

# Applied Image and Signal Processing

Joint Master Programme



Understand and  
create AI empowered  
solutions for industry  
and science.

competent  
relevant  
sustainable

# Master Programme

Univ. Prof. Dr. Andreas Uhl  
Paris Lodron University of Salzburg

»In the highly research oriented courses, particularly chosen from the elective list, students are confronted with state-of-the-art research questions and cutting-edge problem solutions. Working in small groups enables first contacts to academic research and publications, the latter evolving and related to work done in the programs' courses.«

**Image and signal processing affect our daily lives in an ever-increasing way. Participate in designing this fascinating technology and shape its future function in business and society using AI empowered algorithms and methodology.**

Today's networked devices for image and signal generation provide a historically unmatched volume of raw data for automated decision making and control systems. This master programme enables you to design and implement professional data driven solutions in a range of exciting application areas.

## State of the Art Methodology

The first year is devoted to a concise study of the theoretical foundations, the mathematical models and the algorithms used in image and signal processing. Those are complemented by an introduction to data science and machine learning, statistics, audio processing, digital media formats, and, in the third semester, computer vision and geometric modelling.

## Choose your Elective Courses

Starting with the second year, specific application scenarios are discussed and corresponding technologies are investigated in a number of elective courses. Choose two such courses from the list on the next page and complement those by free electives with a total sum of 6 ECTS in the third or fourth semester. While it is recommended to take a third course from the aforementioned list, other lectures given in English on one of the two universities also qualify as free electives.

## Develop your own Ideas

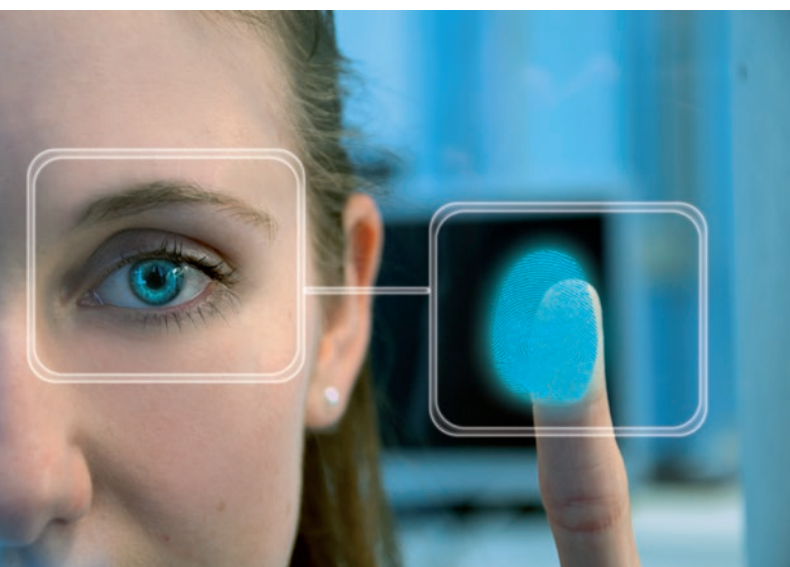
In the third semester, you also start researching on your master thesis. You will acquire profound skills in scientific research and paper writing as well as in agile project management. The fourth semester, finally, is dedicated to the completion of the master thesis. The accompanying master seminar provides a forum for presenting and defending one's approach to a solution and the results obtained, i.e. for scientific discourse with faculty and peers.

## Career and Study Abroad

This master programme is designed to provide you with an in-depth professional and scientific training based on research driven teaching. The sound knowledge and skills acquired qualify the alumni for diverse practical challenges in their professional work and empower them to contribute to future innovations in image and signal processing based on artificial intelligence.

A lot of interesting research and development projects in the private and the public sectors are calling for your expertise. Alternatively, this degree will open up career tracks in universities and research labs by qualifying for applying to PhD programmes.

You also have the opportunity to spend a semester abroad in one of our numerous partner universities in the fourth semester.



# Elective Courses



Choose one course from each university. A third course may be chosen as part of the free electives.

## Salzburg University of Applied Sciences

### Natural Language Processing

Attention-based models have become an indispensable part of modern natural language processing applications, e.g. in the field of social media analysis or human-machine interfaces. You will design and implement appropriate models for areas such as machine translation and sentiment analysis using contextualized text representations and complex neural network architectures. We also take a look at dialog systems and language generation for conversational purposes.

### Reinforcement Learning

Reinforcement Learning (RL) is a learning paradigm to train intelligent agents to optimize their actions in order to maximize a reward given by an environment. It is vital to smart solutions in areas such as robotics, industry 4.0, trading or gaming. Students will identify problems suited for RL, find appropriate models and assemble solutions using toolboxes. Special attention is paid to upcoming areas such as Deep RL and model-based RL that address known issues in real-world applications of RL.

