

# CAS Artificial Intelligence for Creative Practices Study Plan



UNIVERSITÄT  
BERN



7. Oktober 2023

The Artificial Intelligence for Creative Practices Course is a university-based program leading to a “Certificate of Advanced Studies in Artificial Intelligence for Creative Practices” awarded by the University of Bern and the Zurich University of the Arts as laid out in the regulations for the certificate course Artificial Intelligence for Creative Practices of 2023-12-07.

## 1. Course objectives

About

Artificial intelligence (AI), in the form of machine learning (in particular using neural networks) is becoming increasingly important for creative practitioners. On the one hand, machine learning and neural networks are being used to produce new forms of artistic expression across a wide range of creative disciplines, from art and design, to music composition and live entertainment. Outputs are not only high quality imitations of existing forms, but also frequently unexpected innovations. On the other hand, AI poses fundamental questions about human self and society. AI techniques are thus emerging tools and processes which open up new technical, artistic and critical possibilities and perspectives for artists and creative professionals. This CAS provides the technical and conceptual skills needed to understand AI algorithms and to design and train them for creative applications. It covers the main AI applications in the domains of language, imaging, sound, and movement, together with core cultural, philosophical, and aesthetic questions, and ethical debates around AI.

The format is designed to align with the participants’ main professional and study activities. The teaching and learning approaches are team and discussion oriented, aimed at developing practical competency. Most modules can also be attended online.

Competence objectives

The course competencies are developed in six modules. At the end graduates will be:

1. familiar with central cultural, philosophical, and aesthetic questions, and ethical debates around AI.
2. have a basic understanding of common neural network architectures and be able to train and assess those neural networks for art and creative applications.
3. able to perform basic image processing and know the most prominent applications;
4. able to process sound with deep neural networks and know the most prominent applications;
5. able to process movement data with deep neural networks and know the most prominent applications;
6. able to perform basic Natural Language Processing with deep learning models and know the most prominent applications.

## 2. Duration, outcomes and objectives of the modules

Duration and scope

The CAS consists of about 21 days of courses (147 hours attendance) and 16 ECTS credit points (total effort about 480 hours) whereof 4 ECTS result from the CAS project work.

The program consists of six modules whereof four are weekly blocks and two are weekly half days. The final block concludes with a vernissage of works-in-progress created during the CAS. All modules support distant learning. Crash courses on Python and basic mathematical concepts for machine learning (vectors, matrices, optimisation) are offered at the University of Bern before the start of the CAS.

Attendance at one information event *About the CAS Artificial Intelligence for Creative Practices* before course admission is mandatory.

Module 1

### AI and ML Fundamentals

*In which we approach basic AI concepts from an historical, cultural, aesthetic, and technical point of view to perform machine learning. This is a block module in presence.*

<b>ECTS</b>	2 ECTS credit points (incl. self-studies and project)	<b>Duration</b>	3 days = 21 hrs attendance
<b>Assessment</b>	Project presentation	<b>Req. attendance</b>	80%
<b>Learning outcomes</b>	Graduates will <ul style="list-style-type: none"> <li>● build up a general understanding of AI</li> <li>● be introduced to historical background of AI</li> <li>● be introduced to larger conceptual debates around AI in science, art, politics, and the industry.</li> <li>● survey creative uses of AI in the arts historically and in the present.</li> <li>● know basic concepts of machine learning: training, testing, over- and underfitting, performance measures</li> </ul>		
<b>Learning objectives</b>	<ul style="list-style-type: none"> <li>● Definitions of AI and ML</li> <li>● Machine learning concepts</li> <li>● Historical background of AI</li> <li>● Conceptual debates around AI</li> <li>● AI's use in the arts historically and the present with examples of practices</li> <li>● AI applications in art and other creative fields</li> </ul>		
<b>Learning and teaching methods</b>	<ul style="list-style-type: none"> <li>● Online platform</li> <li>● Lectures and inverted classrooms</li> <li>● Hands-on tutorials with Jupyter notebooks</li> <li>● Discussions</li> </ul>		

	<ul style="list-style-type: none"> <li>• Project work with presentation and peer feedback</li> </ul>
<b>Prerequisites</b>	Basic Python programming
<b>Language</b>	English

Module 2

**Neural Networks**

*In which we learn about various neural networks and study common applications in the arts and other creative practices. This is a block module in hybrid format.*

