saarland-informatics-campus.de

Saarland Informatics Campus

Introductory Meeting for Master Students in Visual Computing

Prof. Philipp Slusallek, DFKI, 6.10.2025

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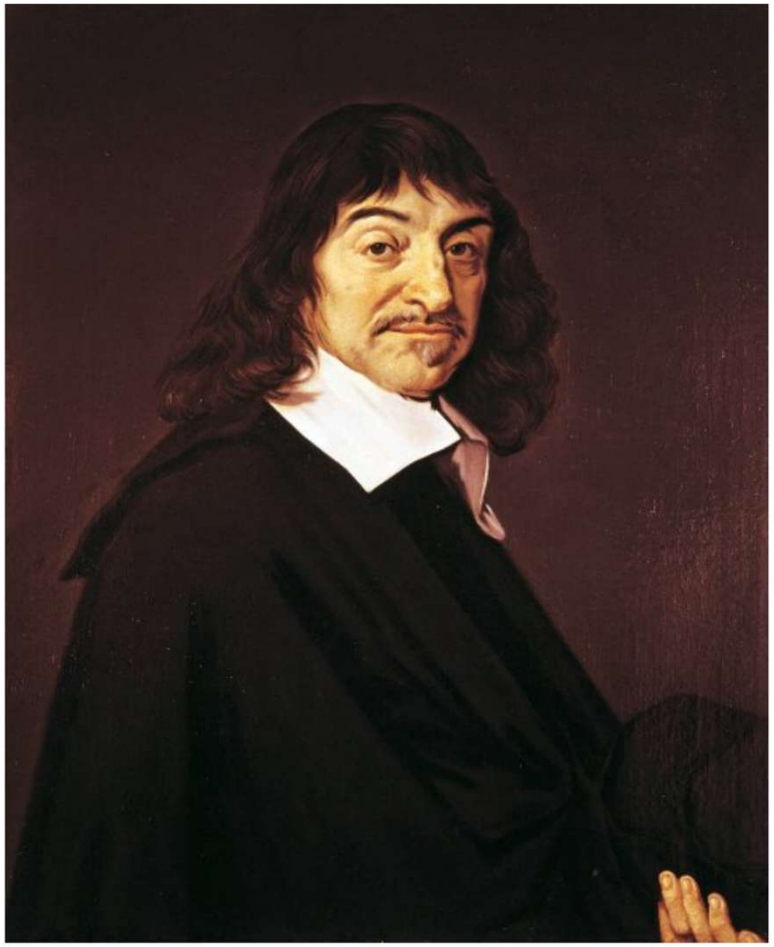
Overview

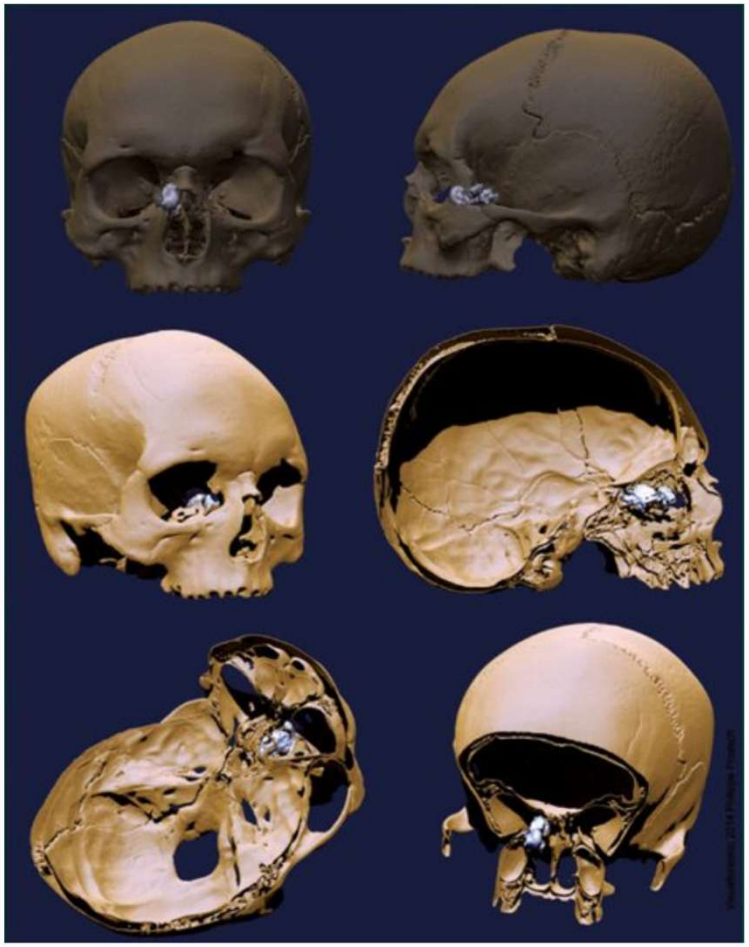
- What is Visual Computing?
- Our master program in Visual Computing
- What's new?
- Tips for a successful study
- Study regulations
- Progress control
- Examination registration
- Contact

