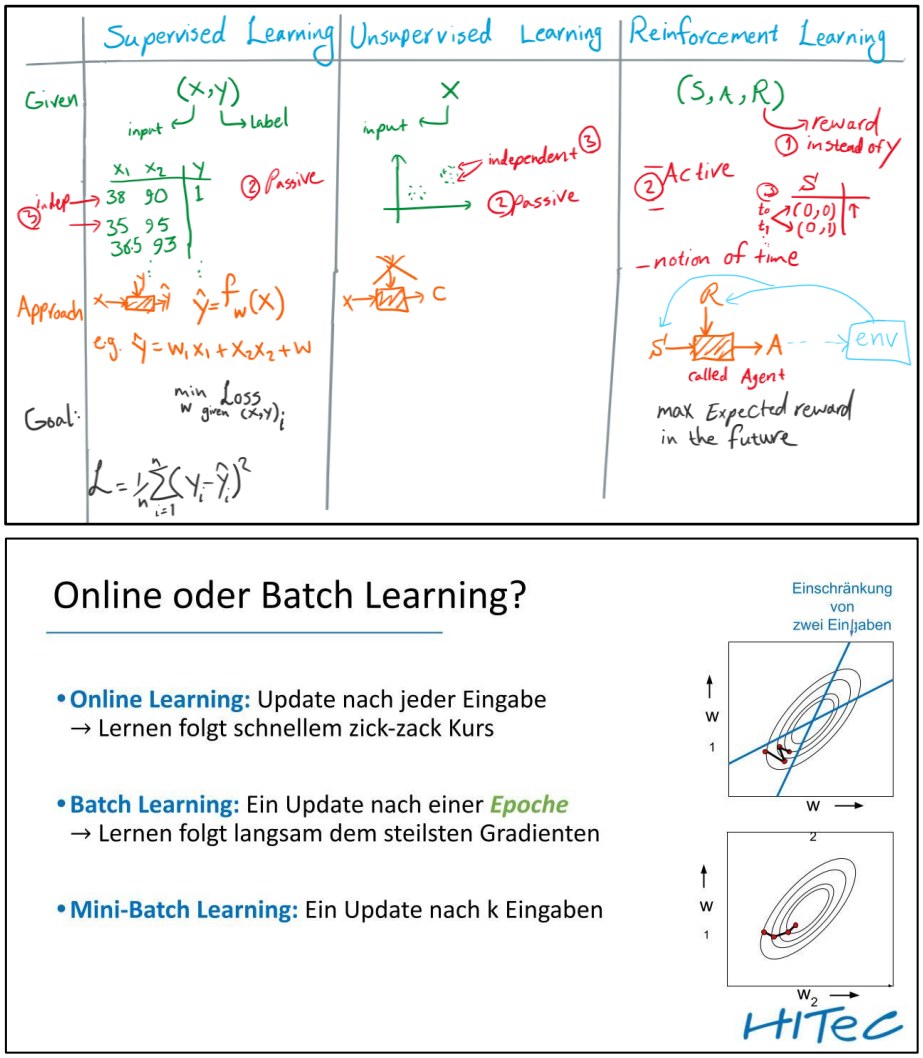


Figure 4: Slide insight into *"An introduction to Machine Learning"*

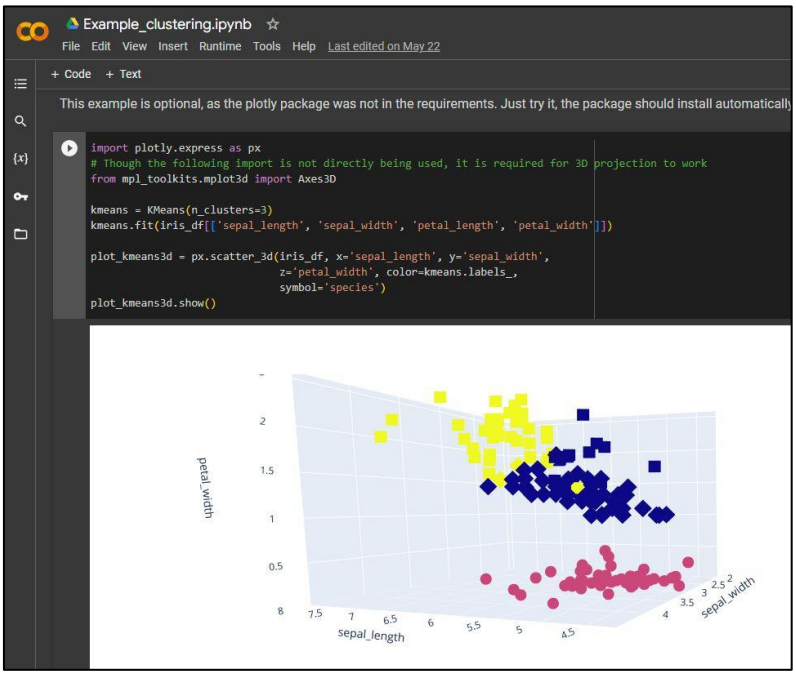
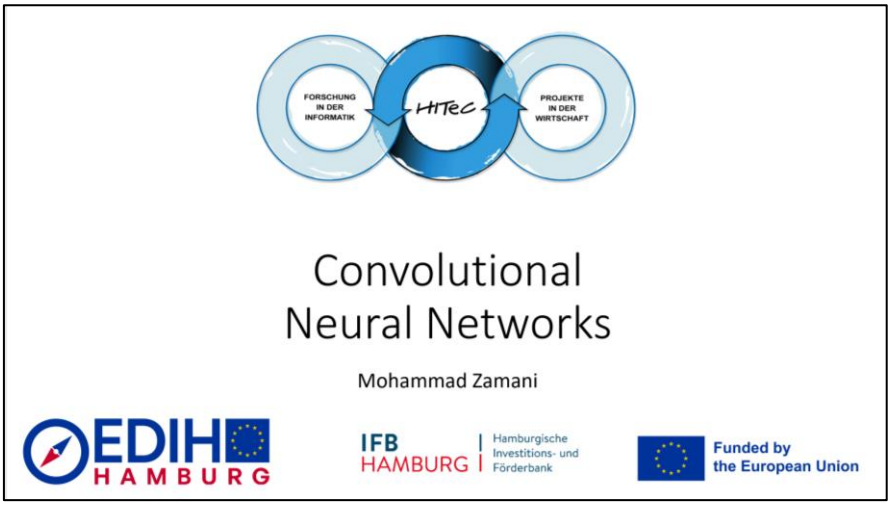
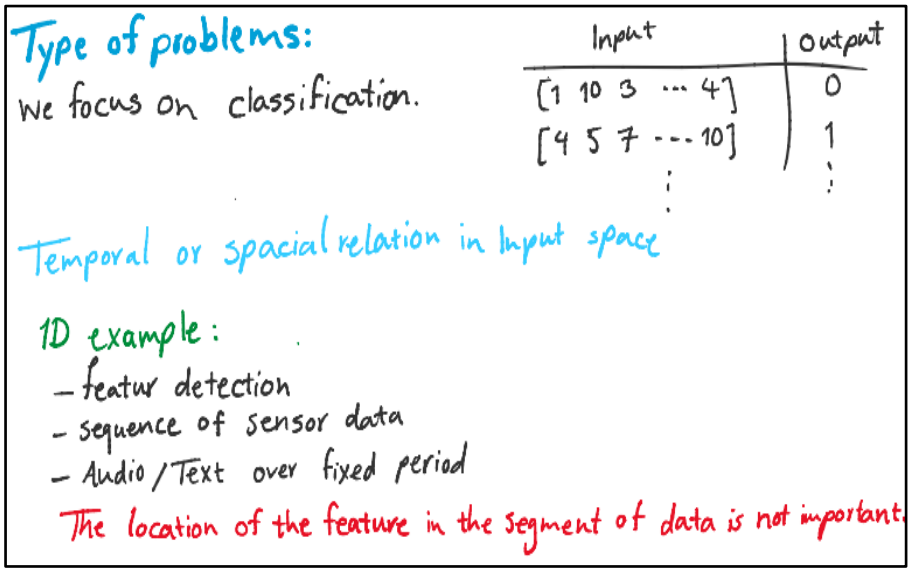
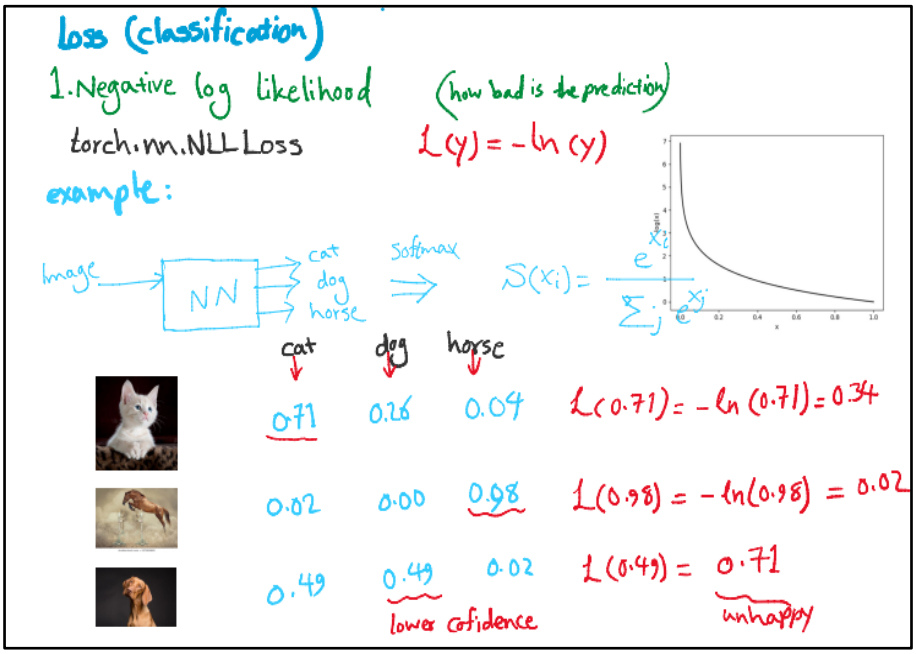


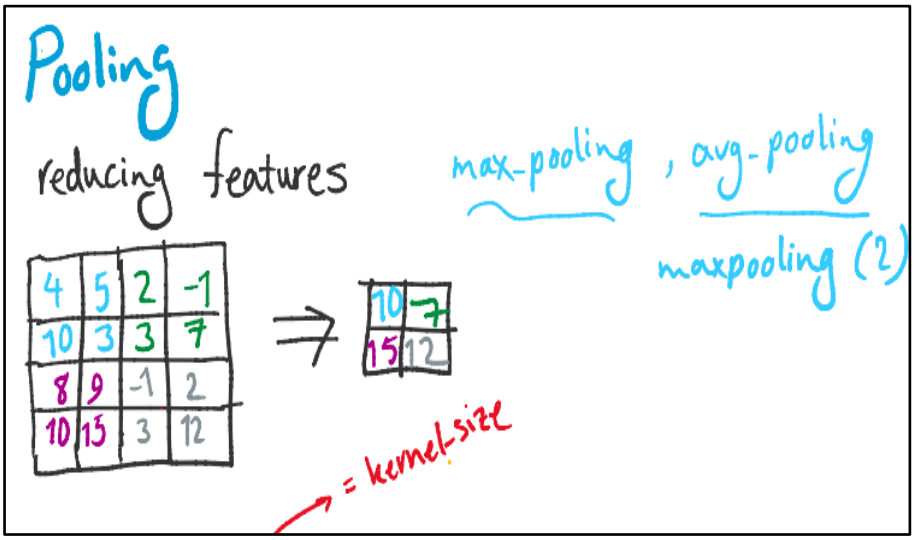
Figure 5: Insights in practical session of workshop

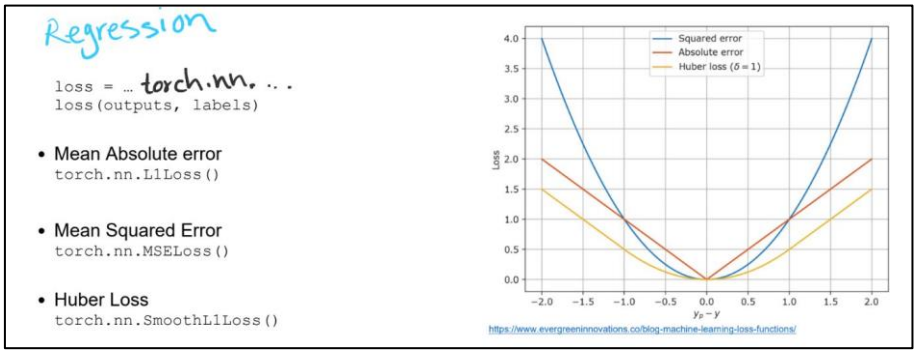
Annex 4. Overview slides for *"Convolutional Neural Networks"*

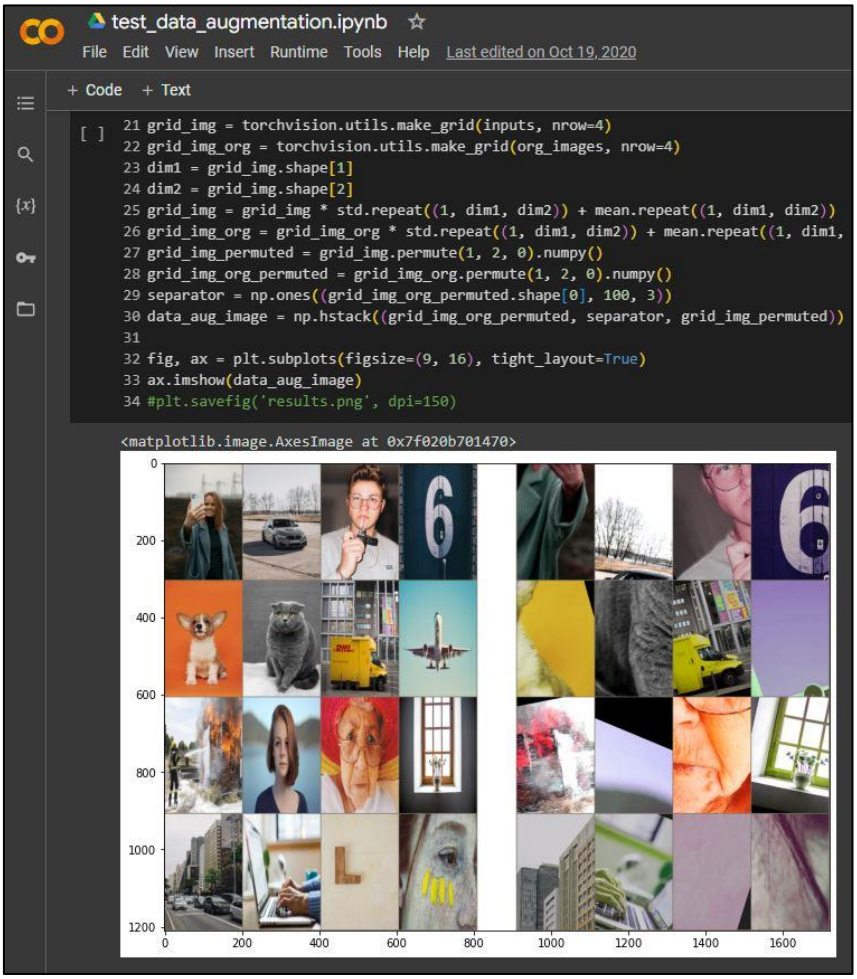







Pooling
reducing features
max-pooling , avg-pooling
maxpooling (2)
4 5 2 -1
10 3 3 7
8 9 -1 2
10 15 3 12
10 7
15 12
= kernel-size


Regression
loss = … torch.nn. . . .
loss(outputs, labels)
• Mean Absolute error
torch.nn.L1Loss()
• Mean Squared Error
torch.nn.MSELoss()
• Huber Loss
torch.nn.SmoothL1Loss()
Squared error
Absolute error
Huber loss (δ = 1)
Loss
https://www.evergreeninnovations.co/blog-machine-learning-loss-functions/



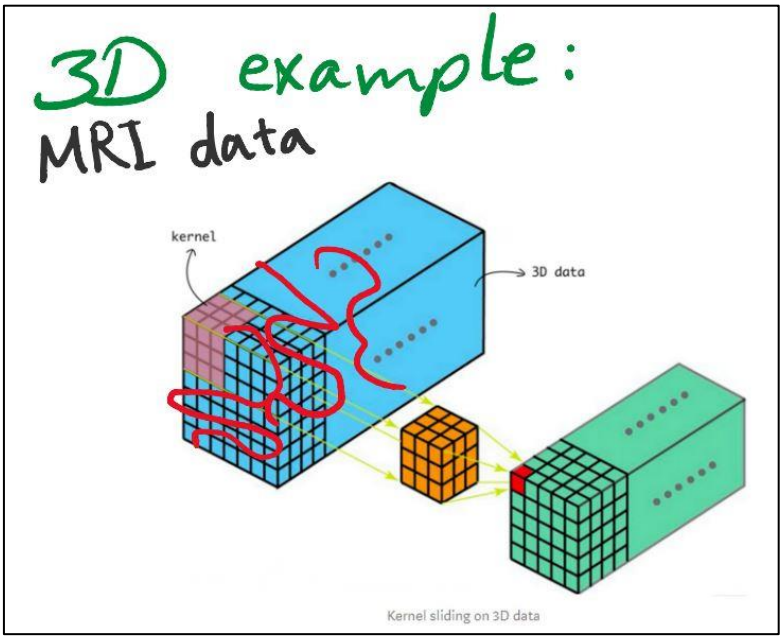
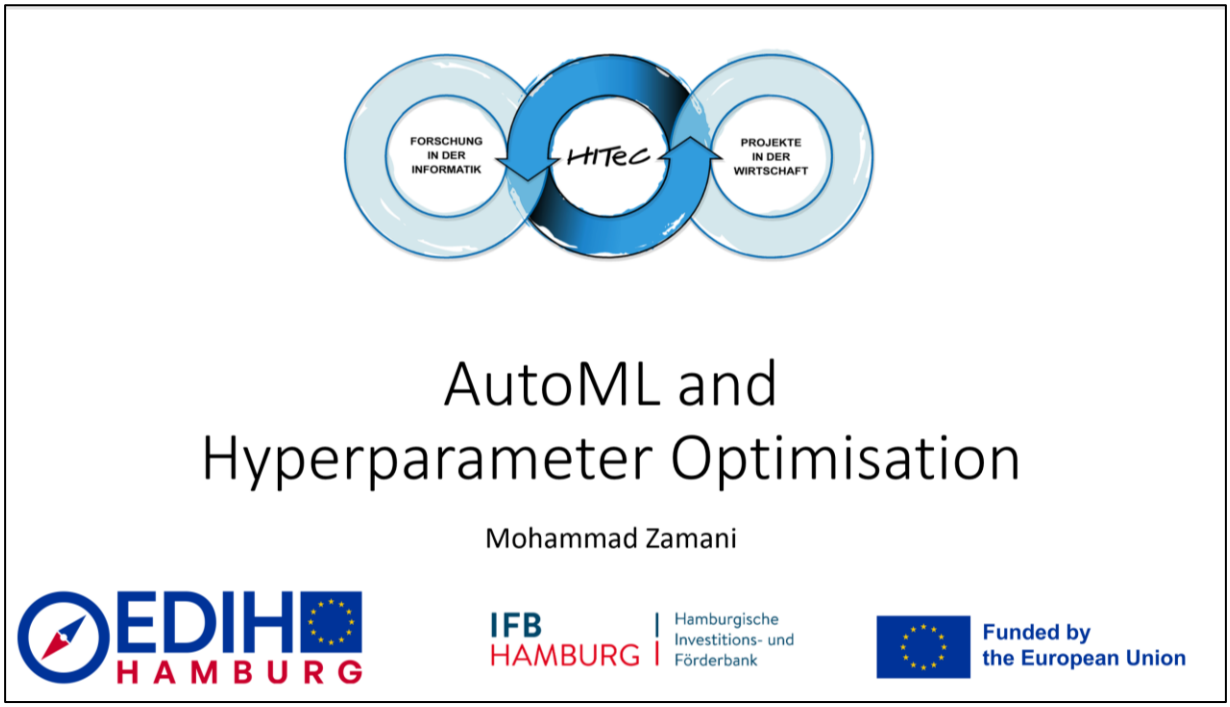


