Vom Digital Native zum
Digital Expert

Wahlpflichtmodule MUC.DAI

Sommersemester 2025

Hochschule
München
University of
Applied Sciences

MUC.DAI
Munich Center for
Digital Sciences and AI

29. Januar 2025

Modulbeschreibungen für MUC.DAI-eigene Wahlpflichtmodule:

Inhaltsverzeichnis

801 - sustAInability - Sustainability and Artificial Intelligence

Contact hours: 30,5 weekly seminar sessions, 3 hour pitch event
Cycle: every semester
Language of instruction: English
Workload/self-study phase: 180h workload, 135h self-study
ECTS: 6
Assessment/Examination: Assignments (0,6) and presentation (0,4)
Responsible: Prof. Dr. Gudrun Socher (FK07)
Lecturers: Team of coaches and experts

Course Objective

Sustainability and digitalization are at the center of scientific, political, and environmental debates as the two significant transformations of our time. Artificial intelligence (AI) is coming into focus, permeating public and private life and increasingly becoming part of sustainability debates. AI has the potential to help us address some of the most pressing sustainability challenges of our time, such as climate change, resource depletion, and inequality. For example, AI can be used to optimize energy consumption, reduce waste, and improve the efficiency of transportation and other systems. However, it is important to consider the potential social and environmental impacts of AI and to ensure that it is developed and used in a way that is responsible and sustainable.

Learning outcomes

After successful participation in this course, students are able to:

- independently acquire knowledge and to put their knowledge, particularly in the context of artificial intelligence and sustainability, into practice e.g. in the form of written essays or presentations in class
- systematically plan, design, and implement solutions with respect to sustainability and artificial intelligence (AI) in a team project to apply their knowledge
- work together in an interdisciplinary team and to present their project results in a public pitch

Prerequisites

This module is aimed at all students enrolled in a Master or third year of Bachelor program at the Technical University Munich (TUM) or the Hochschule München University of Applied Sciences (HM); it is thus designed as an interdisciplinary venue, which brings together a range of scientific perspectives. No specific prior knowledge is required; however, its project-based character requires high levels of intrinsic motivation and the willingness to actively participate in a project. Students with a technological background are as welcome as students from social sciences, economics, design or humanities.

Course Content

Sustainability as a central, political and societal goal, can instead serve as an orientation framework for the responsible development of AI technologies as well as a compass for their use. For this to succeed, both sociological and technical perspectives are necessary. For universities - but also for

other institutions in politics, society and business - this means that disciplinary boundaries must increasingly be broken down and interdisciplinary teaching and learning formats should be created. One such format is "sustAInability" during which students approach AI from various sustainability perspectives in a self-study phase and seminar units, and then develop application-oriented technical and non-technical solutions in the context of AI & sustainability themselves in a workshop week.

During the self study phase and the seminar sessions, students will read relevant literature, watch videos and complete assignments, prepare short presentations, attend lectures and subsequently discuss the gained insights. During the seminars different workshops, such as design thinking or a futurizing workshop, allowing the students to imagine desirable future scenarios and to derive strategies for the present. Students will tackle selected challenges in the field of AI and sustainability. Students will regularly receive feedback and are expected to present their results in a pitch by the end of the seminar.

Assessment/Examination

The module contains self-study phases as well as weekly seminar sessions. Following the idea of flipped-classroom, students are expected to acquire knowledge during the self-study phase in order to be able to participate in profound discussions during the seminar sessions and to actively tackle current challenges in the field of AI and sustainability. Over the course of this module, students will have to complete the following tasks:

- Self-Study and Seminar-Phase: students have to contribute to this phase by carefully reading the provided material and by completing the accompanying assignments in written and oral form preparatory to the workshop week. They also have to actively take part in the seminar sessions and discussions on-site. The preparation of and the participation in the seminar sessions count 60% to the final grade.
- Challenge-based-Learning: students have to form interdisciplinary groups, choose a challenge and develop a project. By the end of the seminar students are expected to present their project at the public conference. This presentation counts 40% to the final grade.

Teaching/learning methods

The module draws on the ideas of service-learning and project-based learning. A range of teaching & learning techniques will be applied:

- Self-Study and Seminar-Phase: Students will be provided with a reading list, news articles, podcasts, and videos on an online platform. These materials allow students to individually gain first insights on the topic. The accompanying written assignments as well as the short presentation on a specific topic will help them to structure the newly acquired knowledge.
- Group work: Next to the (expert-)input on the core topics, students will learn to apply agile methods and work on their projects in groups. Progress will be assessed through project presentations by the end of the seminar as well as continuous feedback from the instructors, from external experts, and as peer-to-peer feedback.
- Presentational skills: Will be further facilitated through the requirement to present ongoing and final results within the seminar and at a final presentation with stakeholders.