## Paris Lodron University of Salzburg

### Medical Imaging

Image and signal processing applications in medicine are optimized with respect to the numerous modalities and sensors used. Images need to be segmented, co-registered and processed with respect to contextual knowledge. You get to know the most popular tools and libraries, and acquire competences in designing solutions for tomorrow's medical technology.

### Biometric Systems

Study biometric technologies and learn the most common modalities for the identification of individuals. Implications on security and privacy are discussed. Biometry is a generic topic in that various methods and concepts can be found in many other areas of image and signal processing as well, and in that the optimization of systems with respect to risk minimization is of a general nature.

### Media Security

Concepts for encryption, authentication and robust labelling of multimedia data are presented and their application in media forensics is discussed. Since different modalities require highly specialized methods, you will become an expert in a range of such algorithms and will be able to design applications that achieve a good compromise between robustness, speed and usability.

### Computational Geometry

Computational geometry is the study of the design and analysis of efficient algorithms for solving problems with a geometric flavor. The methodologies of computational geometry allow one to investigate solutions of numerous geometric problems that arise in application areas such as image processing, computer-aided design, manufacturing, geographic information systems, robotics and graphics. This course offers an introduction to computational geometry like geometric searching, convex hulls, Voronoi diagrams, straight skeletons, triangulations, and robustness issues.

### Machine Learning

You study how to program computers to »learn« from available input data. In other words, it is the process of converting experience in the form of training data into expertise to solve a variety of different tasks. Fundamental concepts such as probably approximately correct (PAC) learning, Vapnik–Chervonenkis theory and applications thereof are considered and applied in the analysis of popular learning algorithms such as boosting or support vector machines.

The detailed course outline  
can be found at:  
[www.fh-salzburg.ac.at/ais](http://www.fh-salzburg.ac.at/ais)

# Curriculum

Courses		Semester			
		1	2	3	4
<b>Image and Signal Processing &amp; Visual Computing</b>					
1	Digital Signal Processing 1	5 (3)			
2	Imaging Beyond Consumer Cameras	4 (3)			
2	Image Processing and Imaging	4 (3)			
1	Digital Signal Processing 2		5 (3)		
2	Computer Vision			5 (3)	
2	Geometric Modelling			5 (3)	
<b>Audio &amp; Media</b>					
2	Audio Processing		5 (3)		
2	Media Data Formats		4 (3)		
<b>Mathematics &amp; Modelling</b>					
1	Mathematics & Modelling	5 (4)			
2	Fourier Analysis, Filter Banks & Wavelets		7 (5)		
1	Applied Statistics		4 (3)		
<b>Data Science &amp; Analytics</b>					
1	Data Science	5 (3)			
1	Analytics & Knowledge Discovery	3 (2)			
2	Natural Computation	4 (3)			
1	Machine Learning		5 (3)		
<b>Elective Courses *</b>					
1	Elective Course SUAS 1: Natural Language Processing			5 (3)	
1	Elective Course SUAS 2: Reinforcement Learning			5 (3)	
2	Elective Course PLUS 1: Medical Imaging			5 (3)	
2	Elective Course PLUS 2: Biometric Systems			5 (3)	
2	Elective Course PLUS 3: Media Security			5 (3)	
2	Elective Course PLUS 4: Computational Geometry			5 (3)	
2	Elective Course PLUS 5: Advanced Machine Learning			5 (3)	
1 2	Free Electives: Select from qualified SUAS and PLUS lectures			3 (2)	3 (2)
<b>Applied Sciences and Methods</b>					
1	Agile Project Management			3 (2)	
1	Ethics & Sustainability			1 (1)	
1 2	Master Seminar			3 (2)	2 (1)
1 2	Master Thesis				23 (-)
1 2	Master Exam				2 (-)
		<b>ECTS (CHW)</b>	<b>30 (21)</b>	<b>30 (20)</b>	<b>30 (19)</b>
				<b>30 (3)</b>	

## Study Locations

- <sup>1</sup> (SUAS) Salzburg University of Applied Sciences  
Department of Information Technology & Systems Management  
Urstein Süd 1, 5412 Puch / Salzburg, Austria
- <sup>2</sup> (PLUS) Paris Lodron University of Salzburg  
Department of Computer Science  
Jakob-Haringerstr. 2, 5020 Salzburg, Austria

\* Choose one elective course from each university SUAS and PLUS.  
Free electives: select from qualified SUAS and PLUS lectures

ECTS: European Credit Transfer and Accumulation System  
CHW: contact hours per week per semester

The shown curriculum is an overview.