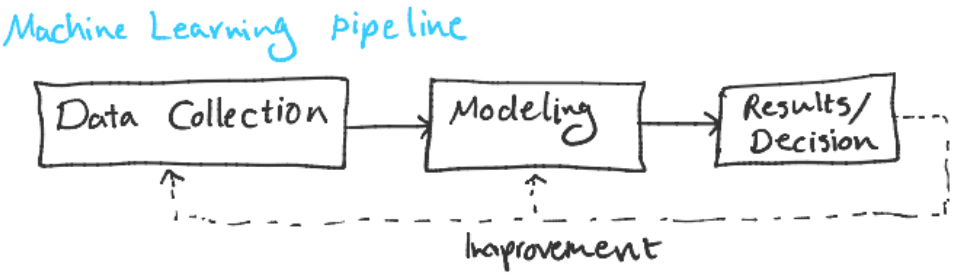
Figure 6: Insights in the hands-on session, live development session *"Convolutional Neural Networks"*

Annex 5. Overview slides for *"AutoML and Hyperparameter Optimisation"*



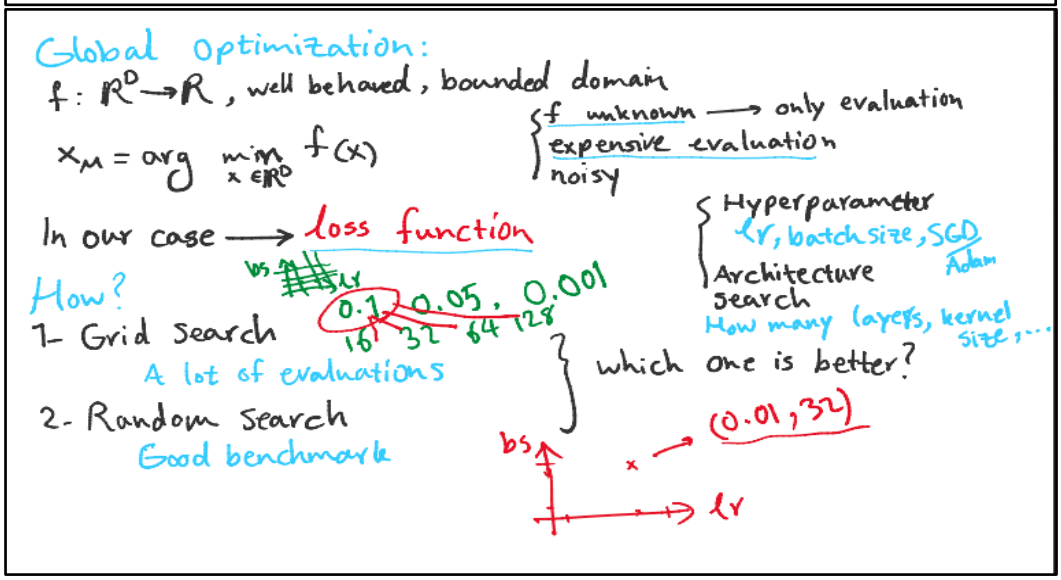
Deep Neural Learning and Bayesian Optimization of Hyperparameters

Mohammad Ali Zamani
zamani.github.io
HiTeC



Topics

- Hyper Parameters Optimization (HPO)
  - Model Free
    - Random Search
    - Grid Search
    - Evolutionary Algorithms, RL
    - Successive Halving, HyperBand
  - Model Based
    - Bayesian Optimization
    -
- Architecture Search
  - Neural Architecture Search (NAS)



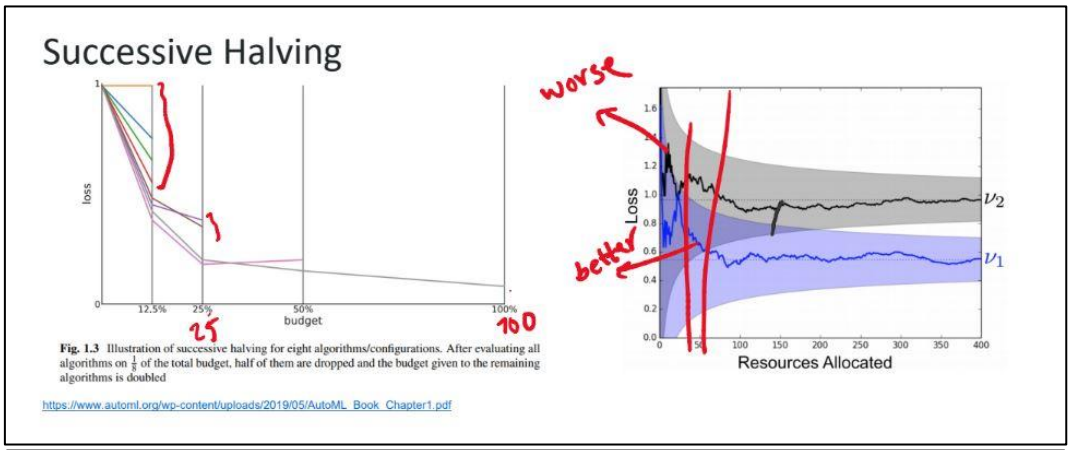
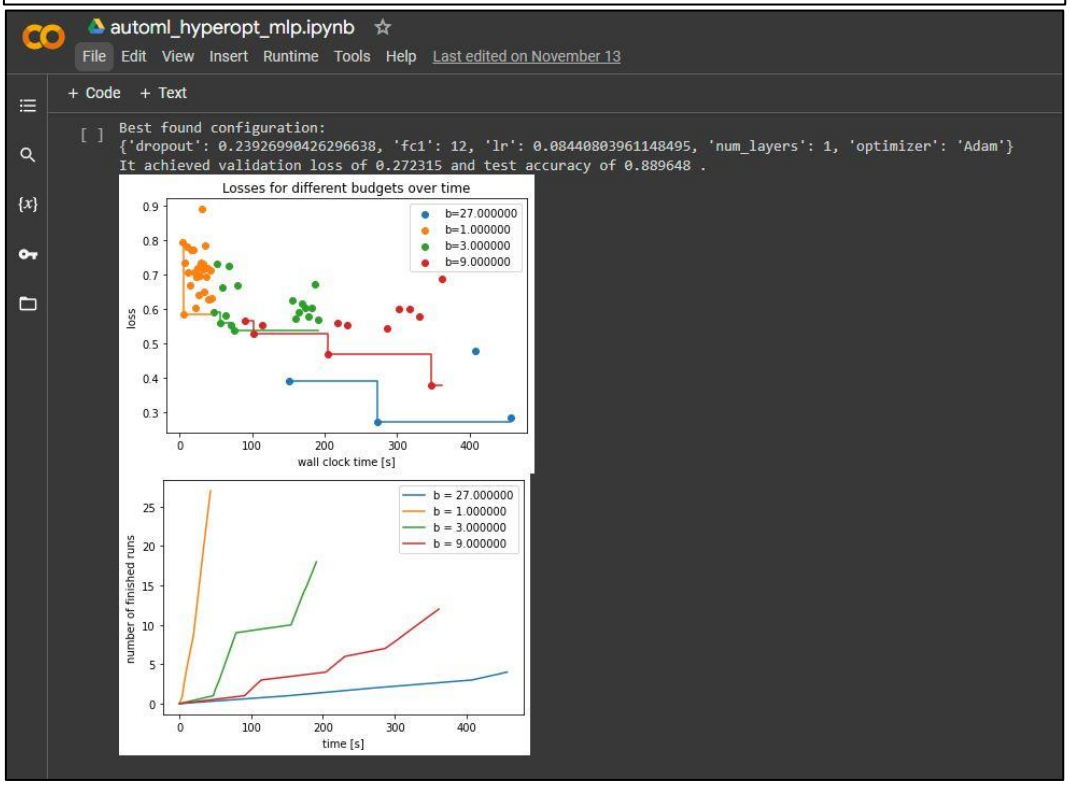


Fig. 1.3 Illustration of successive halving for eight algorithms/configurations. After evaluating all algorithms on $\frac{1}{8}$ of the total budget, half of them are dropped and the budget given to the remaining algorithms is doubled

https://www.automl.org/wp-content/uploads/2019/05/AutoML_Book_Chapter1.pdf



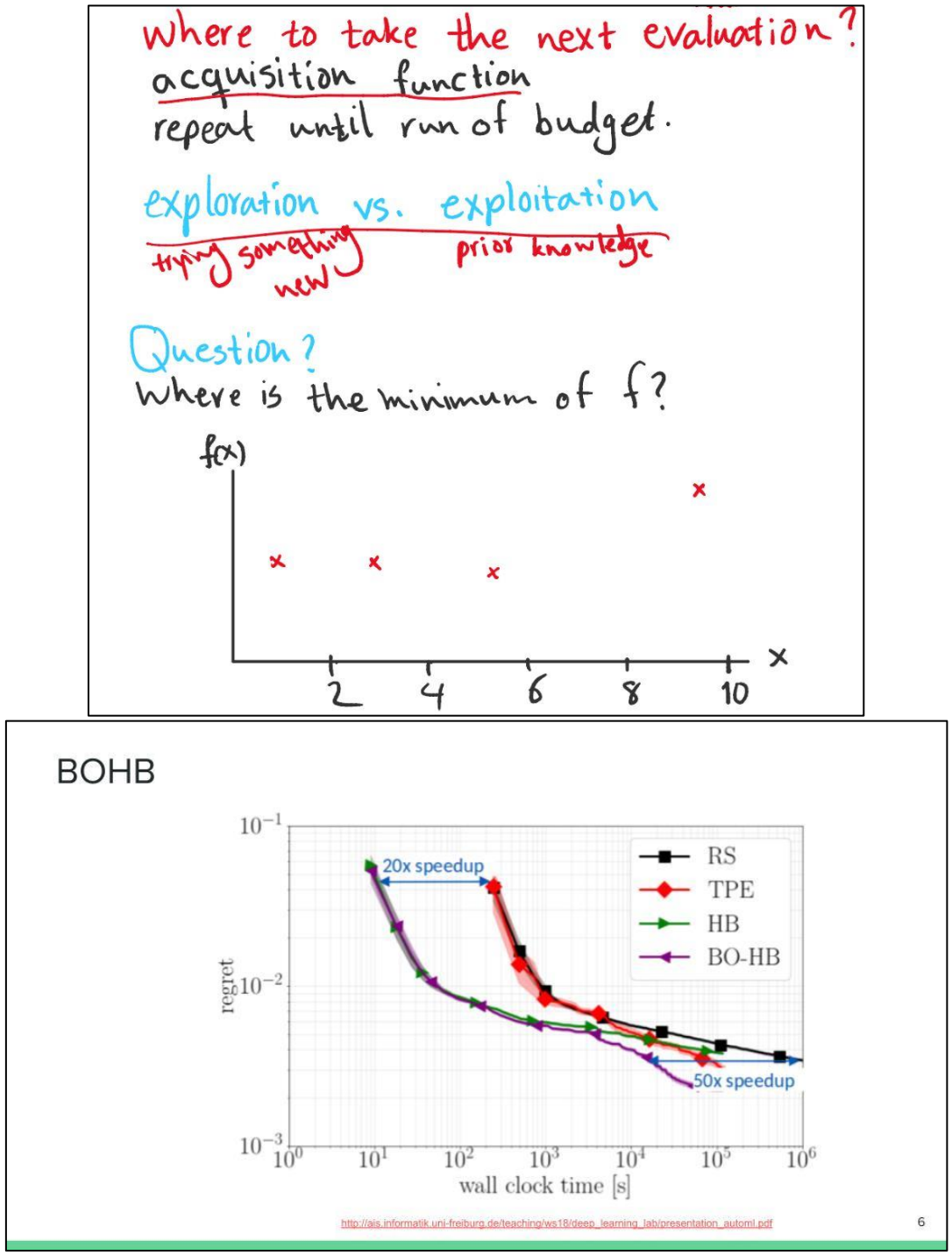
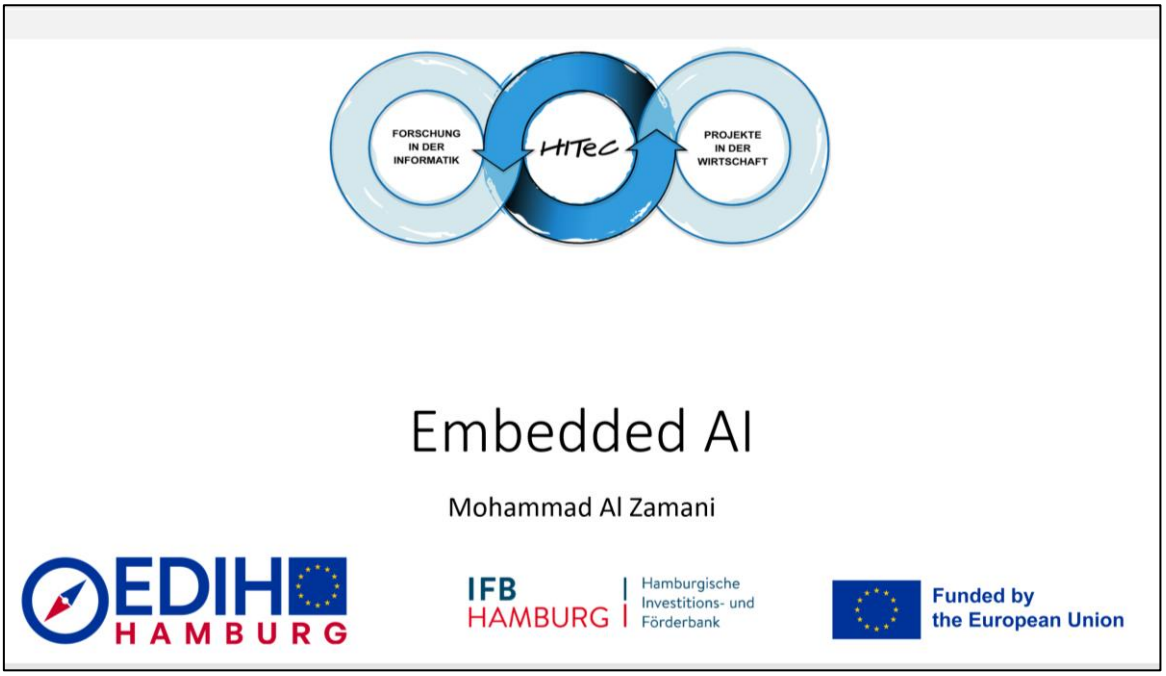
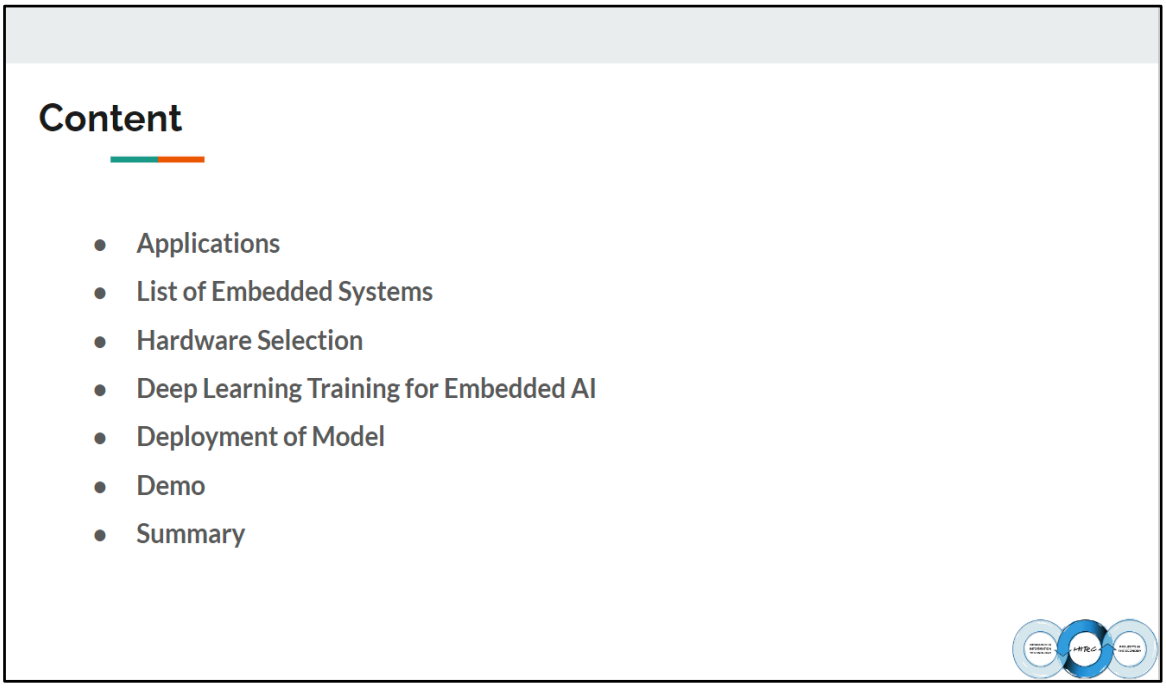