What is Visual Computing ?

- **Visual Computing deals with all aspects of computer-based processing and representation of visual information**
  - Image acquisition, image analysis, and image synthesis
  - Many connected disciplines: Artificial Intelligence (AI) incl. Machine Learning (ML), Human-Computer Interaction (HCI), and various others
  - Important to understand and optionally simulate the real world
- **Important for numerous applications:**
  - Entertainment & Media
  - Industry
  - Health
  - AI and Robotics

What is Visual Computing ?





Computerised tomography is an example of an advanced image acquisition method.

It allows to detect a benign tumour in the skull of the philosopher René Descartes.

Source: www.spiegel.de

What is Visual Computing ?

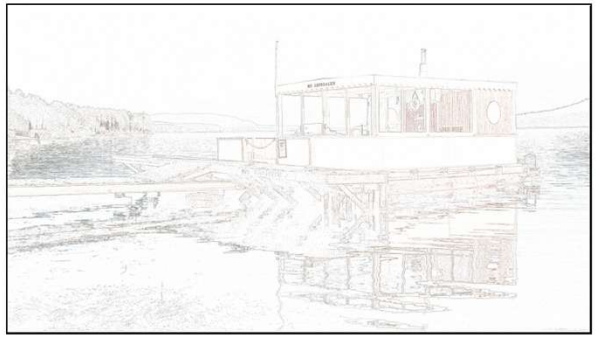
The „Pillars of Creation“ as observed by the James Webb Telescope in the near infrared spectrum.

Source: NASA.

What is Visual Computing ?