Course Type

Elective

Literature

- van Wynsberghe, A. (2021). Sustainable AI: AI for sustainability and the sustainability of AI. AI and Ethics, (https://www.researchgate.net/publication/349639276_Sustainable_AI_AI_for_sustainability_and_the_sustainability_of_AI)
- Vinuesa, R., Azizpour, H., Leite, I., Balaam, M., Dignum, V., Domisch, S., Felländer, A., Langhans, S. D.,Tegmark, M., and Nerini, F. F. (2020). The role of artifcial intelligence in achieving the sustainable development goals. Nature Communications, https://www.nature.com/articles/s41467-019-14108-y
- more reading materials will be provided in the self-study materials

802 - AI in Culture and Arts (AICA) - Project Workshop

Contact hours: three three-day workshop phases, 72 contact hours
Cycle: every winter semester
Language of instruction: English, German
Workload/self-study phase: 180h workload, 108h self-study
ECTS: 6
Assessment/Examination: Project (in German: Modularbeit)
Responsible: Prof. Dr. Gudrun Socher (FK07), Dr. Benedikt Zönnchen (MUC.DAI)
Lecturers: Team of coaches and experts

Course Objective

Artificial intelligence (AI) is finding its application in the cultural and creative industries. It is already changing creation, production, distribution and marketing of art and culture. There are an increasing number of prominent examples of how artificial intelligence paints pictures, composes pieces of music or writes poems, novels and plays. Not only the creation of art, but also other areas of the cultural value chains are being broken up and reordered by AI, such as the the dissemination and communication of artistic content, as well as the acquisition and connecting existing and new recipients. Providers such as Spotify and Netflix are the best-known examples of how AI-powered recommender systems are creating new distribution and marketing of music and video content, and how this can increase how this is changing reception habits and audience preferences. Furthermore, AI harbors the potential to enhance the accessibility and participatory nature of both art creation and consumption. By reducing technical barriers - such as the replacement of expert systems with data-driven machine learning - AI can also democratize technical solutions, making them more accessible to non-experts.

This course aims to bring together students from diverse disciplines, including STEM, creative studies, music, business, and more, to develop tangible AI solutions for the challenges and opportunities present in the cultural and creative industries. The primary objective is to inspire these diverse minds to construct practical AI solutions, addressing both the challenges and opportunities inherent in the cultural and creative industries. Through the course, students will gain crucial competencies, enabling them to comprehend and shape AI-driven processes across numerous artistic and creative fields. Simultaneously, they will reflect on and appreciate the evolving impact of AI within the cultural and creative sectors.

Learning outcomes

After successful participation in this course, students are able to:

- acquire knowledge independently, especially in the context of artificial intelligence's application within culture and arts. This includes the ability to put their understanding into practice, demonstrated through AI's integration into fields such as music, arts, and various cultural facets.
- systematically plan, design, and execute projects in the intersection of AI, culture, and arts, employing agile methodologies like design thinking for innovative problem-solving.
- collaborate effectively within an interdisciplinary team, construct tangible artifacts, and articulate their project outcomes to a public audience through compelling presentations.

Prerequisites

This module is aimed at all students enrolled in a third year Bachelor program at Hochschule München University of Applied Sciences (HM) or the Hochschule für Musik und Theater München (HMTM). Students in Master programs are also welcome; it is thus designed as an interdisciplinary venue, which brings together a range of perspectives. Prior experience and basic knowledge about machine learning is required; its project-based character requires high levels of intrinsic motivation and the willingness to actively participate in a project.

Students apply via a short application form with a query about their competencies and motivation.

Course Content

Over the winter semester, an immersive project workshop will take place, featuring three separate three-day meetings. Here, students will form teams to collaborate with technology and culture experts. Throughout the winter semester, students will collaborate in mixed teams, working on the conception and execution of their own projects. Supported by agile coaches, these teams will work on developing practical AI solutions to tackle challenges and opportunities within the cultural and creative industries. Coaches will guide these teams, providing individualized support during the meetings and the work process at various stages. This assistance throughout the project workshop will be grounded in agile innovation approaches, including design thinking and methods borrowed from the Google Design Sprint.

The project workshop kicks off with the first meeting where topics are established, teams are formed, and initial ideas, along with their potential implementation strategies, are brainstormed. During the second meeting, the teams present their preliminary results. Experts then evaluate these results, focusing on their technical and conceptual aspects, providing crucial feedback for further refinement. The third meeting serves as the conclusion, where final projects are showcased. In the intervals between these meetings, teams independently continue their work on their AI projects. They have access to the technical and content experts, as well as the coaches, for support as needed.