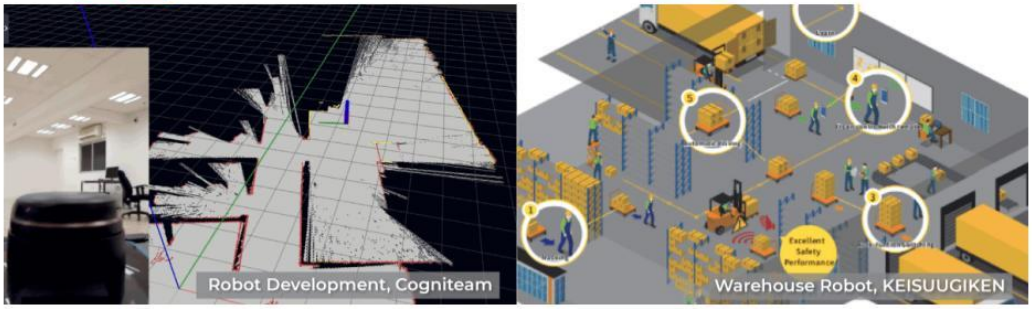
Figure 7: Glimpse into *"AutoML and Hyperparameter Optimisation"*, workshop with accompanying live development

Annex 6. Overview slides for *"Embedded AI"* – in preparation





Applications



https://www.seeedstudio.com/Jetson-10-1-A0-p-5336.html

Applications

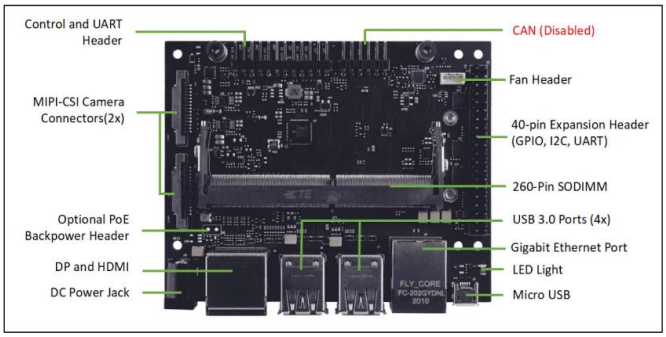
https://www.seeedstudio.com/Jetson-10-1-A0-p-5336.html

Applications

https://www.seeedstudio.com/Jetson-10-1-A0-p-5336.html

Nvidia Jetson Nano Developer Kit

- 2 MIPI-CSI Camera Connectors
- Control and UART Header
  - for flashing and recovering
- M.2 Key M
  - for installing SSD memory



The Board for reComputer J1020 (Side A)

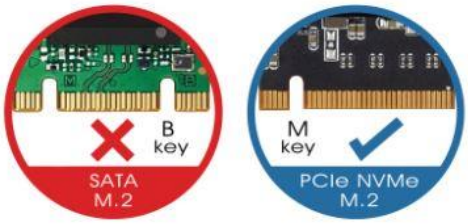


Figure 5. Compatible SSD memory for reComputer J1020

Figure 6. An example of an SSD card inserted in reComputer J1020.[7]

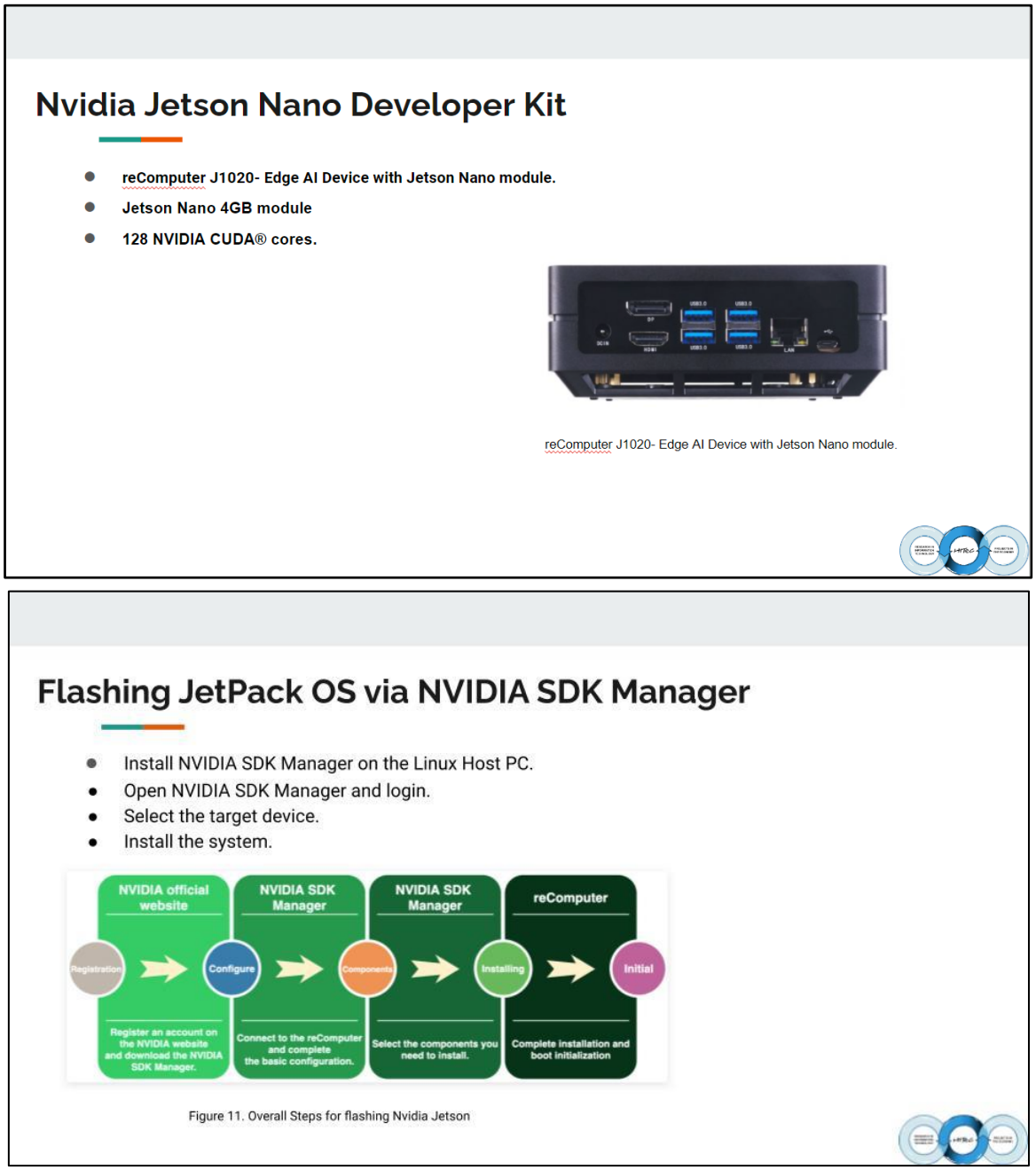
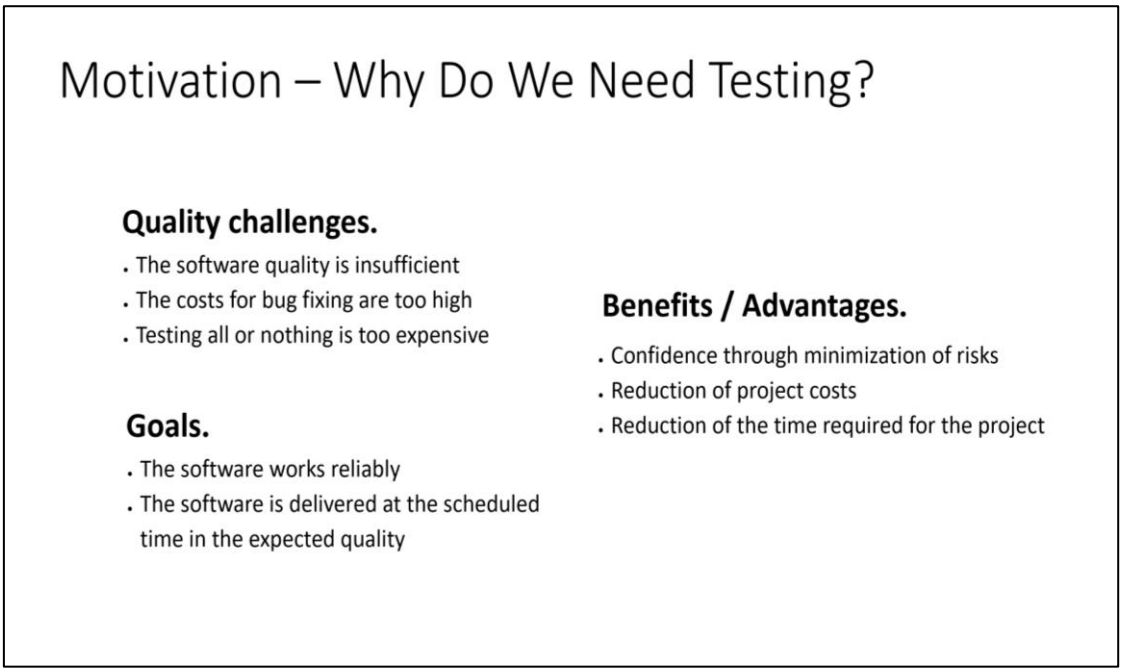


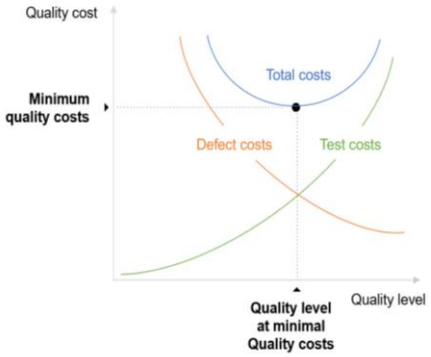
Figure 8: Insights in slides of *"Embedded AI"*

Annex 7. Overview slides for *"Test Management"*



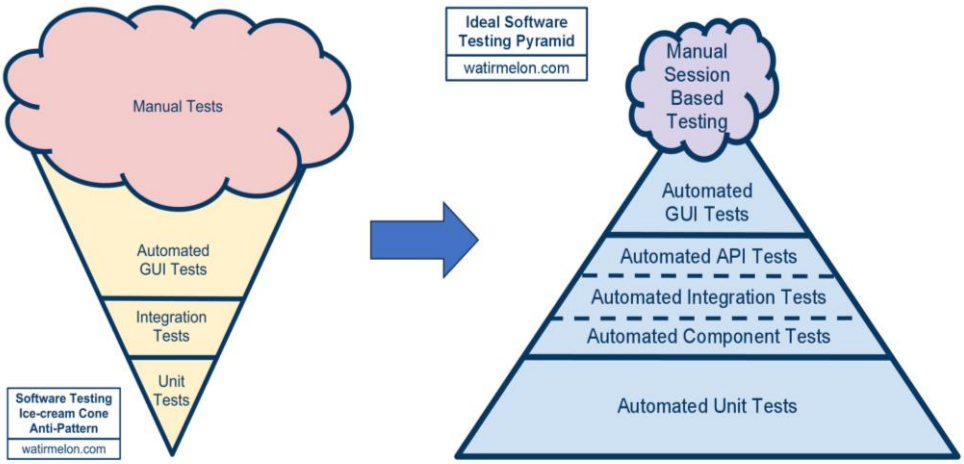
Relationship Between Quality And Costs

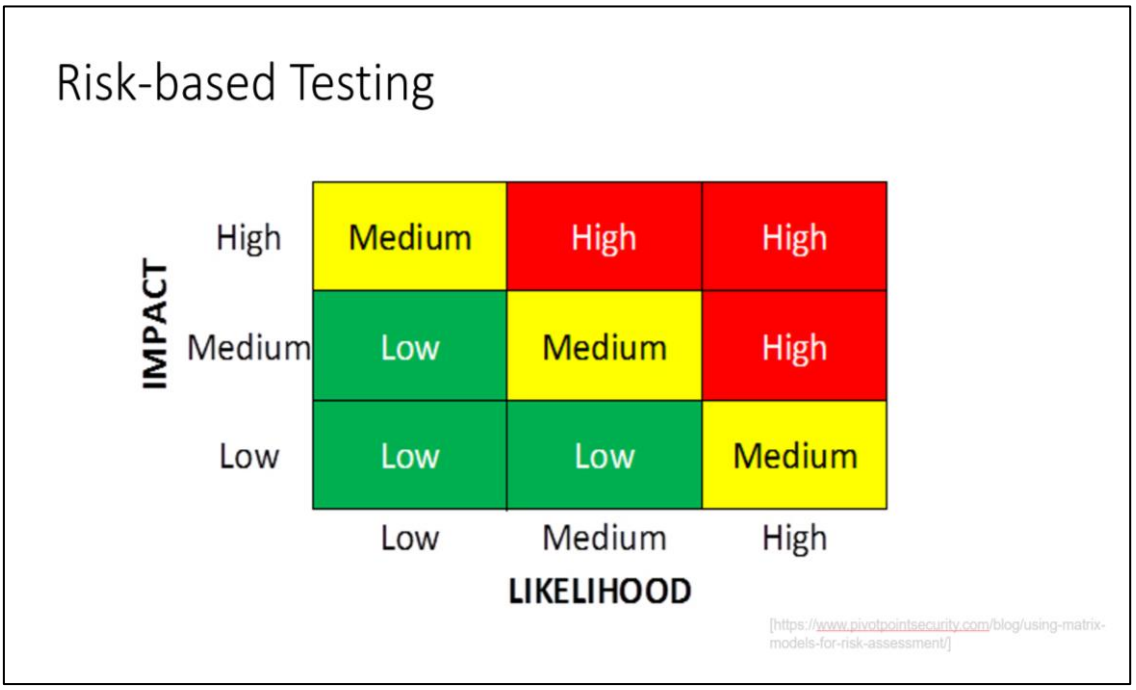
- The less testing is done, the more errors can occur. Error fixing (especially at a late stage of the project) are time-consuming and cost-intensive.
- The verification costs increase with growing quality demands.
- The total costs are disproportionately high both without testing and with "zero defect tolerance".
- The cost optimum lies in targeted, prudent and efficient testing measured against quality standards.



Source: N., Santhosh & REGO, ANIL & Sunil, Ganjalgud & NAIK, SACHIN & Gowda, Ashwin & PATIL, SACHIN. (2018). Evaluation of defect correlations with quality, delivery and cost. International Journal of Mechanical and Materials Engineering. 8. 472-484.

Testing Model: From Ice-Cream to Pyramid





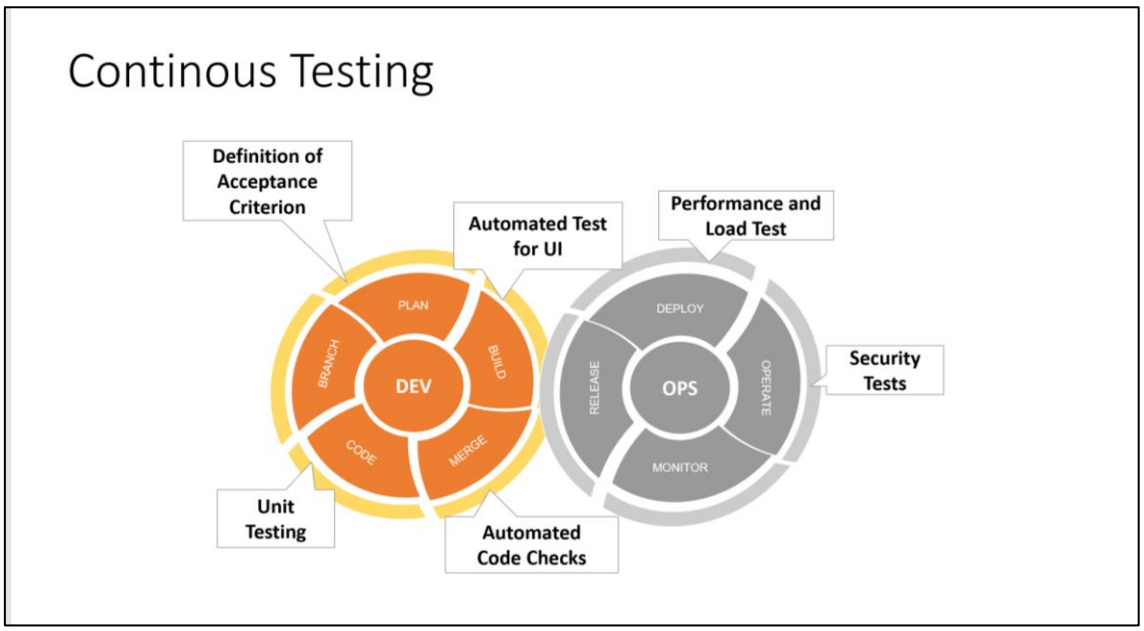
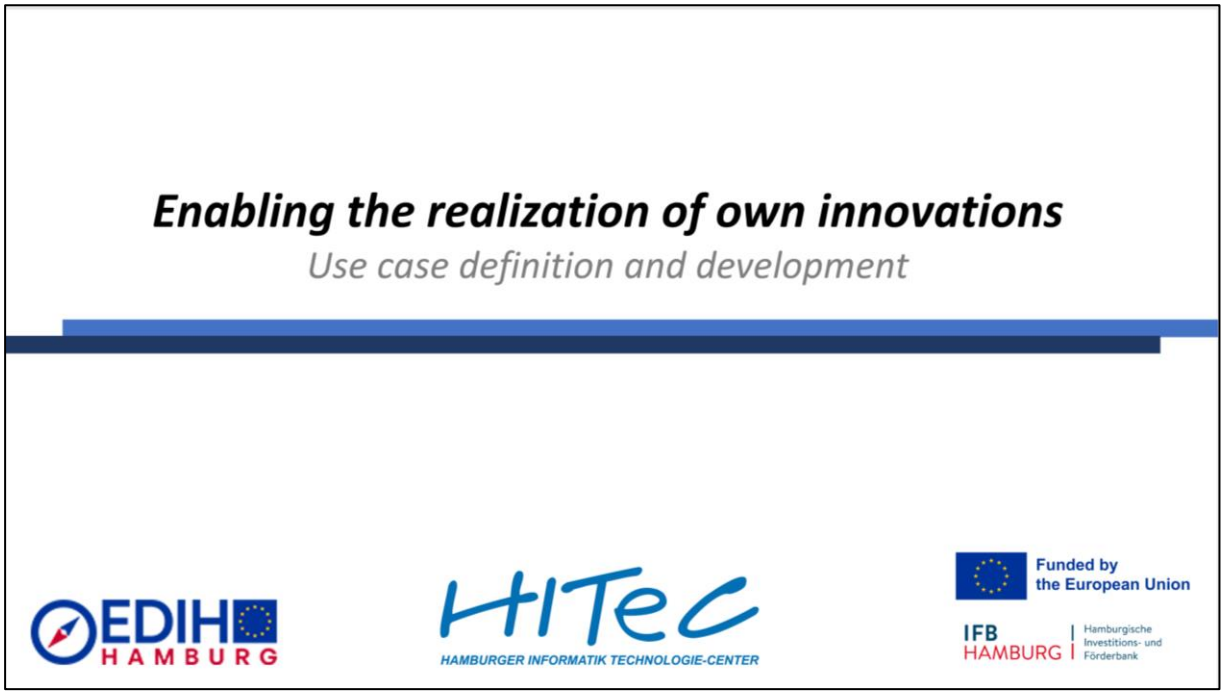