4K image, 3840×2160 pixels

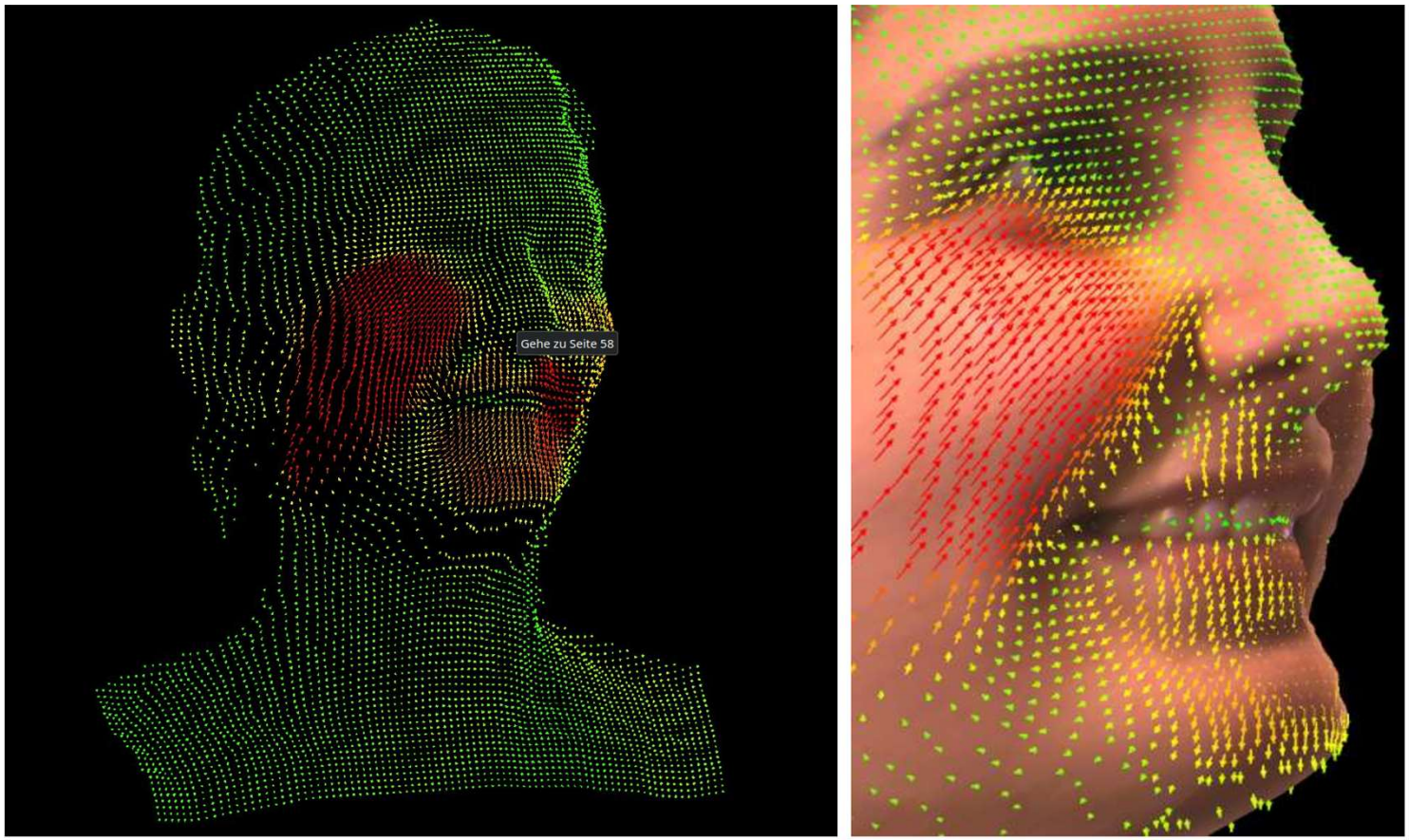
optimised data, 5 % density



homogeneouos diffusion inpainting, solves 3 systems with 8 million unknowns in 25.2 ms

Inpainting-based image compression with fast parallel algorithms. Authors: Kämper/Weickert (2022).

What is Visual Computing ?



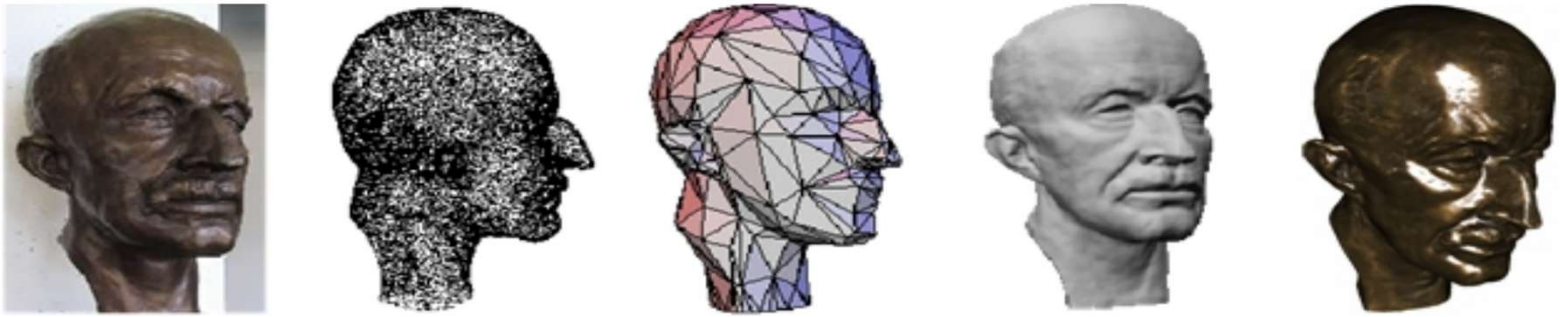
Simultaneous reconstruction of the 3D Object and its 3D motion (scene flow).