Upon completion of the course, students are inspired to extend the scope of their projects, whether through a thesis, product development, or a performance. Experts will persist in their support, fostering the continuation of these projects beyond the confines of the course.

Assessment/Examination

At the end of the project workshop, the students have to present their projects in a final colloquium once per semester. This presentation will be attended by students of both students from both universities along with representatives from the educational, research, cultural, and creative sectors. The colloquium will be open to all students of HMTM and HM who are also interested in projects at the interface between interface of AI and art and culture and want to present them.

Furthermore the teams will compile a 10-page group paper that outlines the project's evolution and progress.

The project, the presentation, and the resulting artifacts are graded.

Teaching/learning methods

The module incorporates the concepts of service-learning and project-based learning within an agile framework, utilizing various teaching and learning techniques:

- Workshops and Teamwork: Students will form teams and, supported by technology and culture experts as well as agile coaches, will develop practical AI solutions to address challenges and opportunities within the cultural and creative industries.
- Challenges: Project ideas may originate from the students themselves or be proposed by stakeholders and institutions within the cultural and creative sectors.
- Presentational skills: These will be further honed through the necessity to present both ongoing and final results within the project scope, and at a final presentation.

Course Type

Elective

Literature

- Anantrasirichai, N.; Bull, D., 2022. *Artificial intelligence in the creative industries: a review*. Artificial Intelligence Review
- Caramiaux, B. et al, 2019. *AI in the media and creative industries*. New European Media (NEM).
- Géron, A., 2019. *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems*
- further literature will be provided at the beginning of the course

804 - AI in Culture and Arts (AICA) - Human-AI Interaction

Contact hours: three two-day blocks (2 SWS), 30 contact hours
Cycle: every summer semester
Language of instruction: English
Workload/self-study phase: 60h workload, 30h self-study
ECTS: 2
Assessment/Examination: Project (in German: Modularbeit)
Responsible: Prof. Dr. Gudrun Socher (FK07), Dr. Benedikt Zönnchen (MUC.DAI)
Lecturers: Dr. Téo Sanchez

Course Objective

Artificial intelligence (AI) is increasingly impacting the cultural and creative sectors. In particular, machine learning algorithms can now generate unprecedented synthetic media, transforming how we create, produce, and distribute art and culture. Students must develop a theoretical and practical understanding of machine learning to comprehend such transformative technology and foster the development of meaningful human-AI interactions.

This course addresses this need and delves into interactive machine learning for the cultural and creative sectors. The course is intended for art, cultural management, design, and computer science students. After this course, students will master the theoretical and technological foundations of machine learning, be able to train and (critically) evaluate machine learning models, and deploy them in meaningful interactive systems.

The course is structured in three 2-day blocks (6 days in total). Each block provides theoretical lectures and hands-on activities to develop interactive machine-learning systems for image, sound, and text-based applications in the creative and cultural sectors. Every teaching day starts with a lecture and discussion in the morning, followed by a hands-on session on the same topic in the afternoon.

Learning outcomes

After successful participation in this course, students are able to:

- **Understand the history and current state of AI**: students will be able to explain the different waves of AI (symbolic, connectionist), precisely identify machine learning algorithms, and explain their distinctive characteristics (dataset, optimization, loss, etc.).
- **Train and (critically) evaluate a machine learning algorithm**: students will be able to explain and apply the main steps of the development cycle of machine learning, from data collection, analysis, preprocessing, training, and evaluation. They will be able to critically examine a learning curve and performance metrics to assess the performance of their machine-learning models. Furthermore, they will be able to critically discuss the limitations of their model from the content of their dataset and from the perspective of bias and fairness.
- **Create interactive machine learning systems**: students can design and implement interactive machine learning systems for image, sound, and text-based applications in the creative and cultural sectors. Three examples of interactive systems will be showcased in this course: a teachable image classifier, a gesture-to-sound synthesizer, and a tool for semantic and multimodal exploration of museum archives. Students already familiar with programming and machine learning will be able to dive deeper into the design and development of novel interactions with machine learning algorithms.

- **Recall examples of AI applications in the cultural and creative sectors**: the theoretical lectures will be illustrated with many applications of AI in the cultural and creative sectors. Students will be able to recall these examples, developing their critical thinking of the applications and impact of AI in this field.