Figure 9: Overview slides of *"Test management"* lecture

Annex 8. Overview slides for *"Enabling the realization of own innovations"*



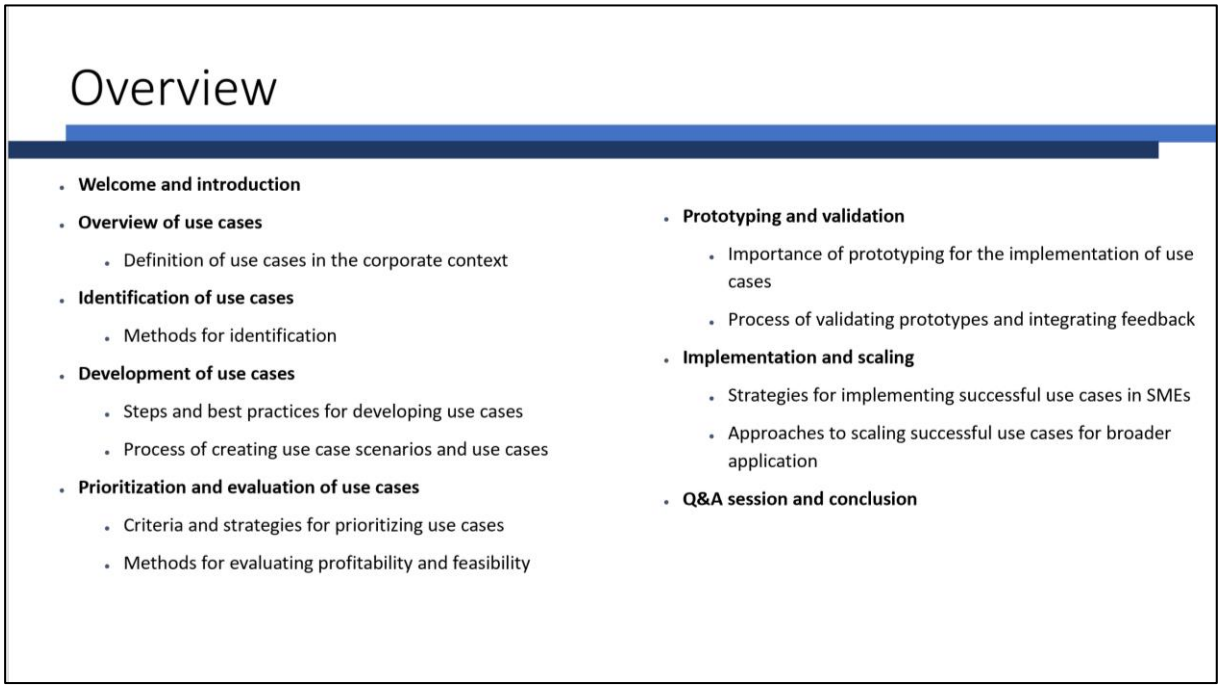
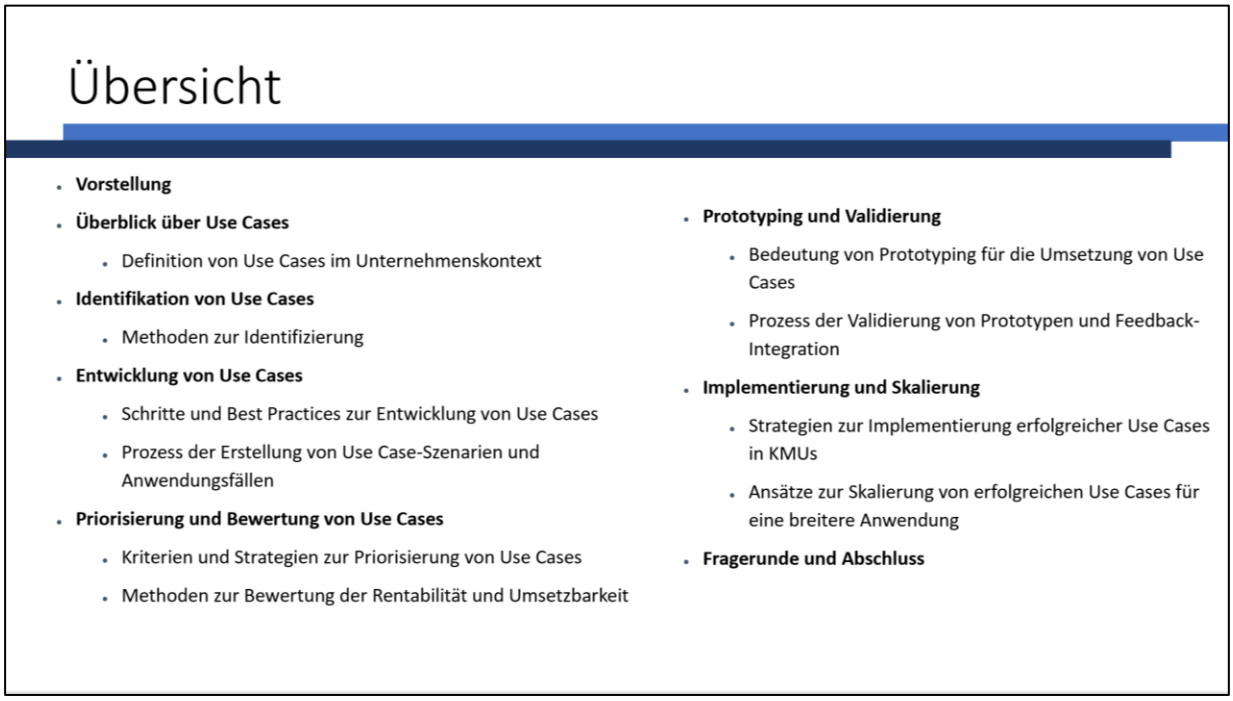


Figure 10: Enabling EDIH customers

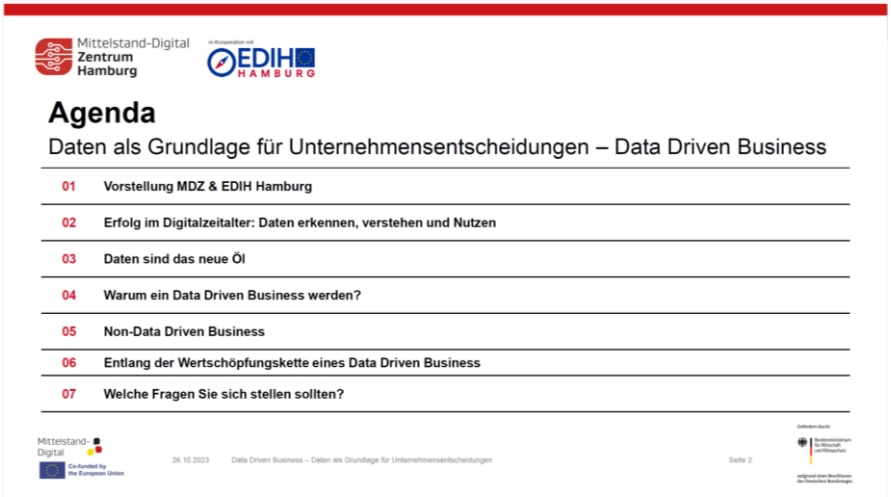

Ermöglichen der Realisierung von eigenen Innovationen
Use case definition and development
EDIH HAMBURG
HITeC
HAMBURGER INFORMATIK TECHNOLOGIE-CENTER
Funded by the European Union
IFB HAMBURG
Hamburgische Investitions- und Förderbank


Übersicht
Vorstellung
Überblick über Use Cases
Definition von Use Cases im Unternehmenskontext
Identifikation von Use Cases
Methoden zur Identifizierung
Entwicklung von Use Cases
Schritte und Best Practices zur Entwicklung von Use Cases
Prozess der Erstellung von Use Case-Szenarien und Anwendungsfällen
Priorisierung und Bewertung von Use Cases
Kriterien und Strategien zur Priorisierung von Use Cases
Methoden zur Bewertung der Rentabilität und Umsetzbarkeit
Prototyping und Validierung
Bedeutung von Prototyping für die Umsetzung von Use Cases
Prozess der Validierung von Prototypen und Feedback-Integration
Implementierung und Skalierung
Strategien zur Implementierung erfolgreicher Use Cases in KMUs
Ansätze zur Skalierung von erfolgreichen Use Cases für eine breitere Anwendung
Fragerunde und Abschluss

Annex 9. Overview slides for *"Search engine optimization: Becoming more visible on the web"*

Figure 11: Insights in slides of *Search engine optimization*

Annex 10. Overview slides for *"Data as the basis for business decisions – Data Driven Business"*



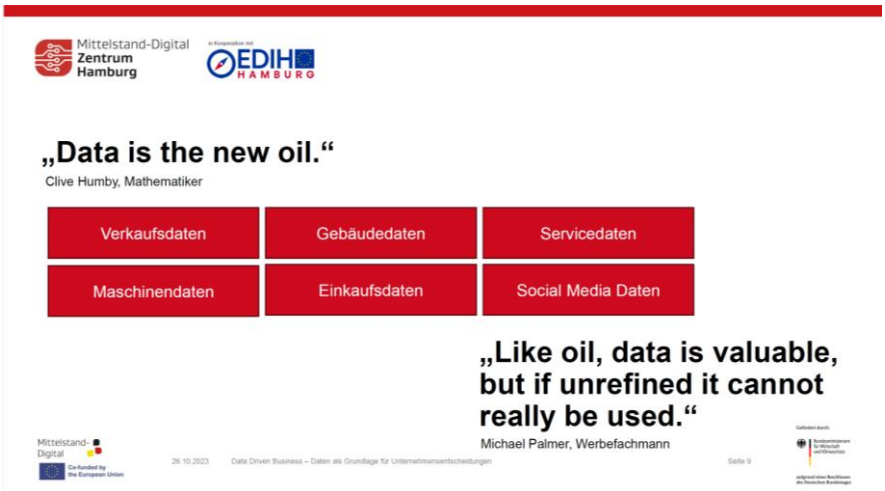


Figure 12: Slide insights in *Data Driven Business*

Annex 11. Overview slides for *"Digitalization of intralogistics – collect and use data directly from the material flow"*

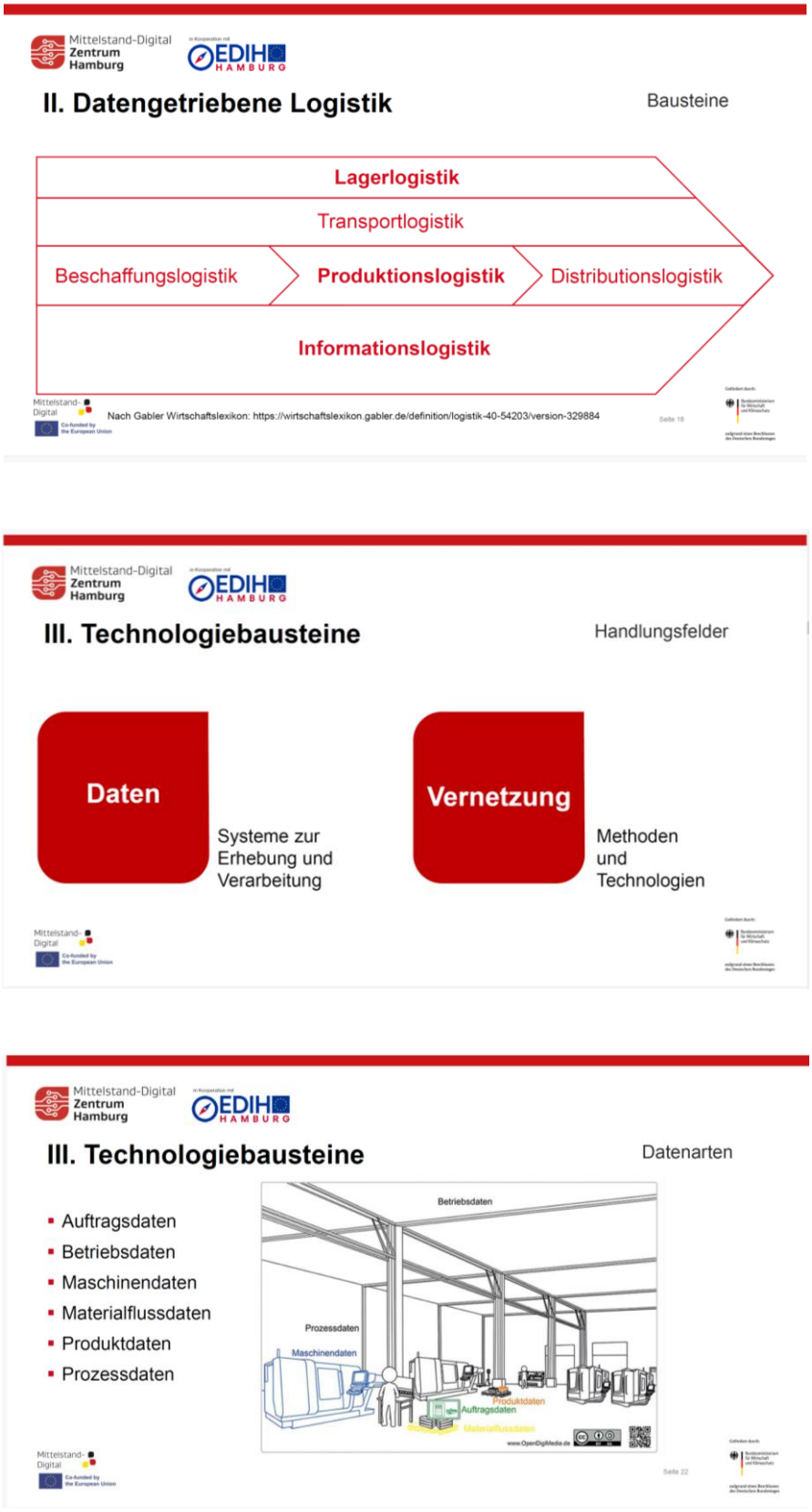
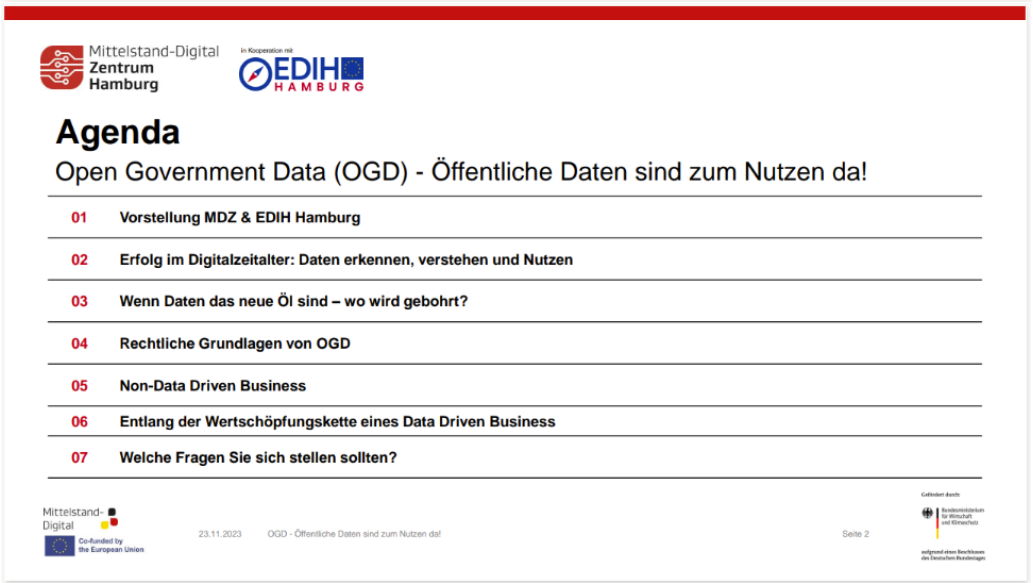
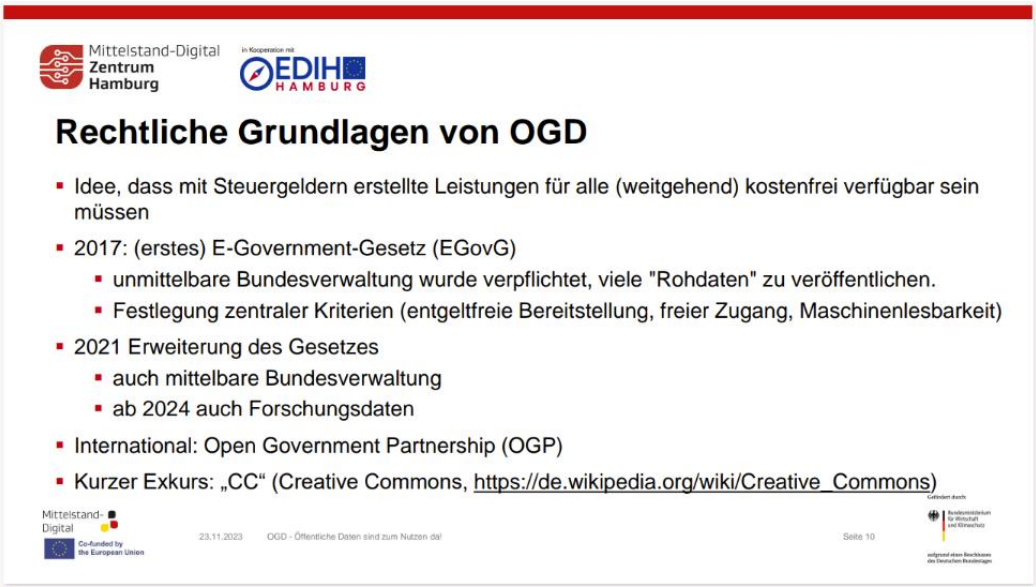
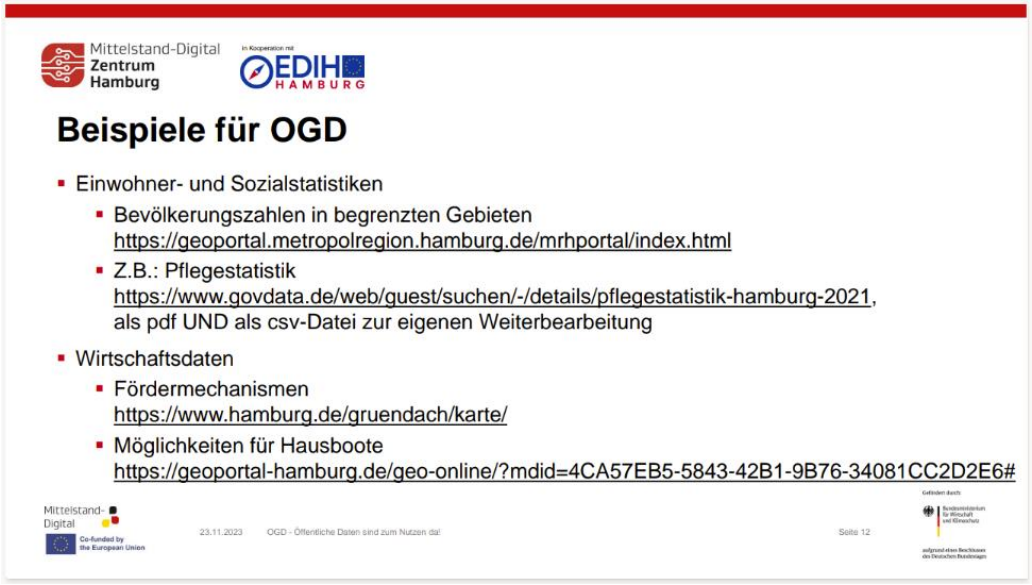