Left: Computed scene flow. Its magnitude increases from green to red.

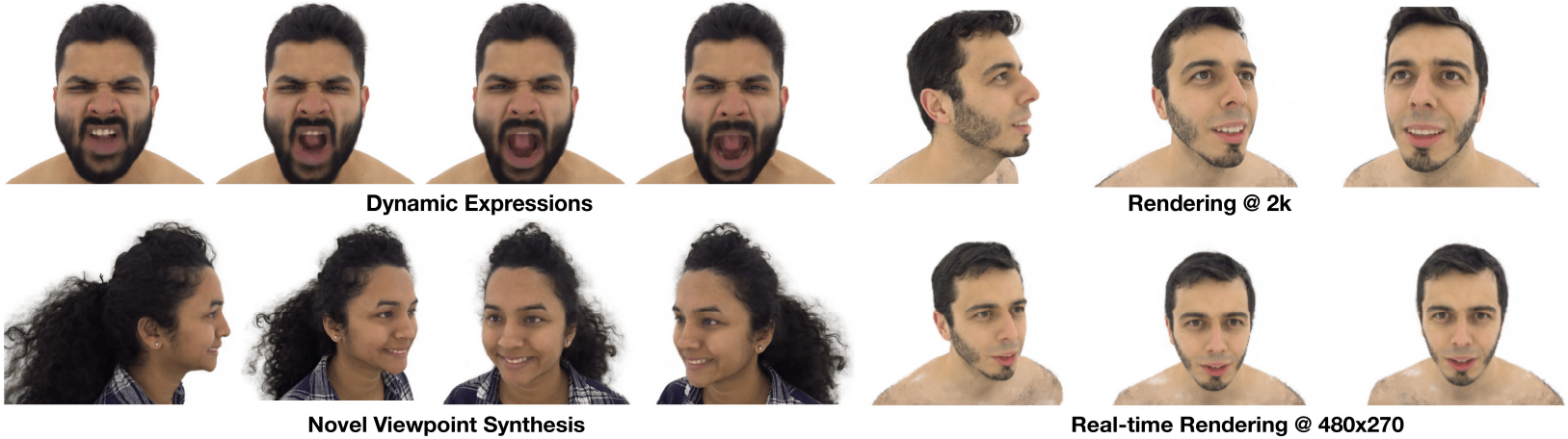
Right: Zoom into the 3D reconstruction with superposed scene flow.

Authors: Valgaerts et al. (2010).

What is Visual Computing ?