Prerequisites

This module is aimed at all students enrolled in a third-year Bachelor's program at Hochschule München University of Applied Sciences (HM) or the Hochschule für Musik und Theater München (HMTM). Students in Master's programs are also welcome; it is thus designed as an interdisciplinary venue that brings together a range of perspectives. Students with prior computer science and machine learning knowledge will be assigned dedicated and more advanced activities to develop interactive ML systems using the open source [Marcelle toolkit](https://marcelle.dev/).

Students apply via a short application form with a query about their competencies and motivation.

Course Content

Structured over three 2-day blocks (6 days in total), the course addresses:

1. **Image**: This introductory block focuses on image classification through machine learning. After a general introduction to AI's history and current state, participants will explore the machine learning development cycle, engaging with dedicated interactive applications (made with Marcelle) and computational notebooks in Python. The hands-on session will focus on training and evaluating museum artifacts using open-access and open-source datasets (MAMe, Smithsonian Open Access).
2. **Sound**: The second block centers on musical applications. Students will be guided to create a regression model from physical gestures to sound using an open-source visual programming language for music and art (Pure Data). Participants will learn Pure Data basics and discover how to transform their smartphones into synthesizers. The more advanced students will also approach symbolic music generation using traditional programming (computational notebooks in Python).
3. **Text**: Building on the first block, this third bloc explores the use of machine learning to "embed" and navigate cultural archives. Students will use multi-modal models that link images to textual descriptions to design interactive tools for exploring and retrieving artifacts in museum archives. The more advanced students will be able to train their own embedding models on personalized datasets in Python.

Assessment/Examination

Students will be graded based on their completion of the hands-on activities.

Teaching/learning methods

A day of teaching is structured as follows:

1. Theoretical lecture on a topic following the blocks above (1h), including examples of AI applications in the cultural and creative sectors;
2. Group discussion and design activities (1h);
3. Hands-on session with personalized support (4h);

Course Type

Elective

Literature

General culture:

- Cardon, D.; Cointet, J.-P.; Mazières, A.; Carey-Libbrecht, L., 2018. *Neurons spike back*. Réseaux 211, 5, 173-220. https://doi.org/10.3917/res.211.0173
- Anantrasirichai, N.; Bull, D., 2022. *Artificial intelligence in the creative industries: a review*. Artificial Intelligence Review
- Caramiaux, B. et al, 2019. *AI in the media and creative industries*. New European Media (NEM).
- Caramiaux, B. 2023. *AI with Museums and Cultural Heritage*. In: Sonja Thiel/Johannes C. Bernhardt, *AI in Museums* (117-130). Bielefeld: transcript Verlag. https://doi.org/10.14361/9783839467107-011
- Briot, J.-P.; Hadjeres, G.; Pachet, F.-D., 2019. *Deep learning techniques for music generation -- a survey*. arXiv:1709.01620 [cs.SD]
- Fiebrink, R. 2019. *Machine learning education for artists, musicians, and other creative practitioners*. ACM Transactions on Computing Education (TOCE) 19, 4, Article 31 (September 2019), 32 pages. https://doi.org/10.1145/3294008

Practical resources:

- Françoise, J.; Caramiaux, B.; Sanchez, T., 2021. *Marcelle: composing interactive machine learning workflows and interfaces*. In: UIST '21: The 34th Annual ACM Symposium on User Interface Software and Technology, October 10-13, 2021, Virtual Event, USA. ACM, New York, NY, USA, 15 pages. https://marcelle.dev/
- Géron, A., 2019. *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems*
- Fleuret, F., 2023. *The Little Book of Deep Learning*. A lovely concise introduction. https://fleuret.org/dlc/

805 - Impact Entrepreneurship for Transformational Change

Contact hours: 10h bi-weekly seminar session, 35h workshop week
Cycle: every semester
Language of instruction: English (winter) / German (summer)
Workload/self-study phase: 180h workload, 135h self-study
ECTS: 6
Assessment/Examination: Assignments (0,6) and presentation (0,4)
Responsible: Prof. Dr. Gudrun Socher (FK07), Dr. Benedikt Zönnchen (MUC.DAI)
Lecturers: Team of coaches and experts

Course Objective

The course objective is to equip students from diverse disciplines with the skills and knowledge necessary to tackle pressing social, ecological, and technological challenges through innovative and socially-driven business solutions. Throughout the semester, students will engage in intensive team-based projects, applying methods such as system innovation, design thinking, future thinking, and impact-oriented business models. Emphasizing a systemic perspective, the course recognizes that major contemporary issues are interconnected and require holistic approaches. Students will receive guidance from lecturers and external coaches, ultimately presenting their solutions as impact-oriented business models.