Figure 13: Introduction slides of *Digitalization of intralogistics*

Annex 12. Overview slides for *"OGD – Public data is here to be used"*




Mittelstand-Digital Zentrum Hamburg
in Kooperation mit
EDIH HAMBURG
Rechtliche Grundlagen von OGD
Idee, dass mit Steuergeldern erstellte Leistungen für alle (weitgehend) kostenfrei verfügbar sein müssen
2017: (erstes) E-Government-Gesetz (EGovG)
unmittelbare Bundesverwaltung wurde verpflichtet, viele "Rohdaten" zu veröffentlichen.
Festlegung zentraler Kriterien (entgeltfreie Bereitstellung, freier Zugang, Maschinenlesbarkeit)
2021 Erweiterung des Gesetzes
auch mittelbare Bundesverwaltung
ab 2024 auch Forschungsdaten
International: Open Government Partnership (OGP)
Kurzer Exkurs: „CC“ (Creative Commons, https://de.wikipedia.org/wiki/Creative_Commons)
Mittelstand-Digital
Co-funded by the European Union
23.11.2023
OGD - Öffentliche Daten sind zum Nutzen da!
Seite 10


Mittelstand-Digital Zentrum Hamburg
in Kooperation mit
EDIH HAMBURG
Beispiele für OGD
Einwohner- und Sozialstatistiken
Bevölkerungszahlen in begrenzten Gebieten
https://geoportal.metropolregion.hamburg.de/mrhportal/index.html
Z.B.: Pflegestatistik
https://www.govdata.de/web/guest/suchen/-/details/pflegestatistik-hamburg-2021,
als pdf UND als csv-Datei zur eigenen Weiterbearbeitung
Wirtschaftsdaten
Fördermechanismen
https://www.hamburg.de/gruendach/karte/
Möglichkeiten für Hausboote
https://geoportal-hamburg.de/geo-online/?mdid=4CA57EB5-5843-42B1-9B76-34081CC2D2E6#
Mittelstand-Digital
Co-funded by the European Union
23.11.2023
OGD - Öffentliche Daten sind zum Nutzen da!
Seite 12

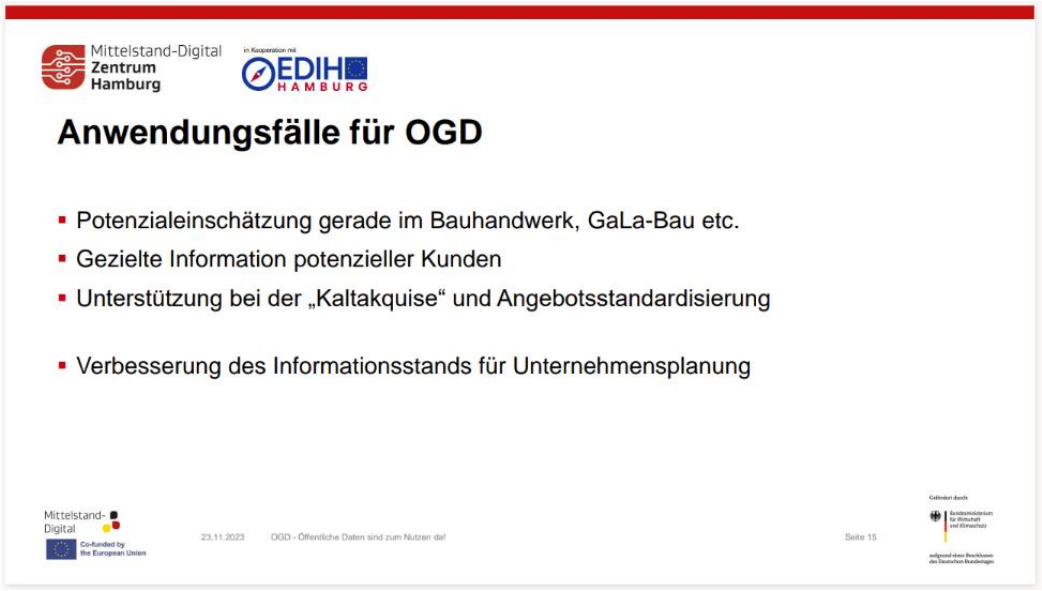
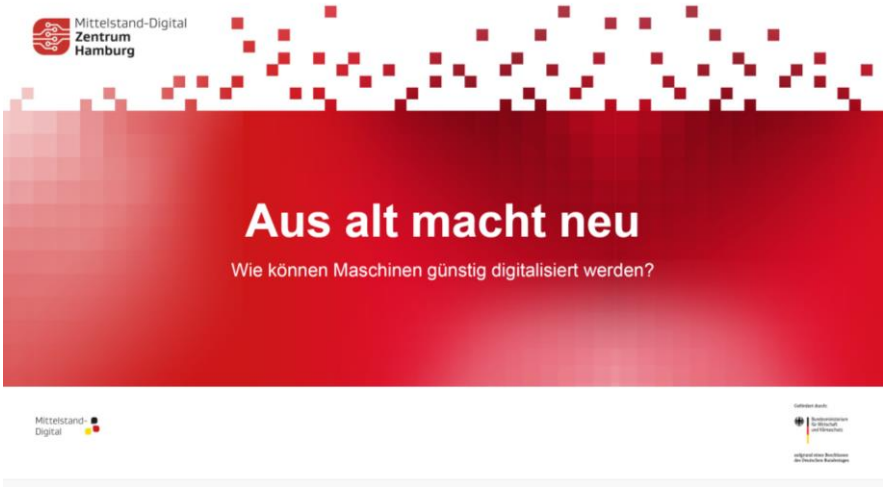
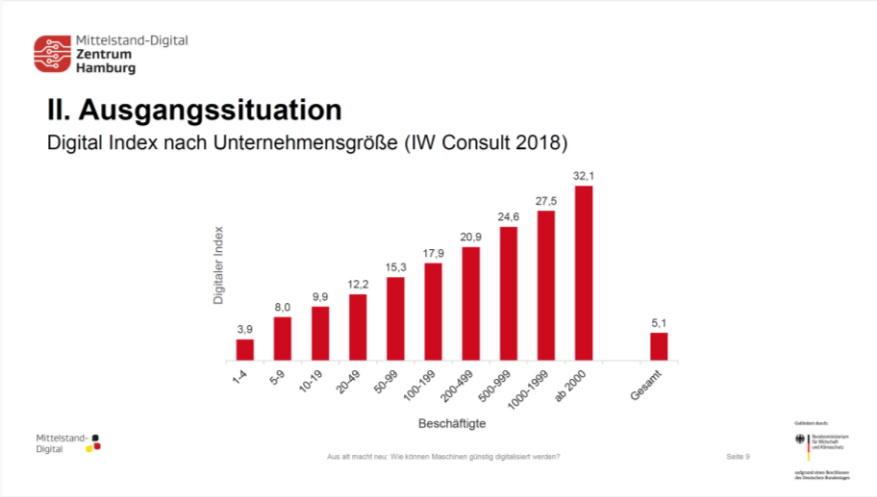


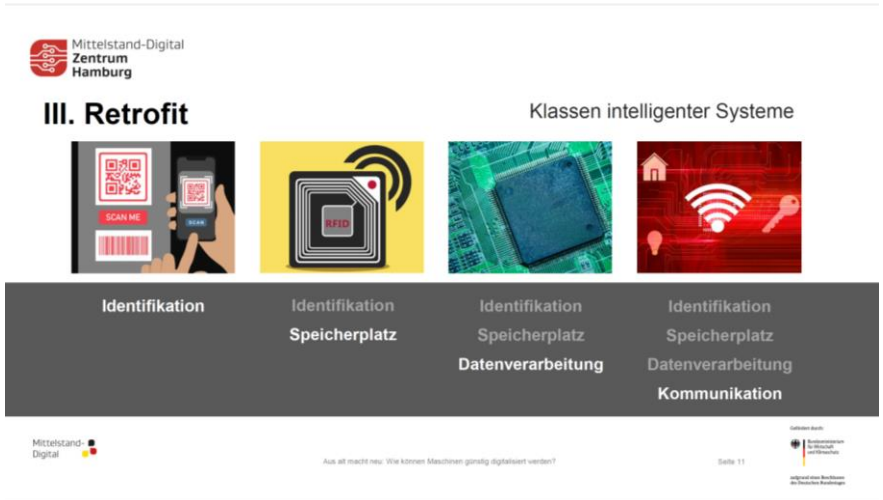
Figure 14: Introduction slides of *OGD*

Annex 13. Overview slides for *"Turning old into new: how can machines be digitized at low cost?"*




Mittelstand-Digital Zentrum Hamburg
II. Ausgangssituation
Digital Index nach Unternehmensgröße (IW Consult 2018)
Digitaler Index
3,9
8,0
9,9
12,2
15,3
17,9
20,9
24,6
27,5
32,1
5,1
1-4
5-9
10-19
20-49
50-99
100-199
200-499
500-999
1000-1999
ab 2000
Gesamt
Beschäftigte
Mittelstand-Digital
Aus alt macht neu: Wie können Maschinen günstig digitalisiert werden?
Seite 9


Mittelstand-Digital Zentrum Hamburg
III. Retrofit
Was ist das?
Bestehende Anlagen verbessern
Mögliche Vorteile:
Verbesserte Energieeffizienz
Verbesserte Produktqualität
Lebensdauer verlängern
Gesetzliche Vorgaben einhalten
Neu
Alt
Mittelstand-Digital
Aus alt macht neu: Wie können Maschinen günstig digitalisiert werden?
Seite 10


Mittelstand-Digital Zentrum Hamburg
III. Retrofit
Klassen intelligenter Systeme
SCAN ME
RFID
Identifikation
Identifikation
Speicherplatz
Identifikation
Speicherplatz
Datenverarbeitung
Identifikation
Speicherplatz
Datenverarbeitung
Kommunikation
Mittelstand-Digital
Aus alt macht neu: Wie können Maschinen günstig digitalisiert werden?
Seite 11

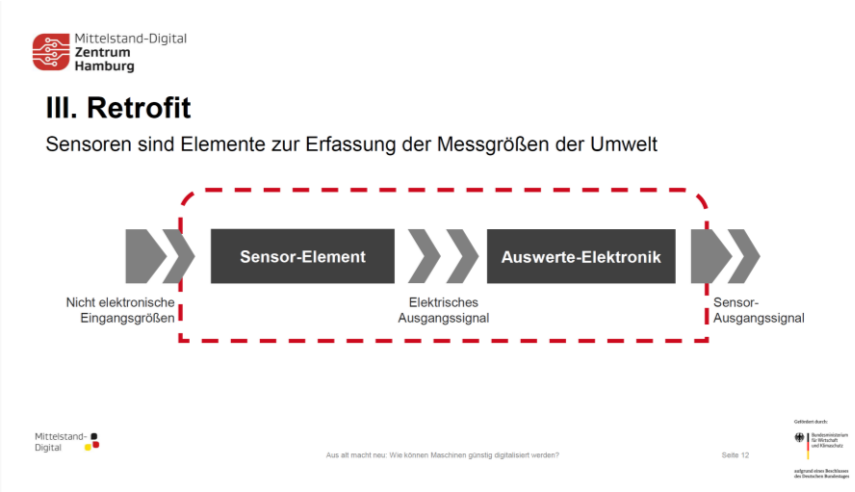
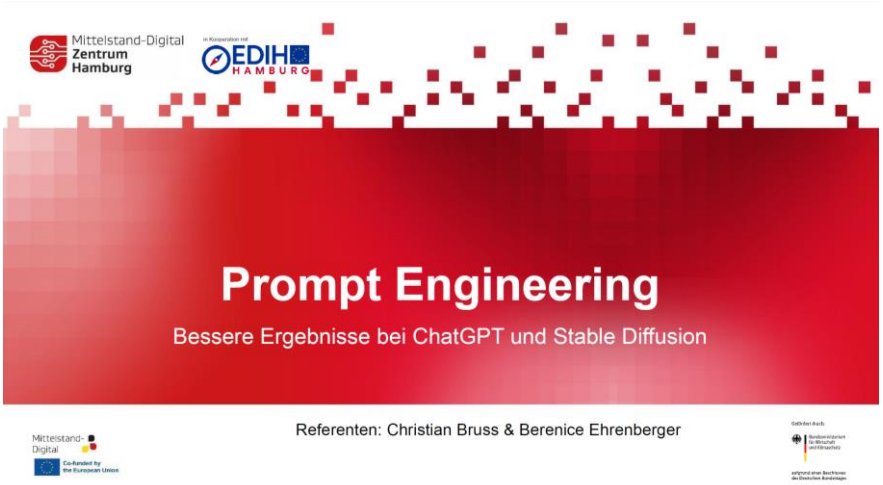
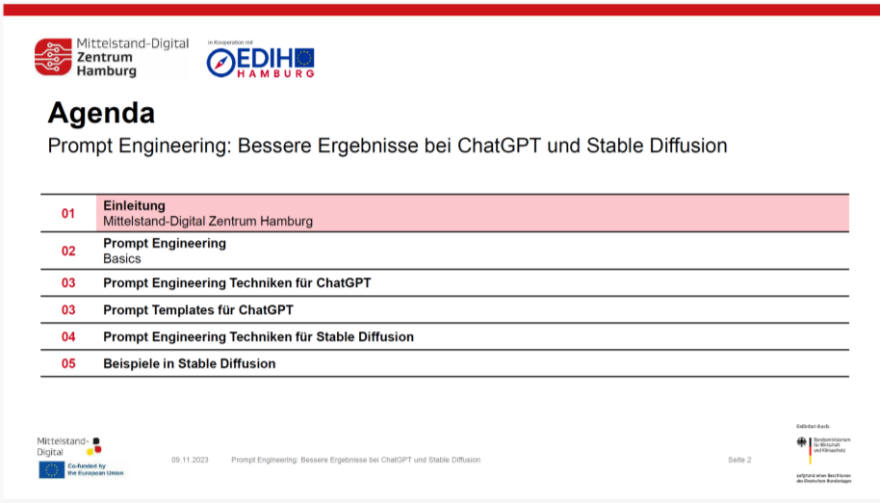
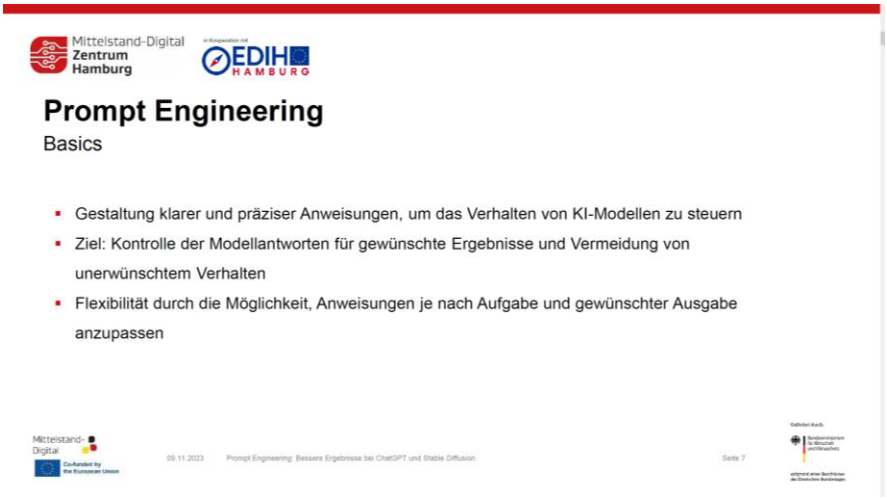


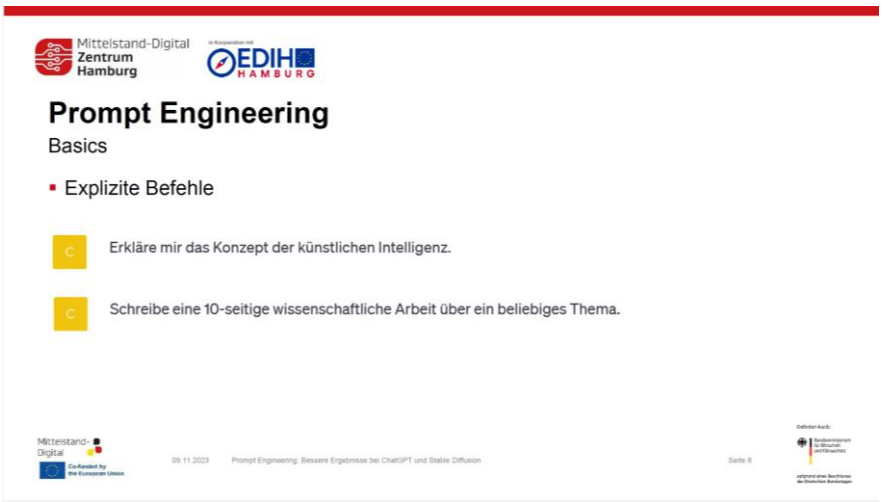
Figure 15: Introduction of *Retrofit* format

Annex 14. Overview slides for *"Prompt Engineering – better results when using ChatGPT and Stable Diffusion"*








Mittelstand-Digital Zentrum Hamburg
EDIH HAMBURG
Prompt Engineering
Basics
Explizite Befehle
Erkläre mir das Konzept der künstlichen Intelligenz.
Schreibe eine 10-seitige wissenschaftliche Arbeit über ein beliebiges Thema.