<b>ECTS</b>	2 ECTS credit points (incl. self-studies and project)	<b>Duration</b>	3 days = 21 hrs attendance
<b>Assessment</b>	Project presentation	<b>Req. attendance</b>	80%
<b>Learning outcomes</b>	Graduates will <ul style="list-style-type: none"> <li>• know common machine learning models, in particular Neural Networks (NN)</li> <li>• design and train NN</li> <li>• perform data input and output for machine learning</li> <li>• perform basic data preprocessing</li> <li>• be able to train and tune neural networks via application programming interfaces and scripting</li> <li>• know popular NN applications for art and creative practices</li> </ul>		
<b>Learning objectives</b>	<ul style="list-style-type: none"> <li>• Machine Learning Models</li> <li>• Data handling</li> <li>• NN tuning and training</li> <li>• NN and their applications</li> </ul>		
<b>Learning and teaching methods</b>	<ul style="list-style-type: none"> <li>• Online platform</li> <li>• Lectures and inverted classrooms</li> <li>• Hands-on tutorials with Jupyter notebooks</li> <li>• Discussions</li> <li>• Project work with presentation and peer feedback</li> </ul>		
<b>Prerequisites</b>	<ul style="list-style-type: none"> <li>• Basic knowledge of machine learning concepts</li> <li>• Basic experience with Python</li> </ul>		
<b>Language</b>	English		

**AI for Movement/Sensing: Realtime interaction**

*In which we study how to train deep neural networks to learn and generate data from movement and vice versa. We will also consider real time interactions and the loops thereby generated. This is a block module in presence.*

<b>ECTS</b>	2 ECTS credit points (incl. self-studies)	<b>Duration</b>	6 half-days = 21 hrs attendance
<b>Assessment</b>	Project presentation or paper (to be fixed with tutor)	<b>Required attendance</b>	80%
<b>Learning outcomes</b>	Graduates will <ul style="list-style-type: none"> <li>• know common applications and platforms for AI movement analysis and generation</li> <li>• be introduced to various types of sensors for capturing movement</li> <li>• record and collect movement data</li> <li>• know human and machine understandable representations of movement data</li> <li>• train deep neural networks with movement data</li> </ul>		
<b>Learning objectives</b>	<ul style="list-style-type: none"> <li>• Applications and platforms for AI movement analysis and generation</li> <li>• Collection and representation of movement data</li> <li>• Model training with movement data</li> <li>• Machine generation of movement data</li> </ul>		
<b>Learning and teaching methods</b>	<ul style="list-style-type: none"> <li>• Online platform</li> <li>• Lectures online and onsite with hands-on tutorials</li> <li>• Workshops</li> <li>• Project presentations</li> </ul>		
<b>Prerequisites</b>	<ul style="list-style-type: none"> <li>• Experience in training, tuning and applying deep neural networks, e.g. from previous modules</li> </ul>		
<b>Language</b>	English		

**AI for Imaging**

*In which we learn how to process and generate images with deep learning and convolutional neural networks. The module runs weekly for a month in hybrid format.*

<b>ECTS</b>	2 ECTS credit points (incl. self-studies and project)	<b>Duration</b>	6 half-days = 21 hrs attendance
<b>Assessment</b>	Project presentation or paper (to be fixed with tutor)	<b>Required attendance</b>	80%

<b>Learning outcomes</b>	<p>Graduates will</p> <ul style="list-style-type: none"> <li>• understand digital image representations</li> <li>• perform basic image techniques for preprocessing</li> <li>• design and train Convolutional Neural Networks (CNN)</li> <li>• use CNN for image processing and computer vision</li> <li>• know image based generative AI techniques</li> </ul>
<b>Learning objectives</b>	<ul style="list-style-type: none"> <li>• Image representations</li> <li>• Image preprocessing</li> <li>• Convolutional Neural Networks (CNN)</li> <li>• Image based generative AI techniques</li> </ul>
<b>Learning and teaching methods</b>	<ul style="list-style-type: none"> <li>• Online platform</li> <li>• Lectures and inverted classrooms</li> <li>• Hands-on tutorials with Jupyter notebooks</li> <li>• Discussions</li> <li>• Project work with presentation and peer feedback</li> </ul>
<b>Prerequisites</b>	<ul style="list-style-type: none"> <li>• Basic knowledge of machine learning concepts</li> <li>• Basic experience with Python</li> </ul>
<b>Language</b>	English

Module 5

### AI for Sound

*In which we learn about common sound patterns, how to collect and represent sound data, train models with them, generate new patterns with the trained models and get an overview of the common AI sound applications in art and other creative practices. The module runs weekly for a month.*