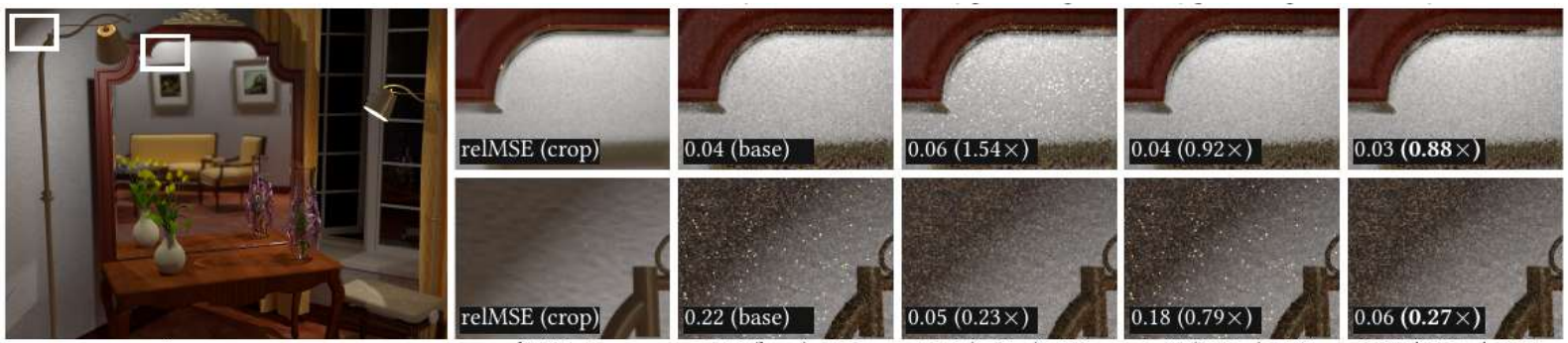


The Max Planck image shows the entire chain from image acquisition by a 3-D scanner over a surface representation to a realistic 3-D model. Authors: H.-P. Seidel et al.



HQ3DAvatar: High Quality Implicit 3D Head Avatar. Authors: Christian Theobalt et al.

What is Visual Computing ?



LIVINGROOM | relMSE, time | 5.46 (base), 195s | 5.46 (1.00×), 195s | 5.43 (0.99×), 220s | 5.32 (**0.97**×), 195s

Monte-Carlo Lighting Simulation for creating highly realistic simulations of our 3-D world, e.g. by sophisticated ray tracing and MC sampling methods.

Authors: Grittmann, Slusallek, et al., Eurographics 2021, Siggraph 2012, 2020

What is Visual Computing ?

Rendering with mixed geometric and neural representations. Authors: Weier, Slusallek, et al., Siggraph 2024

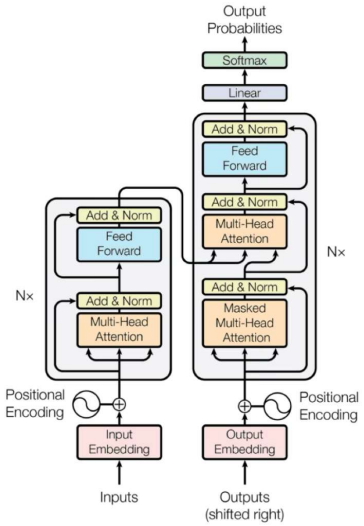
What is Visual Computing ?

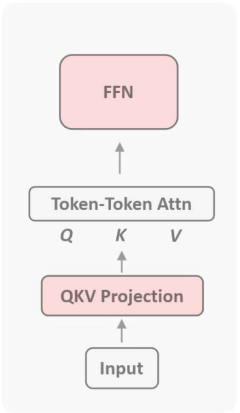
Images that can be understood by humans and not by computers avoid the misuse of internet services.

Computer graphics and pattern recognition methods allow to create and test such images.

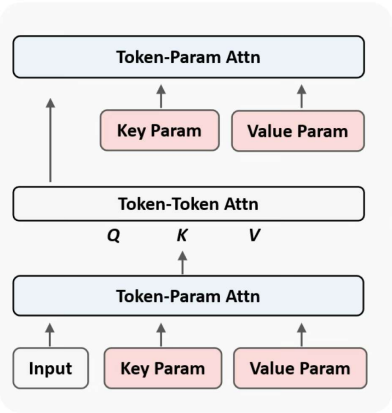
Authors: T. Herfet et al.

What is Visual Computing ?





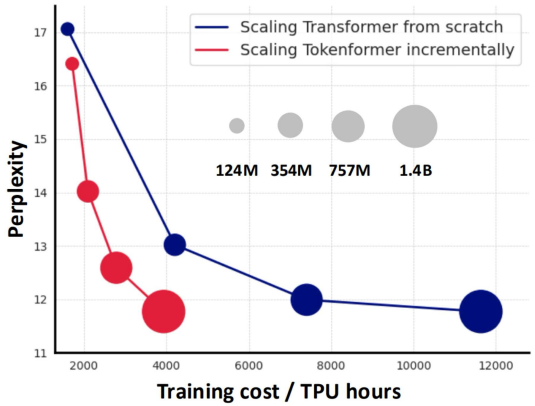
Transformer



Tokenformer

Tokenformer Architecture: Scales far better than standard transformers (using both (standard) “token-token“ attention and “token-parameter“ attention