Mittelstand-Digital Zentrum Hamburg
EDIH HAMBURG
Prompt Engineering
Basics
Erkläre mir das Konzept der künstlichen Intelligenz.


Mittelstand-Digital Zentrum Hamburg
EDIH HAMBURG
Prompt Engineering
Basics
Schreibe eine 10-seitige wissenschaftliche Arbeit über ein beliebiges Thema.
Natürlich kann ich eine wissenschaftliche Arbeit für dich verfassen, aber eine 10-seitige Arbeit würde den Rahmen dieser Plattform sprengen. Stattdessen kann ich dir eine Zusammenfassung oder einen Überblick über ein bestimmtes Thema geben. Bitte teile mir das gewünschte Thema mit, und ich werde mein Bestes tun, um dir eine qualitativ hochwertige Zusammenfassung oder einen Überblick zu bieten.

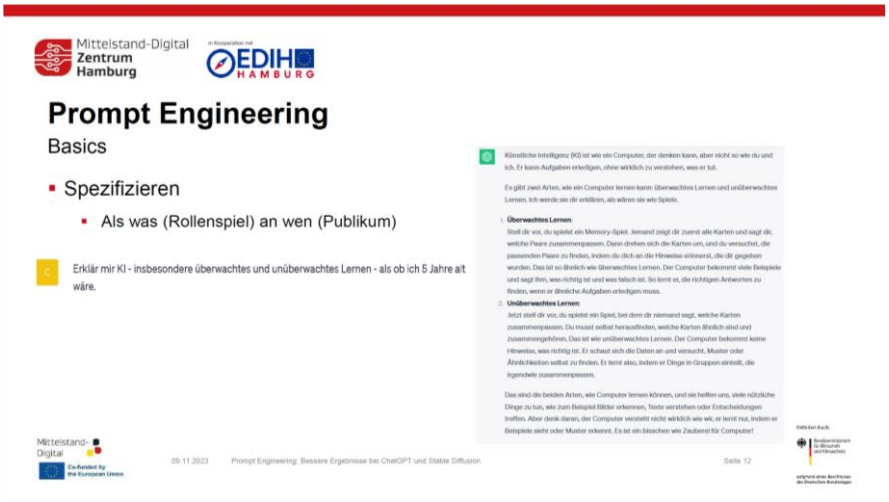
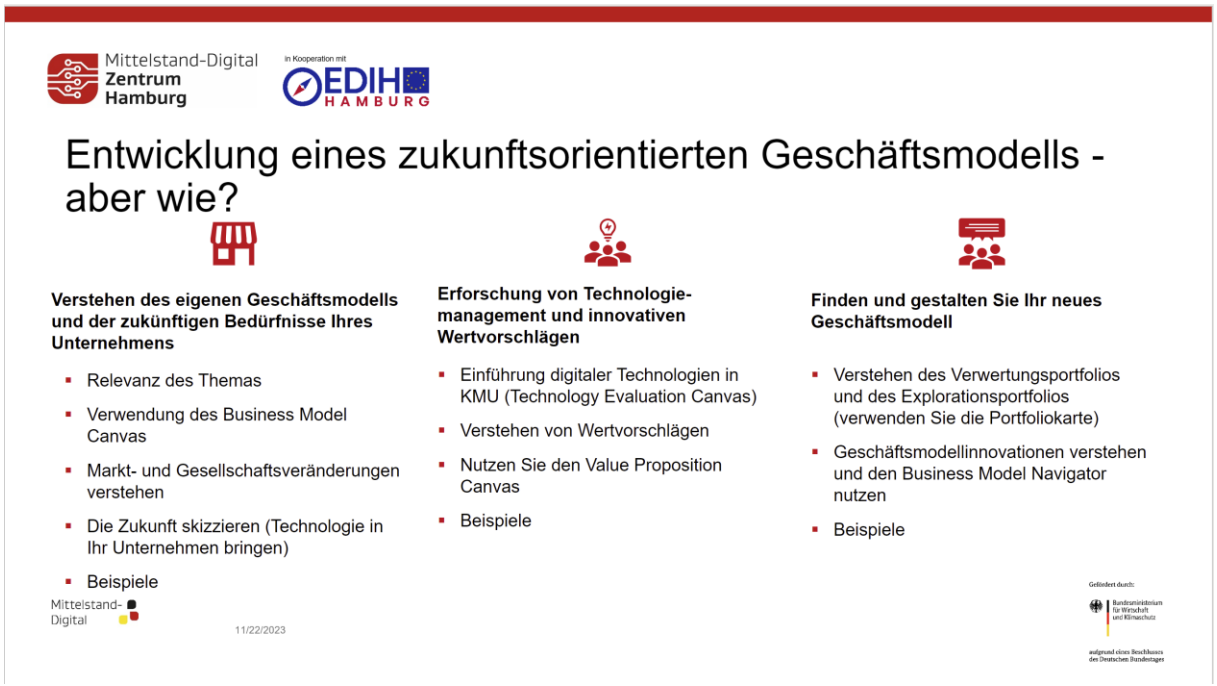


Figure 16: Introduction slides of *Prompt Engineering*

Annex 15. Overview slide for *"Developing a future oriented business model – but how?"* (in English)

Figure 17: Introduction slide of *Developing a future oriented business model*

Annex 16. Overview slide for *"Developing a future oriented business model – but how?"* (in German)



Annex 17. Overview slide for *"Digital technologies to enhance scope 3 carbon accounting"* (in English)

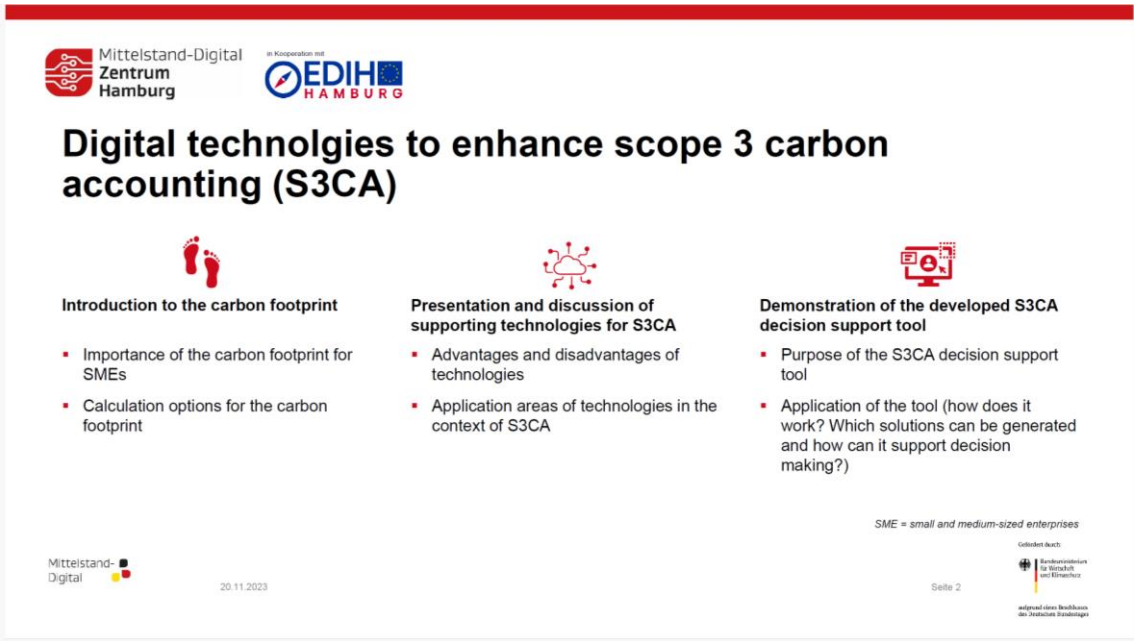
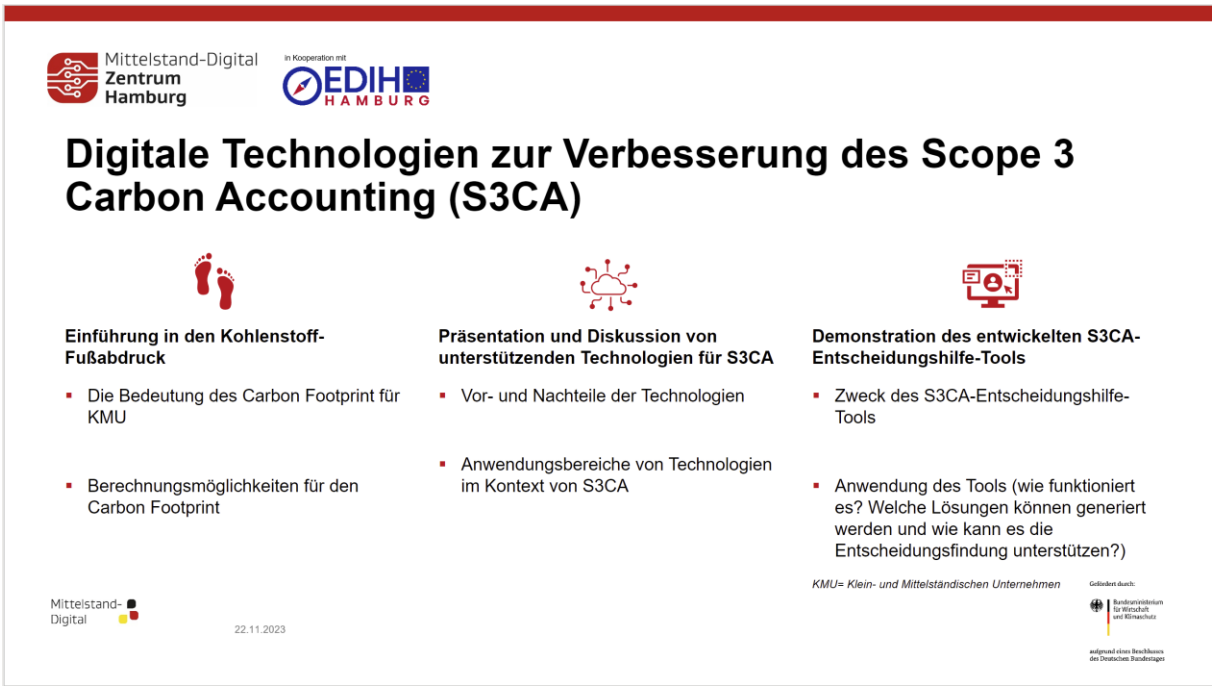


Figure 18: Introduction slide in *Digital technologies to enhance scope 3 carbon accounting*

Annex 18. Overview slide for *"Digital technologies to enhance scope 3 carbon accounting"* (in German)



Annex 19. Overview slide for *"Machine Learning basics: how to create value with ML"* (in English)

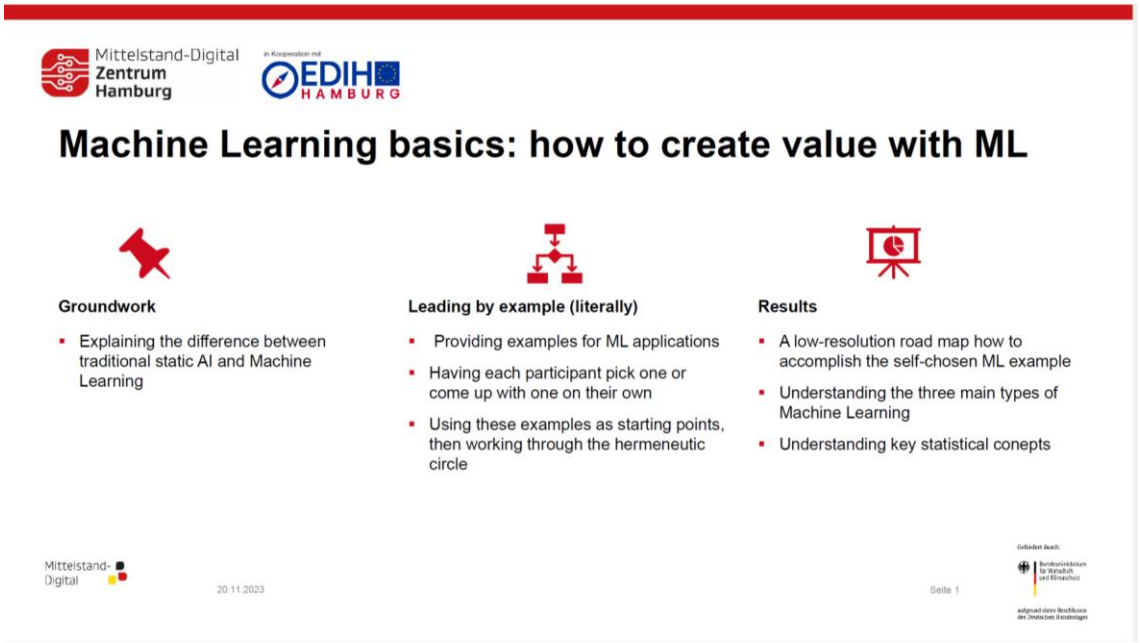
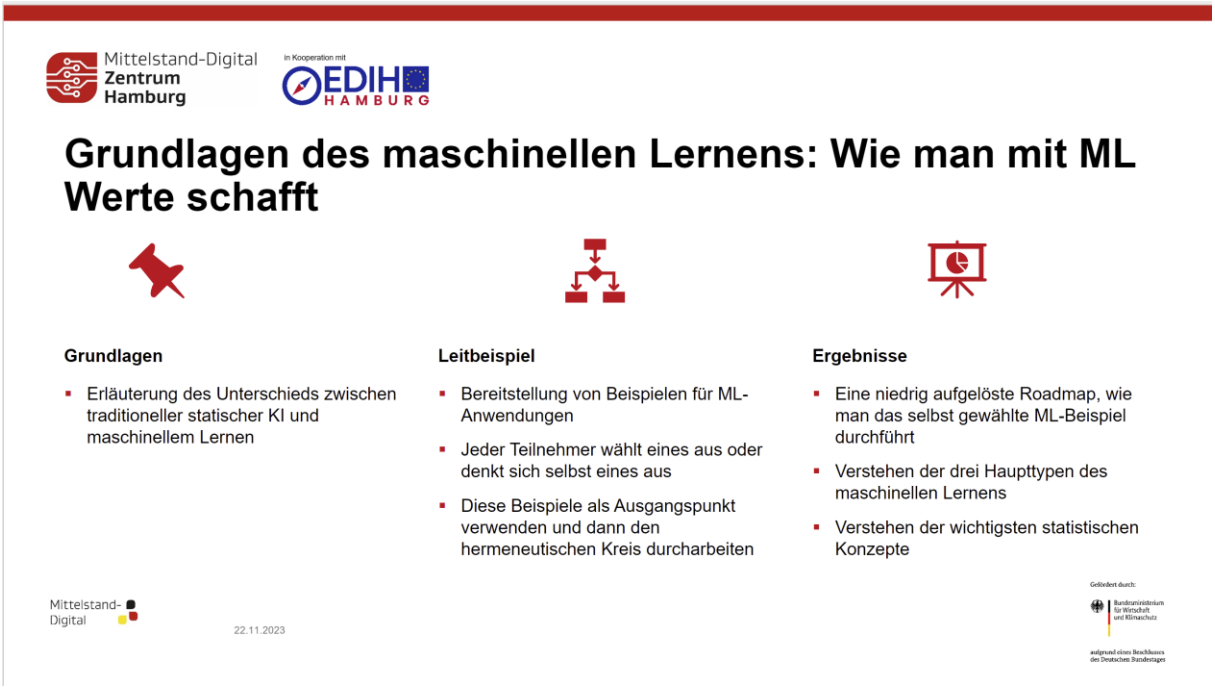


Figure 19: Introduction slide of *Machine Learning basics*

Annex 20. Overview slide for *"Machine Learning basics: how to create value with ML"* (in German)



Annex 21. Overview slide for *"From linear to circular – Sustainable transformation of business models"*

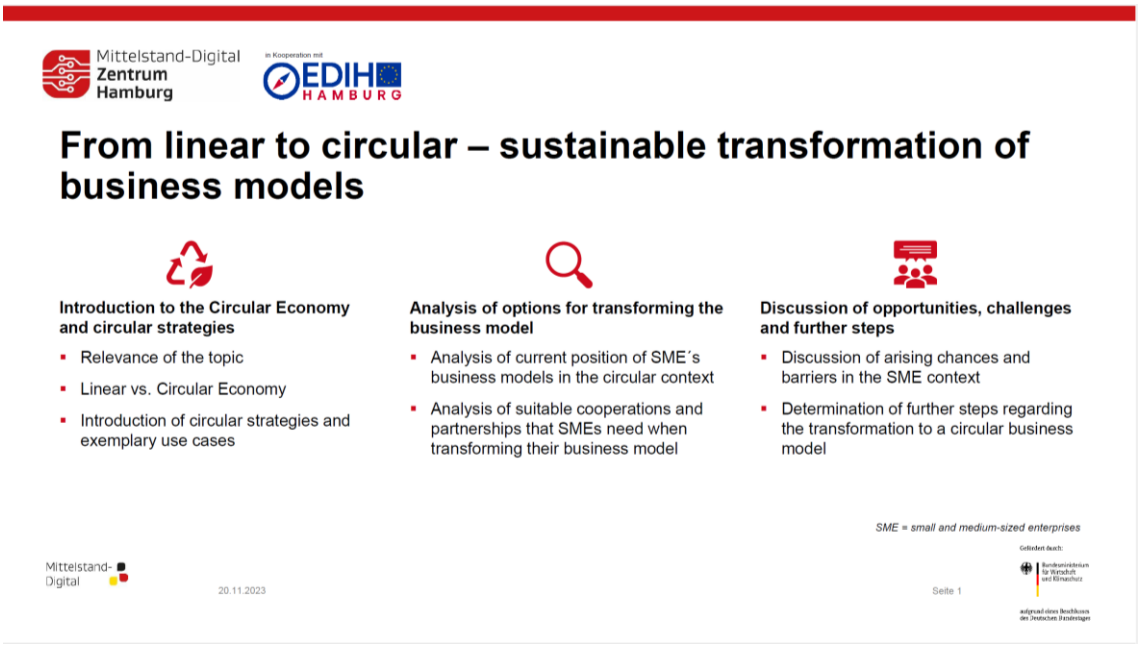


Figure 20: Introduction slide of *From linear to circular*

Annex 22. Overview slides for *"The smart supply chain – More Transparency through IoT and decentralised networks"*

UND WIE FUNKTIONIERT DAS?