<b>ECTS</b>	2 ECTS credit points (incl. self-studies and project)	<b>Duration</b>	3 days = 21 hrs attendance
<b>Assessment</b>	Project presentation	<b>Req. attendance</b>	80%
<b>Learning outcomes</b>	<p>Graduates will</p> <ul style="list-style-type: none"> <li>• know how automatic sound, speech and music generation works</li> <li>• understand digital audio representations</li> <li>• perform basic audio techniques for pre- and postprocessing</li> <li>• design and train Recurrent (RNN) and Convolutional Neural Networks (CNN)</li> <li>• use RNN or CNN for audio processing and computer listening</li> <li>• sound based generative AI techniques</li> </ul>		

<b>Learning objectives</b>	<ul style="list-style-type: none"> <li>• Audio representations</li> <li>• Audio preprocessing</li> <li>• Audio-based generative AI techniques</li> </ul>
<b>Learning and teaching methods</b>	<ul style="list-style-type: none"> <li>• Online platform</li> <li>• Lectures and inverted classrooms</li> <li>• Hands-on tutorials with Jupyter notebooks</li> <li>• Discussions</li> <li>• Project work with presentation and peer feedback</li> </ul>
<b>Prerequisites</b>	<ul style="list-style-type: none"> <li>• Basic Python experience</li> <li>• Basic machine learning with neural networks experience</li> </ul>
<b>Language</b>	English

Module 6

### AI for Natural Language

*In which we learn basic natural language processing techniques with deep learning, together with common applications in the art and other creative fields. This is a retreat block module in presence.*

<b>ECTS</b>	2 ECTS credit points (incl. self-studies and project)	<b>Duration</b>	4 days = 28 hrs attendance
<b>Assessment</b>	Presentation	<b>Req. attendance</b>	80%
<b>Learning outcomes</b>	Module graduates will <ul style="list-style-type: none"> <li>• perform basic preprocessing and segmentation of text for natural language purposes</li> <li>• perform basic information extraction (know forms of annotation and corresponding evaluation)</li> <li>• perform basic natural language generation with Transformer Models</li> </ul>		
<b>Learning objectives</b>	<ul style="list-style-type: none"> <li>• Preprocessing of language for machine learning</li> <li>• Modern language models</li> <li>• Training and fine tuning techniques</li> <li>• Popular NLP applications in art and creative practice</li> </ul>		
<b>Learning and teaching methods</b>	<ul style="list-style-type: none"> <li>• Online platform</li> <li>• Lectures and inverted classrooms</li> <li>• Hands-on tutorials with Jupyter notebooks</li> <li>• Discussions</li> <li>• Project work with presentation and peer feedback</li> </ul>		
<b>Prerequisites</b>	<ul style="list-style-type: none"> <li>• Basic experience with Python</li> </ul>		

	<ul style="list-style-type: none"> <li>• Basic deep learning experience</li> </ul>
<b>Language</b>	English

### CAS Project Work

*In which participant teams create and present a comprehensive extended intelligence art project based on all CAS modules. For the realisation of the project, mentors with different expertise can be consulted by the teams throughout the preparation period which goes from the last module to the exhibition. Regular check-in with the advisors is suggested. Assessment by all module responsables.*

<b>ECTS</b>	4 ECTS credit points	<b>Duration</b>	120 hours
<b>Assessment</b>	Exhibition/performance work	<b>Req. attendance</b>	None
<b>Institute resp</b>	UniBE and ZHdK		
<b>Location</b>	ZHdK		
<b>Learning outcomes</b>	Graduates will be able to conceive, create and implement an AI focused project based on their own specific creative practice		
<b>Learning objectives</b>	Selection of objectives from all modules so to integrate AI into own creative practice		
<b>Teaching methods</b>	<ul style="list-style-type: none"> <li>• Project work with remote supervision</li> <li>• Public showing: Exhibition/Performance</li> </ul>		
<b>Prerequisites</b>	Module 1 - 6		
<b>Language</b>	English		

Assessment

### 3. Overall assessment

The overall assessment includes 80% attendance and passed assessments from all modules together with the CAS project exhibition.

- For Modules 1+ 2, 5 and 6 oral and visual presentations are assessed.
- For Modules 3 and 4 there is the option, for one of the modules, to write a text instead of a group presentation.
- For the CAS concluding project, the exhibition/performance work is assessed.

#### 4. Final regulations

Entry into force      The present plan shall enter into force on 2024-01-01.

2. Oktober 2023      Released by the program management

A handwritten signature in blue ink, appearing to read 'Christiane Tretter', with a long horizontal flourish extending to the right.

Prof. Dr. Christiane Tretter (Chair)

7. Dezember 2023      Adopted by the Faculty of Science, University of Bern

The Dean

A handwritten signature in blue ink, appearing to read 'M. Herwegh', with a long horizontal flourish extending to the right.

Prof. Dr. Marco Herwegh