# Studying in Salzburg

The Salzburg University of Applied Sciences (SUAS) and the Paris Lodron University of Salzburg (PLUS) have joined forces to offer this international joint master programme. This programme will allow you to get to know two different academic cultures, meet people with different backgrounds and learn to communicate professionally in an international working environment. We offer an up-to-date curriculum which we constantly adapt to the challenges of economy and society. An experienced and qualified faculty drawn from both academia and industry guarantee a cutting-edge education and provide impetus for scientific and academic content. Combined with state-of-the-art equipment in our auditoriums and labs, this stimulating environment creates the optimal breeding ground for growing your knowledge.

Both of our locations – Urstein Campus, where the SUAS is situated and the Techno-Z Campus of the PLUS – are situated in one of the most beautiful areas in the world. Whether you are an art and architecture buff, a music fan or a lover of the great outdoors, Salzburg combines historical heritage and modern lifestyle culture to offer something for everyone.

**Urstein Campus:** This campus is surrounded by greenery, next to the neighbouring medieval estate known as the »Meierei« (dairy). This modern building houses our central administrative offices and is where most of our degree programmes are taught. Trains from the S-Bahn station directly on campus will take you to Salzburg city centre in no time.

**Techno-Z Campus:** The modern Techno-Z Campus in Salzburg houses high-tech firms, institutes of higher education and a residence hall for students. Salzburg city centre is reachable within 10 minutes by bus, allowing students to explore the marvelous Old Town of Salzburg, which is a World Heritage Site. You can get to the main train and bus stations on foot or by bus within a few minutes.

**The FH Salzburg Career Center** supports students in planning their careers and entering the world of work. Students can benefit from exclusive free workshops on 'career planning' and a jobs and careers portal. [www.fh-salzburg.ac.at/career-center](http://www.fh-salzburg.ac.at/career-center)

**Sports & Nature:** Our sports programme offers a wide range of courses and training sessions. As a student you can use the facilities of the University and County Sports Centre Salzburg/Rif. Alternatively, you can simply explore nature outside your front door; the options are unlimited. Salzburg's mountains and lakes are available in closest proximity.

**Living & studying:** Students who would like to combine study with housing are welcome to check out the hall of residence of the Urstein Campus ([www.studentenheim.at](http://www.studentenheim.at)) or the Techno-Z Campus ([www.techno-z.at](http://www.techno-z.at)). Information about grants, legal and practical issues is provided by [www.oead.at](http://www.oead.at)

Campus Urstein



Techno-Z Campus



Get to know us better:



# Application & Admission

FH-Prof. Univ. Doz. Dr. Stefan Wegenkittl  
Salzburg University of Applied Sciences

»AI empowered image and signal processing defines the way in which machines can successfully interact with the real world. Mastering these technologies opens up a lot of professional and scientific career options and interesting job offers. Our alumni will design and implement the next generation of smart solutions in complex environments.«

**Study mode:** full-time  
**Length of study:** 4 semesters  
**Degree awarded:** Master of Science in Engineering (MSc)  
**Teaching language:** English  
**Study places per year:** 20  
**Location:** Salzburg University of Applied Sciences and Paris Lodron University of Salzburg  
**Tuition and fees:** at least 380 Euro / semester (EU students) up to double amount for other countries of origin

## Requirements for enrollment

Admission to this programme requires an adequate academic background, as provided by relevant bachelor programmes in the fields of engineering, computer science or mathematics offered by recognized national or foreign post-secondary educational institutions, such as bachelor programmes in computer science, computer engineering, mathematics, mechatronics, mechanical engineering, electrical engineering, automation engineering, or digital media science. The following competences are essential and need to be documented in your transcript and outlined in your application form: Mathematics (real and complex analysis, algebra, probability calculus), and at least one of

- i) Informatics (procedural programming, algorithms and data structures) and/or
- ii) Signal Processing (Time-Frequency Domain, Fourier Series, Laplace- & Z-Transform, Convolution).

Bridge Courses are offered to cover missing competences in areas i) or ii).

## Application procedure

1. Check necessary documents and deadlines on [www.fh-salzburg.ac.at/ais](http://www.fh-salzburg.ac.at/ais)  
International students: please consider the information given on the website.
2. Online application at: [www.fh-salzburg.ac.at/online-application](http://www.fh-salzburg.ac.at/online-application)  
The application procedure is managed by the Salzburg University of Applied Sciences on behalf of both institutions.
3. After your documents and the entry requirements have been assessed, you will be invited for a personal interview.



Further information on:  
[www.fh-salzburg.ac.at/ais](http://www.fh-salzburg.ac.at/ais)

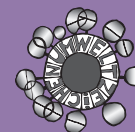
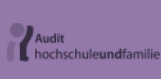
## Contact

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