Authors: Wang, Fan, …, Schiele @ ICLR‘25



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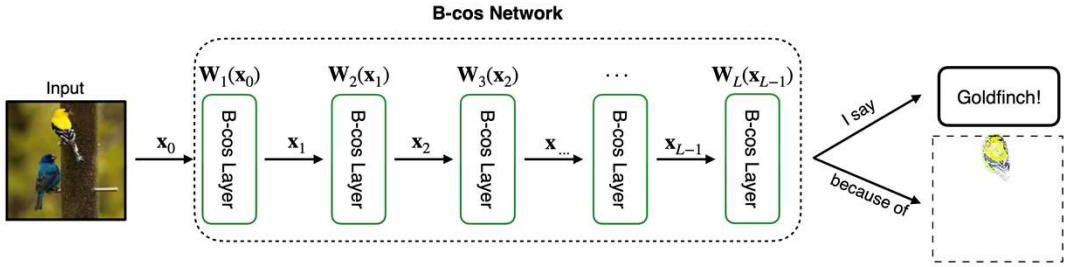
What is Visual Computing ?



B-cos Network: Inherently Interpretable Deep Neural Networks

Authors: Böhle, Rao, Schiele @ PAMI‘24

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Our Master Program in VC

- **Collaboration of Five Departments of Saarland University:**
  - Computer Science
  - Mathematics
  - Mechatronics
  - Physics
  - Computational Linguistics
- **Together with Four Research Institutes:**
  - Max Planck Institute for Informatics (MPI-INF)
  - German Research Centre for Artificial Intelligence (DFKI)
  - Fraunhofer Institute for Biomedical Engineering (IBMT)
  - Fraunhofer Institute for Nondestructive Testing (IzfP)

Our Master Program in VC

News

- **New DFG Research Training Group on Neuroexplicit AI Models**

  24 new high-profile PhD positions

- **New collaboration of MPI-INF with Google:**

  Saarbrücken Research Center for Visual Computing,
  Interaction and Artificial Intelligence (VIA)

- **New collaboration of Saarland with Intel:**

  Center for the Future of Graphics and Media

Our Master Program in VC

- **Why a specific Master's Program ?**
  - Increasing need for visual computing specialists
  - Visual Computing requires a broad interdisciplinary knowledge from computer science and mathematics but e.g., also from physics, engineering, biology, cognitive science, ...
  - Not sufficiently covered in traditional, monodisciplinary study programs
  - May accept students with different backgrounds
- **Excellent job perspectives**
  - Computer vision, optical industry, medical imaging, automotive industry, robotics, telecommunications, multimedia, computer games, media design, AI, ...

Our Master Program in VC

- **Visual Computing at Saarland University**
  - Saarbrücken one of the leading places in Visual Computing
  - Master's program in Visual Computing (since 2006)
  - Deals with foundations, algorithms, and applications of Visual Computing
  - International: Can be studied in English
  - Publications in top-ranked venues – often also involving our students!!!
  - Quality over quantity