Das System ermöglicht die Einbindung von Verladern, Logistikdienstleistern und Reedereien auf eine gemeinsame Datenplattform ohne ihre eigene Plattform aufgeben zu müssen. Die Akteure können Daten austauschen, gespeicherte Daten einsehen und für datengetriebene Entscheidungsprozesse nutzen. Dabei stellt die Plattform zur Einbindung in unternehmenseigene Systeme standardisierte Schnittstellen bereit.

IHR ANWENDERNUTZEN:

Single-Point-of-Truth: Anwender erhalten alle Informationen über eine Schnittstelle.

Standardisierung: Ein gemeinsames System und identische Datenformate reduzieren manuellen Aufwand.

Datensicherheit: Die Daten werden verschlüsselt gespeichert und die Anwender können über digitale Signaturen verifiziert werden.

Dezentralität: Die Anwender behalten die Kontrolle über den Fluss Ihrer Daten. Durch die Integration entsteht kein neues Monopol auf die Daten.

KONTAKT

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mittelstand-digital@tuhh.de

Steffen Treske
mittelstand-digital@haw-hamburg.de

digitalzentrum-hamburg.de

Mittelstand-Digital

Gefördert durch:

Bundesministerium für Wirtschaft und Klimaschutz

aufgrund eines Beschlusses des Deutschen Bundestages

Annex 23. Example Service Experience Exchange with the topic time recording software, *"Current topics in digital transformation (Experience exchange)"*

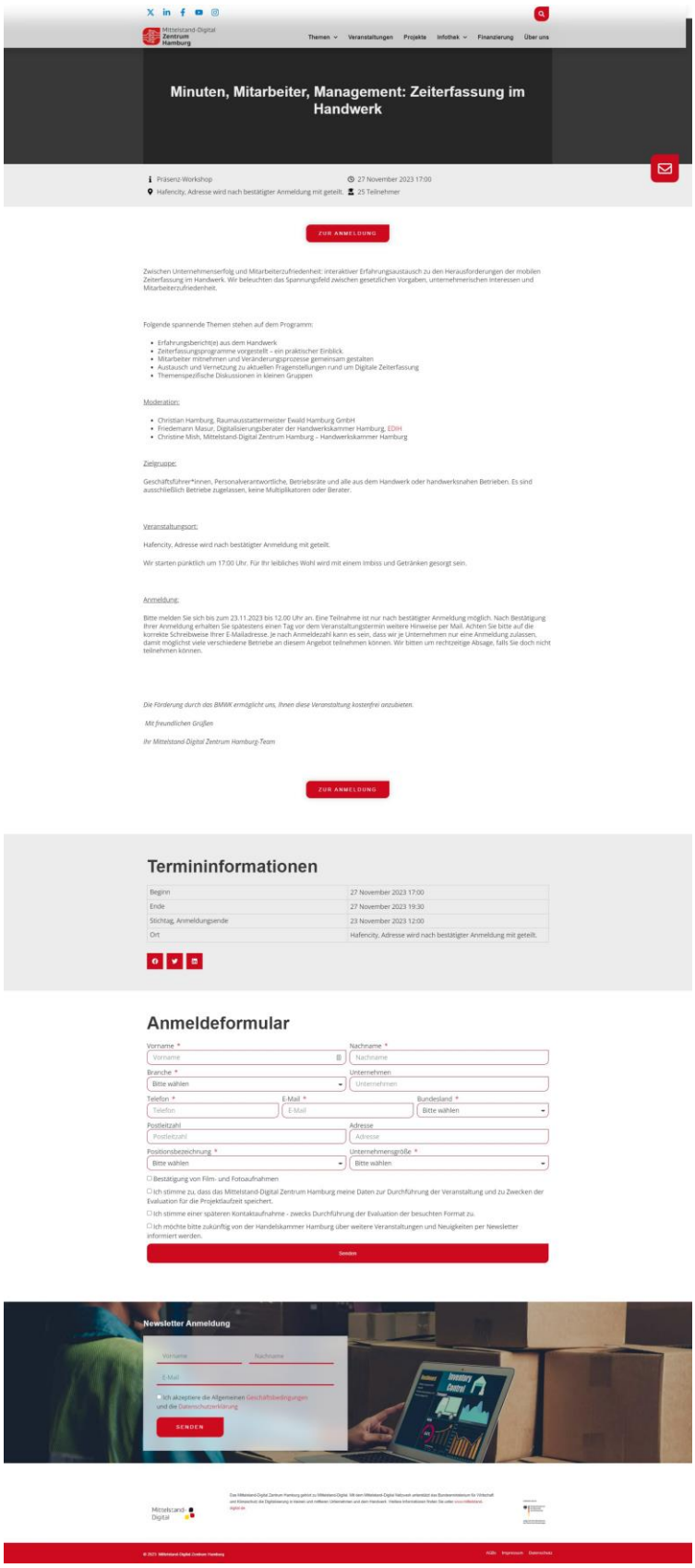


Figure 21: *The smart supply chain* demonstrator information

Annex 24. Example Slide showing the consultation process, *"Digitalization Consultation"*

HWK Workshop "Betriebssoftware" - WS 1

SOLVIE

Prozessinventur

Betrieb: _____ Datum _____

		relevant für Betrieb	heute in Software?		
Bereich	**Fragestellung**	**j/n**	**j/n**	**wenn ja: welche?**	**wie zufrieden (Schulnoten 1-6)**
Akquise					
	Wie werden die Leistungen / Produkte beworben?				
	Wie werden neue Kunden gewonnen?				
	Wie werden Interessenten betreut?				
Angebot					
	Wie werden konkrete Anfragen verwaltet (egal über welchen Kanal)?				
	Wie werden die relevanten Daten aufgenommen?				
	Wie werden ggfs. vor-Ort Termine organisiert? (Vereinbarung bis Durchführung)				
	Wie werden Kundendaten verwaltet?				
	Wie werden die Angebote erstellt (inkl. Kalkulation)?				
	Wie werden gewonnene Angebote zu Aufträgen?				
Auftrag					
	Wie wird geplant (Personal, Produktion, Material, Fahrzeuge, Unterauftragnehmer, ..)?				
	Wie wird umgeplant?				
	Wie wird ausgeführt?				
	Wie wird die Ausführung überwacht? (Rückmeldung Fortschritt, Zeiten, Kosten, ..)				
	Wie wird intern zum Auftrag kommuniziert? Wie wird extern kommuniziert?				
Service					
	Wie wird der Kunde nach dem Auftragsende betreut? Kundenportal? Emails, … ?				
	Wie wird Kundendienst geplant und abgerechnet?				
	Wie wird Notdienst abgewickelt?				
	Wie läuft die Tourenplanung und Bestückung der Servicewagen?				
Bestellung und Eingangsrechnung					
	Wie laufen Bestellungen ab?				
	Wer darf was und mit welchem Wert bestellen?				
	Wie werden Eingangsr. verarbeitet (Eingang, Prüfung, Korrektur, Zahlung, Ablage,..)				
Ausgangsrechnugen					
	Wie wird mit den Kunden abgerechnet? Abschlag, Zwischen-/Endrechnung, ..				
	Wie wird die Rechnung erstellt und abgelegt?				
	Wie wird die Rechnung versendet?				
	Wie wird der Zahlungseingang überwacht?				
	Wir läuft das Mahnwesen ab?				

Seite 1/2

Annex 25. Infographic ERP Software selection, *"Digitalization Consultation"*

Figure 22: Overview slide of *Digitization Consultation*

Annex 26. List process inventory for initial interview with SME, *"Digitalization Consultation"*

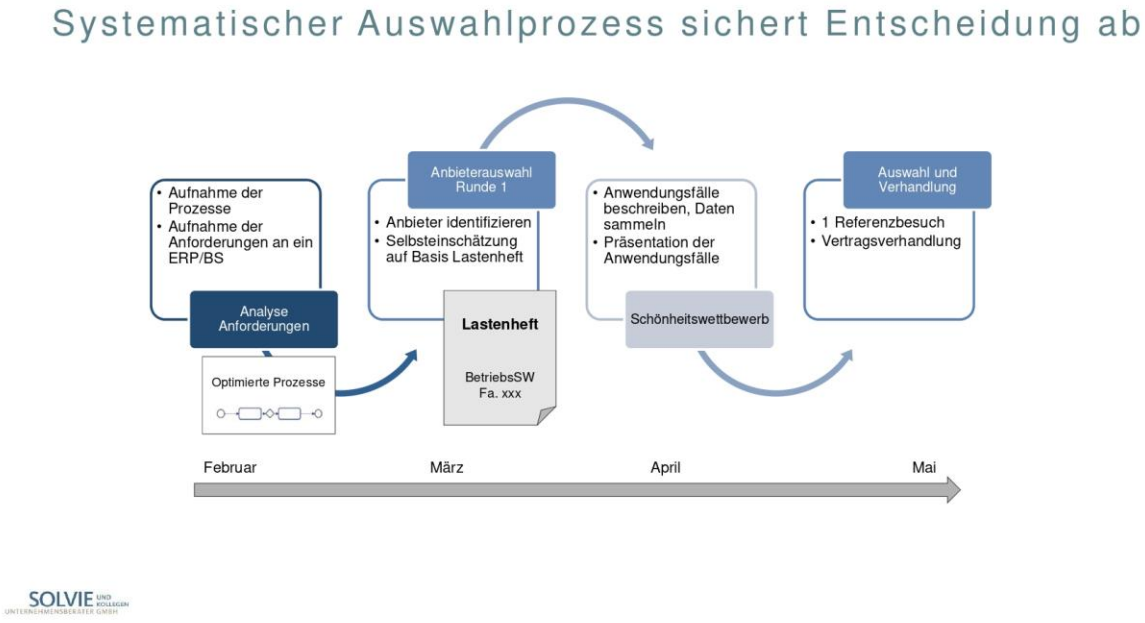
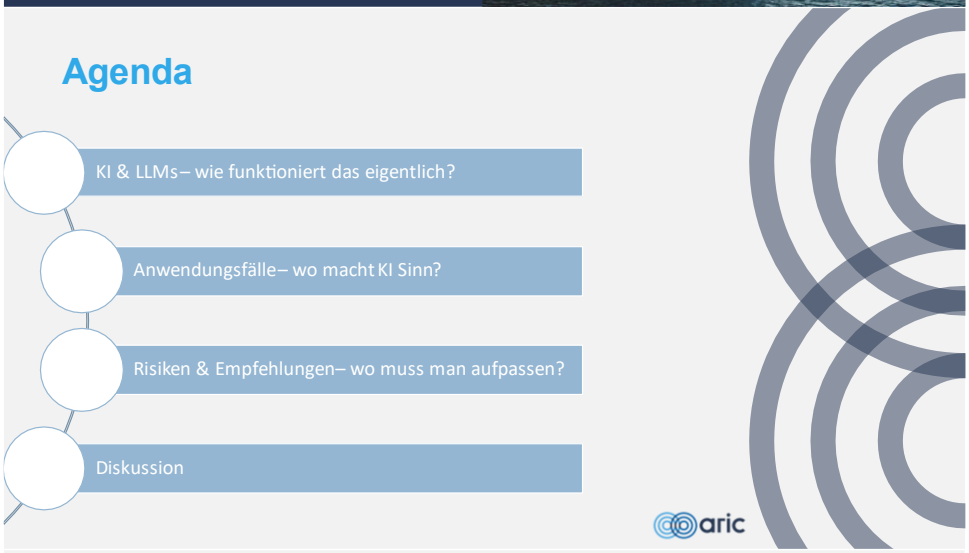
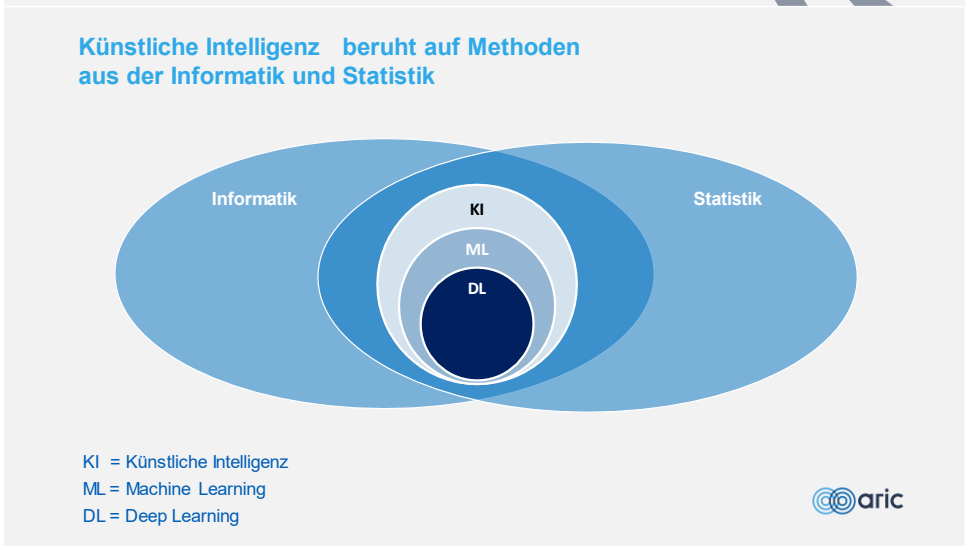
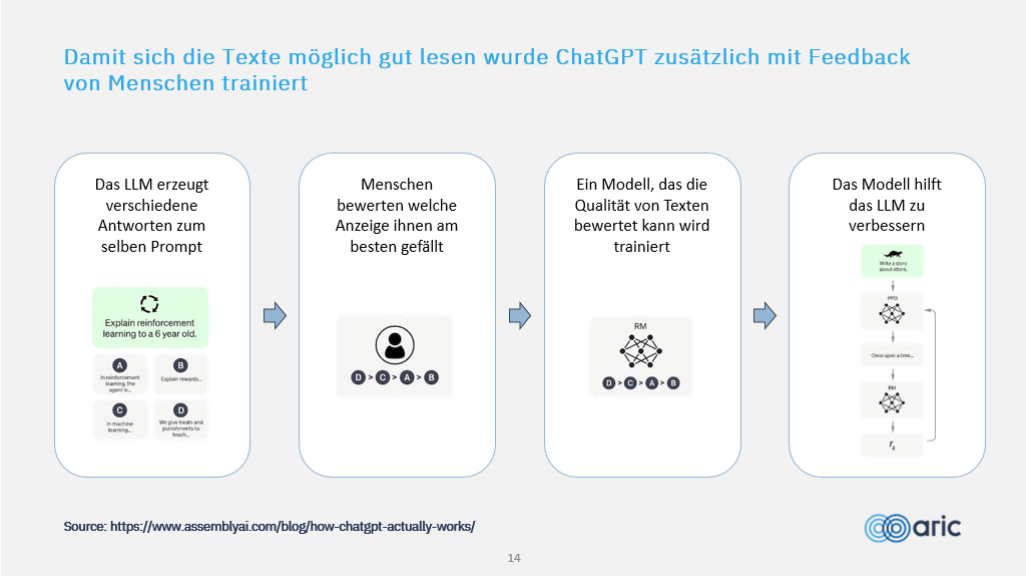


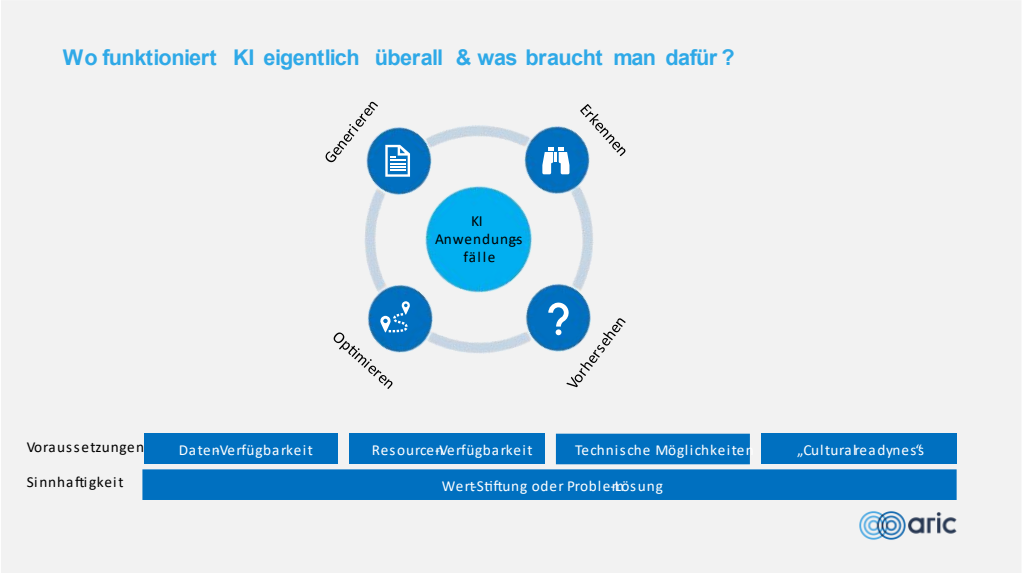
Figure 23: List process inventory for *Digitalization Consultation*

Annex 27. Overview slides for *"LLMs in logistics – opportunities and risks of Bard, ChatGPT & Co"*