Learning outcomes

The aim of the module is to enable students to develop practice-oriented solutions in the form of impact-oriented business models. The focus is on generating impact in the sense of the United Nations Sustainable Development Goals. Students will be able to

- explain the concept of impact and its implications and illustrate them using specific case studies,
- develop entrepreneurial solutions for real challenges in interdisciplinary teams,
- apply tools and methods from the fields of systems thinking, future thinking, human-centred design, impact orientation and business modelling to their challenges
- present the solutions developed for their challenges using professional presentation techniques appropriate to the target group,
- categorise and discuss alternative economic models such as the Economy for the Common Good, Doughnut Economics and post-growth approaches.

The module focuses on experience-based and problem-oriented learning and aims to promote the development of social and entrepreneurial innovations as well as the promotion and development of students' skills with regard to responsible entrepreneurship. By developing solutions in interdisciplinary teams, students also improve their soft skills such as creativity, perseverance, communication skills, and interdisciplinary competences.

Prerequisites

This module is aimed at all students enrolled in a Master or third year of Bachelor program at the Technical University Munich (TUM), the Hochschule München University of Applied Sciences (HM) or the Hochschule Landshut University of Applied Sciences (HAW); it is thus designed as an interdisciplinary venue, which brings together a range of scientific perspectives; basic understanding

of entrepreneurship and its principles, such as from attending an introductory lecture on the topic, founding experience, or closely following the media on the topic as well as basic knowledge in sustainability and interest in developing innovative solutions from a systemic perspective to generate social and environmental impact is required; its project-based character requires high levels of intrinsic motivation and the willingness to actively participate in a project. Students with a technological background are as welcome as students from social sciences, economics, design or humanities.

Course Content

As part of the course, students from various disciplines spend a semester working intensively on social, ecological or technological challenges and the question of how these can be solved with the help of social and innovative business ideas. The programme teaches methods and knowledge on topics such as system innovation, design thinking, future thinking, regenerative and impact-oriented business models, impact management and financing. The systemic perspective is of particular importance in the programme. In particular, the major social and ecological problems of our time cannot be solved in isolation as "wicked problems". Solutions are therefore only possible by viewing them as phenomena that are integrated into systems.

Students work in teams on social, ecological or technological challenges and apply the methodological knowledge they have acquired to develop an entrepreneurial solution for the selected problem. This process is structured and supported by lecturers and external coaches. At the end of the semester, the students present the solutions they have developed in the form of impact-orientated business models. In this context, they receive feedback and the opportunity to apply for follow-up coaching for the business ideas they have developed.

The course is held in German in the summer semester and in English in the winter semester.

Assessment/Examination

The examination consists of three components. In the accompanying online course, the content of the respective units is tested and deepened through reflection tasks and research tasks. This part represents 50% of the grade. Furthermore, the presentation prepared by the students at the end of the semester and its corresponding documentation (pitch deck or similar) is part of the examination (50%).

Following the idea of flipped-classroom, students are expected to acquire knowledge through an online course during the self-study phase in order to be able to participate in profound discussions during the seminar sessions. Students have to actively take part in the seminar sessions and discussions on-site.

As part of a final event, the teams present a solution idea for the problem they have chosen and developed in the area of society, ecology or technology. The presentation lasts 5-10 minutes. The students demonstrate that they are able to translate the information they have received into an independently developed impact-orientated business model and present this in an appropriate manner. They are supported in their preparation by regular feedback from lecturers and coaches.

Teaching/learning methods

Lectures and interactive, seminar-style teaching in the form of discussions, group work, development of challenges, team coaching sessions, feedback discussions, presentations, and Q&A sessions. The variety of methods ensures that the right method is chosen for each learning content to be taught. For example, new knowledge and tools are presented by experts in the field in keynote speeches and then discussed in large or small groups before being incorporated into the development of

solutions. Feedback discussions and team coaching sessions facilitate the application of the tools and methods presented. The final presentation at the closing event gives participants the opportunity to practise their communication skills and improve them through appreciative, constructive feedback. The synchronous online and face-to-face teaching is supplemented by asynchronous elements of self-learning time via the accompanying online course and associated reflection tasks, as well as by self-organised project group meetings, which are documented in the final report.

Course Type

Elective

Literature

- Meadows, D. H., 2008. *Thinking in Systems*, Chelsea Green Publishing, 240, ISBN: 978-1603580557.
- Stroh, D. P., 2015. *Systems Thinking For Social Change: A Practical Guide to Solving Complex Problems, Avoiding Unintended Consequences, and Achieving Lasting Results*, Chelsea Green Publishing, 264, ISBN: 978-1603585804.
- Kurz, B.; Kubek, D 2017. *Social Impact Navigator*, Phineo, 240. https://www.social-impact-navigator.org/
- More reading materials will be provided in the self-study materials.