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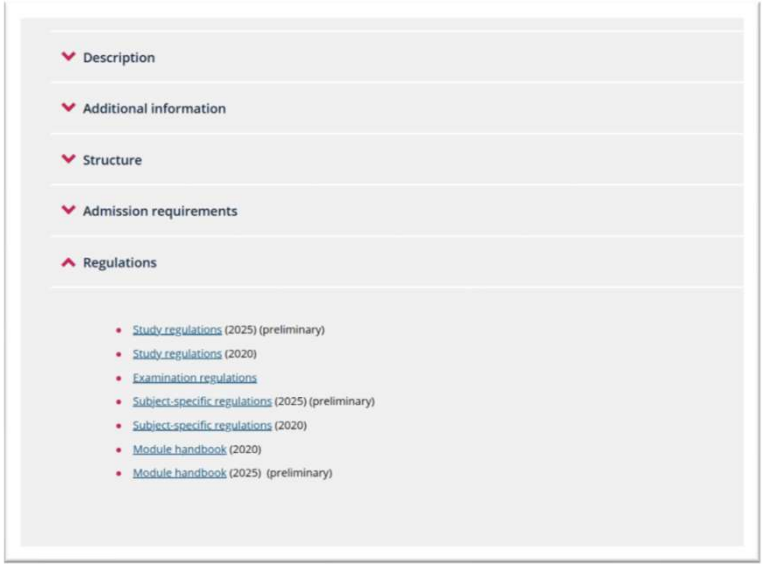
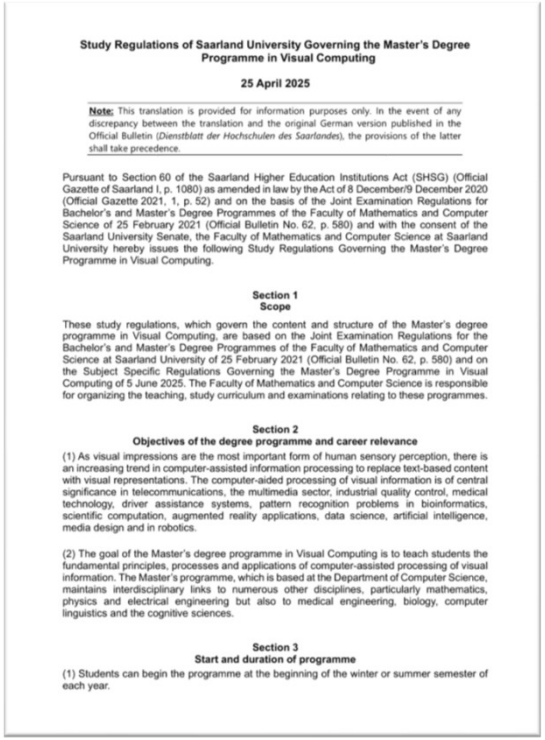
Our Master Program in VC

Study Documents:



Read your study documents carefully!

You have to know your rights and duties as a student!



Study Regulations of Saarland University Governing the Master's Degree Programme in Visual Computing

25 April 2025

Note: This translation is provided for information purposes only. In the event of any discrepancy between the translation and the original German version published in the Official Bulletin (*Dienstblatt der Hochschulen des Saarlandes*), the provisions of the latter shall take precedence.

Pursuant to Section 60 of the Saarland Higher Education Institutions Act (SHSG) (Official Gazette of Saarland I, p. 1080) as amended in law by the Act of 8 December/9 December 2020 (Official Gazette 2021, 1, p. 52) and on the basis of the Joint Examination Regulations for Bachelor's and Master's Degree Programmes of the Faculty of Mathematics and Computer Science of 25 February 2021 (Official Bulletin No. 62, p. 580) and with the consent of the Saarland University Senate, the Faculty of Mathematics and Computer Science at Saarland University hereby issues the following Study Regulations Governing the Master's Degree Programme in Visual Computing.

Section 1
Scope

These study regulations, which govern the content and structure of the Master's degree programme in Visual Computing, are based on the Joint Examination Regulations for the Bachelor's and Master's Degree Programmes of the Faculty of Mathematics and Computer Science at Saarland University of 25 February 2021 (Official Bulletin No. 62, p. 580) and on the Subject Specific Regulations Governing the Master's Degree Programme in Visual Computing of 5 June 2025. The Faculty of Mathematics and Computer Science is responsible for organizing the teaching, study curriculum and examinations relating to these programmes.

Section 2
Objectives of the degree programme and career relevance

(1) As visual impressions are the most important form of human sensory perception, there is an increasing trend in computer-assisted information processing to replace text-based content with visual representations. The computer-aided processing of visual information is of central significance in telecommunications, the multimedia sector, industrial quality control, medical technology, driver assistance systems, pattern recognition problems in bioinformatics, scientific computation, augmented reality applications, data science, artificial intelligence, media design and in robotics.