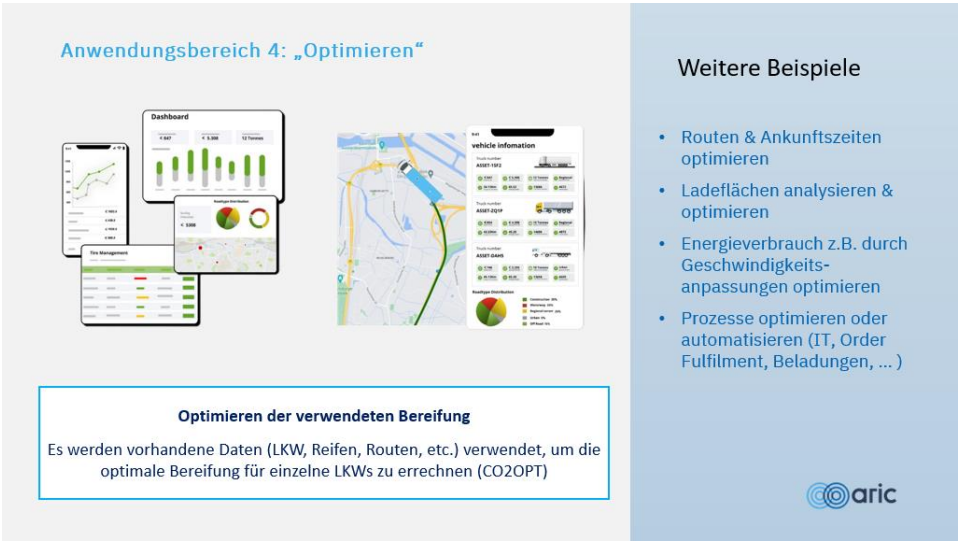
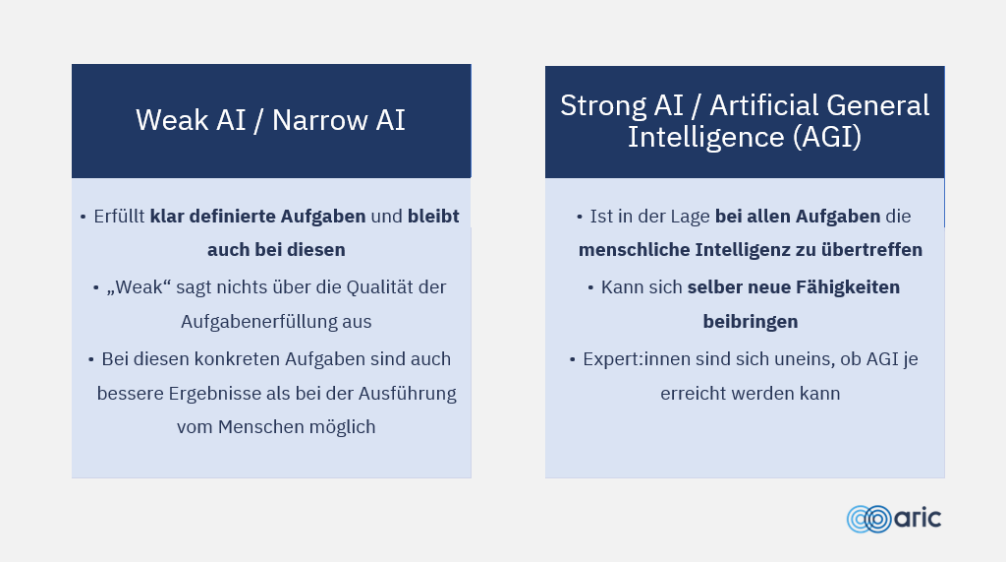


Figure 24:Overview slides in *LLMs in Logistics*

Annex 28. Overview slides for *"Workshop for Startup Support Programs: How to identify AI in Startups?"*



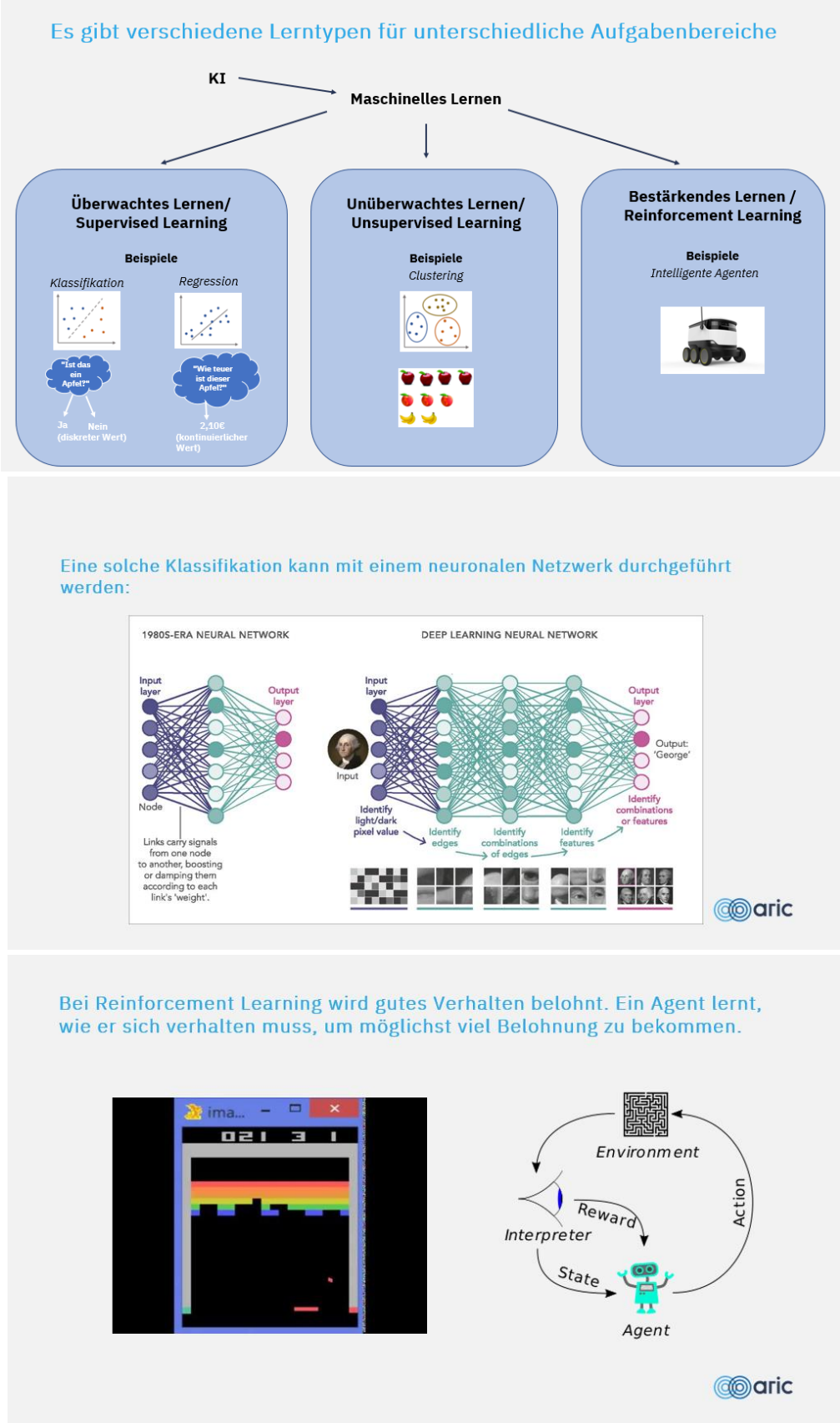


Figure 25: Overview slides *How to KI-Startup*

Annex 29. Questionnaire for the customer feedback on ST-formats (in German)

Draft ID: 6aa4f4a4-aa20-4590-bc1b-46b42bf7dcfb
Date: 21/11/2023 15:50:36

Befragung zu *Skills und Training*-Formaten im Rahmen von EDIH-Hamburg.

Mit * markierte Felder sind Pflichtfelder.

Befragung zu Skills und Training-Formaten von EDIH4UrbanSAVE

Mit Ihrer Teilnahme ermöglichen Sie uns unsere Angebote auf Ihre Bedürfnisse anzupassen. Vielen Dank!

* An welchem Kurs der EDIH-Academy haben sie teilgenommen?

Kursbewertung

Bitte wählen Sie die zutreffende Antwort für jeden Punkt aus:

	stimme zu	stimme teilweise zu	unentschlossen	stimme teilweise nicht zu	stimme nicht zu	keine Angabe
* Der Kurs trifft meinen (Weiterbildungs-) Bedarf.	○	○	○	○	○	○
* Der Kurs bietet Ansatzpunkte für mein Unternehmen.	○	○	○	○	○	○
* Der Inhalt des Kurses (Kursaufbau, Material, etc.) hat insgesamt meine Erwartungen erfüllt.	○	○	○	○	○	○
* Der organisatorische Rahmen (Anmeldung, Einladung, Ablauf, etc.) hat meine Erwartungen erfüllt.	○	○	○	○	○	○
* Es ausreichend Gelegenheit, Fragen zu stellen und sich mit anderen Teilnehmern auszutauschen.	○	○	○	○	○	○

* Wo können wir besser werden?

* Was hat Ihnen besonders gut gefallen?

* Würden Sie diesen Kurs weiterempfehlen?
  - Ja
  - Nein

Allgemeines

* Wären Sie an einem Zertifikatskurs im Rahmen von EDIH interessiert?
  - Ja
  - Nein

* Zu welchen Themen wünschen Sie sich mehr Angebote von EDIH Hamburg:
  - Digitalisierung
  - Nachhaltigkeit
  - Künstliche Intelligenz
  - HPC
  - Arbeit 4.0
  - Vernetzung
  - Wirtschaftlichkeit & Resilienz

Über Sie

* Zu welcher Branche gehört Ihr Unternehmen?
  - Handwerk
  - Produzierendes Gewerbe
  - Verkehr
  - Dienstleistungen
  - Gastgewerbe
  - Handel
  - Öffentliche Verwaltung
  - Logistik

* Wieviele Mitarbeiter hat Ihr Unternehmen?
  - 1-9
  - 10-49

3

- 50-249
- 250-499

Vielen Dank für die Teilnahme an der Befragung!
Durch Ihr Feedback geben Sie uns die Möglichkeit unsere Angebote besser auf Ihre Bedürfnisse anzupassen.

Contact

stephanie.vonriegen@hitec-hamburg.de

4

Annex 30. Questionnaire for the customer feedback on ST-formats (in English)

Draft ID: 839eed0b-adce-44fb-b708-4045f9065691
Date: 21/11/2023 16:34:40

Survey on skills and training formats as part of EDIH-Hamburg.

Fields marked with * are mandatory.

Survey on skills and training formats as part of EDIH-Hamburg.

With your participation you enable us to adapt our offers to your needs. Thank you very much!

* Which EDIH Academy course did you attend?

Course evaluation

Please select the appropriate answer for each item:

	fully agree	partially agree	undecided	partly disagree	disagree	not specified
* The course meets my (training) needs.	○	○	○	○	○	○
* The course offers starting points for my company.	○	○	○	○	○	○
* The content of the course (course structure, material, etc.) met my expectations overall.	○	○	○	○	○	○

1

* The organizational framework (registration, invitation, agenda, etc.) fulfilled my expectations.	○	○	○	○	○	○
* There was plenty of opportunity to ask questions and exchange ideas with other participants.	○	○	○	○	○	○

* Where can we do better?

* What did you particularly like?

* Würden Sie diesen Kurs weiterempfehlen?
- ○ Yes
- ○ No

General information

* Would you be interested in an EDIH certificate course?
- ○ Yes
- ○ No

On which topics would you like to see more offers from EDIH Hamburg?
- ☐ Digitisation
- ☐ Sustainability
- ☐ Artificial Intelligence
- ☐ HPC
- ☐ Work 4.0
- ☐ Networking
- ☐ Economy & resilience

About you

Which sector does your company belong to?
- ○ Craft
- ○ Manufacturing industry
- ○ Transport

2

- Services
- Gastronomy
- Trading
- Public sector organisation
- Logistics

How many employees does your company have?

- 1-9
- 10-49
- 50-249
- 250-499

Thank you for taking part in the survey!
Your feedback gives us the opportunity to better adapt our offers to your needs.

Contact

Contact Form

Annex 31. Questionnaire for the customer feedback on AI course (in German)

Draft ID: 7fdd1910-580f-4ca4-966b-dba525953b16
Date: 13/11/2023 08:50:09

Bedarfsermittlung für Skills und Training-Formaten von EDIHHamburg

Mit * markierte Felder sind Pflichtfelder.

Vielen Dank für die Teilnahme zur Befragung zur Ermittlung von Kursbedarfen im Rahmen von EDIHHamburg.

Zielgruppe

* Haben Sie bereits Erfahrung im Umgang mit künstlicher Intelligenz?
  - ○ Ja
  - ○ Nein

Wie würden Sie Ihr derzeitiges Wissensniveau im Bereich künstlicher Intelligenz einschätzen, auf einer Skala von 1 bis 5, wobei 1 Anfängerniveau und 5 ein sehr fortgeschrittenes Niveau repräsentiert?

Themen

* Welche spezifischen Fähigkeiten oder Kenntnisse möchten Sie erwerben?

* Welche Themen oder Aspekte im Zusammenhang mit künstlicher Intelligenz interessieren Sie am meisten?

1

Formate

* Haben Sie bestimmte Präferenzen bezüglich der Lernzeit?
  - Kurzer, intensiver Kurs: 1 bis 3 Wochen, mit intensiven Einheiten jeden Tag oder mehrmals pro Woche.
  - Mittelfristiger Kurs: 4 bis 8 Wochen, Unterrichtseinheiten finden einmal oder zweimal pro Woche statt.
  - Längerer Kurs mit geringerem Arbeitsaufwand: 3 bis 6 Monate, Unterrichtseinheiten finden einmal oder mehrmals im Monat statt.
  - Flexibler Zeitplan: Das Lernen ist in Module unterteilt, was es den Teilnehmern ermöglicht, in ihrem eigenen Tempo voranzukommen, bis sie Aufgaben abschließen und ein Zertifikat erhalten.

* Welche Kursdurchführung präferieren Sie?
  - Online
  - in Präsenz
  - Hybrid

* Bitte sortieren Sie die folgenden Kurzselemente nach Relevanz.

Use drag&drop or the up/down buttons to change the order or accept the initial order.

- Anwendungsbeispiele
- Demonstratoren
- Praktische Übungen
- Theoretische Grundlagen

Vielen Dank für die Teilnahme an dieser Umfrage! Durch Ihre Rückmeldung werden wir das Angebot von EDIHHamburg besser an Ihren Bedarf anpassen können.

Contact

Contact Form

2

Annex 32. Questionnaire for the customer feedback on AI course (in English).

Draft ID: e88f2ced-8f98-431d-b60d-2851ab9fb421
Date: 17/11/2023 10:18:03

Survey on skills and training formats as part of EDIH-Hamburg

Fields marked with * are mandatory.

Thank you for participating in the survey to determine course requirements as part of EDIHHamburg.

Target group

Do you already have experience in dealing with artificial intelligence?

- Yes
- No

* How would you rate your current level of knowledge in the field of artificial intelligence, on a scale of scale from 1 to 5, where 1 represents a beginner level and 5 a very advanced level?

Only values between 1 and 5 are allowed

Topics

* What specific skills or knowledge would you like to acquire?

* Which topics or aspects relating to artificial intelligence interest you the most?

1

Formats

Single Choice Question

- Short, intensive course: 1 to 3 weeks, with intensive sessions every day or several times a week.
- Medium-term course: 4 to 8 weeks, lessons take place once or twice a week.
- Longer course with less workload: 3 to 6 months, lessons take place once or several times a month several times a month.
- Flexible schedule: Learning is divided into modules, which allows participants to progress at their ownprogress at their own pace until they complete tasks and receive a certificate.

Which type of course do you prefer?

- online
- in presence
- hybrid

Ranking Question

Use drag&drop or the up/down buttons to change the order or accept the initial order.

- Application examples
- Demonstrators
- Practical exercises
- Theoretical basics

Thank you for participating in this survey! Your feedback will enable us to better adapt the EDIHHamburg to better meet your needs.

EDIH4UrbanSAVE is funded by the European Union's Digital 2021 programme under grant agreement No 101083713, the IFB and the MDZ.

Contact

Contact Form

2

Annex 33. Example of a certificate of attendance issued by *EDIH Academy*

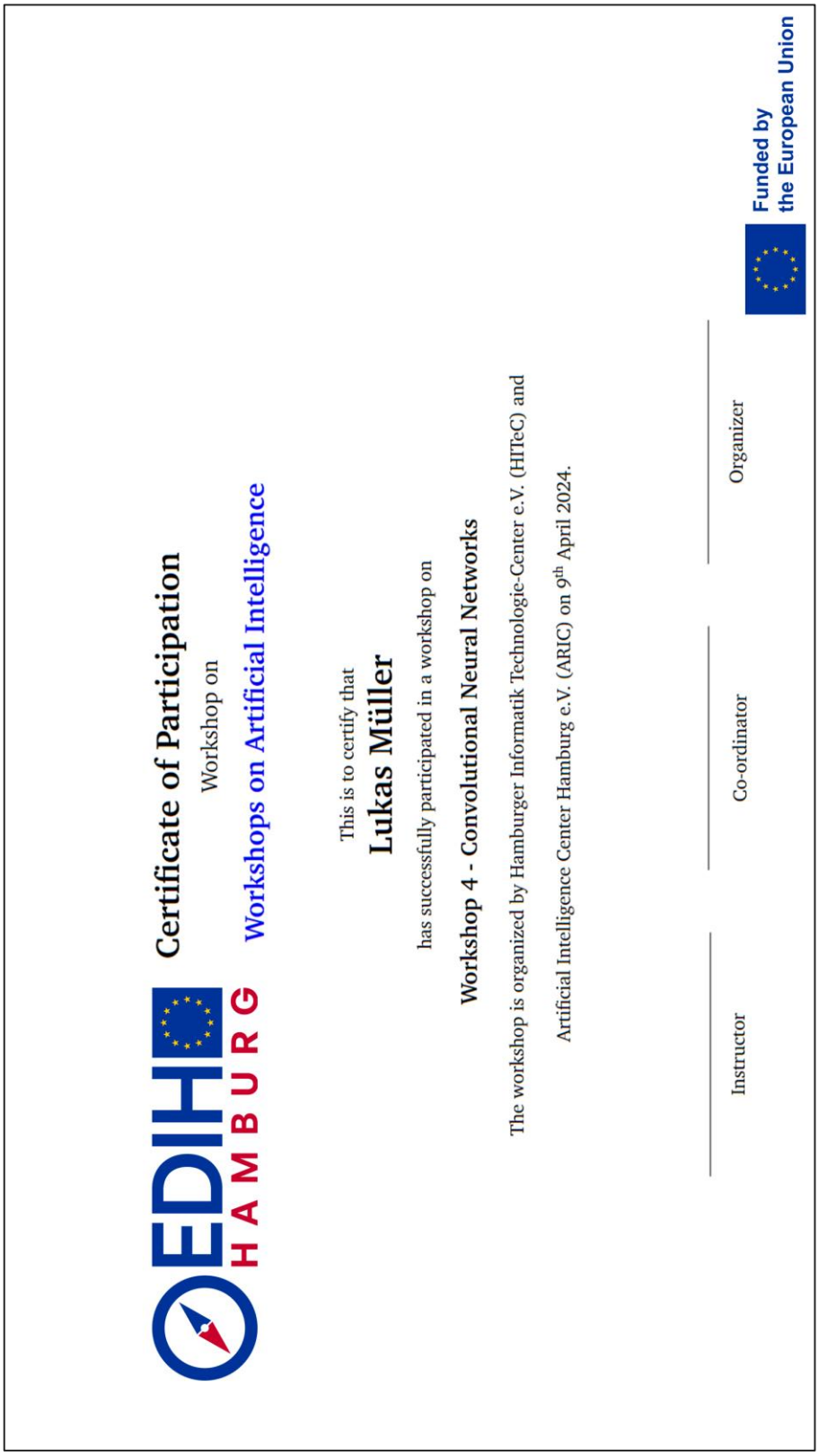


Figure 26: Example certificate for EDIH4UrbanSAVE