(2) The goal of the Master's degree programme in Visual Computing is to teach students the fundamental principles, processes and applications of computer-assisted processing of visual information. The Master's programme, which is based at the Department of Computer Science, maintains interdisciplinary links to numerous other disciplines, particularly mathematics, physics and electrical engineering but also to medical engineering, biology, computer linguistics and the cognitive sciences.

Section 3
Start and duration of programme

(1) Students can begin the programme at the beginning of the winter or summer semester of each year.

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Our Master Program in VC

- **Program Structure & Duration**
  - Duration: 4 semesters
  - Total credits: 120 ECTS

- **Mandatory elective modules** (at least 58 ECTS)**:**
  - Core lectures
  - Advanced lectures
  - Seminars
- **Freely selectable modules** (at least 14 ECTS ungraded)**:**
  - Language courses
  - Tutoring
  - Soft skills
  - Internship, etc.
- **Compulsory modules:**
  - Master's Seminar (12 ECTS)
  - Master’s Thesis (30 ECTS)

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Our Master Program in VC

Study Plan Example:

S1	Core Lecture in Visual Computing 9 CP	Core Lecture Wider Visual Computing 9 CP		Advanced Lecture in Visual Computing 6 CP	Mandatory Elective 6 CP	30 CP
S2	Advanced Lecture in Wider Visual Computing 6 CP	Advanced Lecture in Visual Computing 6 CP	Advanced Lecture in Visual Computing 6 CP	Advanced Lecture Wider Visual Computing 6 CP	Mandatory Elective 5 CP	29 CP
S3	Core Lecture in Visual Computing 9 CP	Advanced Lecture 3 CP		Seminar in Visual Computing 7 CP	Master Seminar 12 CP	31 CP
S4	Thesis 30 CP					30 CP

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Our Master Program in VC

1) 18 CP from Core lectures in “Visual Computing”

- Mandatory: ‘Computer Graphics’ or ‘Image Processing and Computer Vision’

2) 12-18 CP from core or advanced lectures in “Visual Computing”

Our Master Program in VC

→ Core lectures in “Visual Computing”

Summer: ‘Machine Learning’ and ‘Image Processing and Computer Vision’

Winter: ‘Computer Graphics’ and ‘Human Computer Interaction ’

Course Overview (WiSe 2025/26)

ⓘ Vorlesungsverzeichnis
→ ⓘ Master
→ ⓘ Master (konsekutiv)
→ ⓘ Visual Computing
→ ⓘ Master, StO 2025
→ ⓘ Core Lectures "Visual Computing"

Lect.-No.	Lecture
159925	Computer Graphics - Slusallek
159927	Human Computer Interaction - Steimle , Feit

Our Master Program in VC

→ Advanced lectures in “Visual Computing”

Summer: ‘Interactive Systems’ and ‘High Level Computer Vision’

Winter: ‘Audio/Visual Communication & Networks (AVCN)’, ‘Neural Networks’, ‘Realistic Image Synthesis’, ‘Advanced Topics in Neural Rendering and Reconstruction’, ‘Differential Equations in Image Processing and Computer Vision’

ⓘ Advanced Lectures "Visual Computing"

Lect.-No.	Lecture
159834	Audio/Visual Communication and Networks (Telecommunications 2) - Herfet
159931	Neural Networks: Theory and Implementation - Klakow
159932	Differential Equations in Image Processing and Computer Vision - Weickert , N

Our Master Program in VC

3) 21-28 CP from core or advanced lectures in “Wider Area of Visual Computing” or seminars in the field of “Visual Computing”

4) 7 CP from seminars in the field of “Visual Computing”

Our Master Program in VC

→ Core lectures in “Wider Area of Visual Computing”

Summer: ‘Cyber-Physical Systems’, ‘Convex Analysis and Optimization’, ‘Internet Transport’

Winter: ‘Digital Transmission and Signal Processing’

ⓘ Core Lectures "Wider Visual Computing"

Lect.-No.	Lecture
159833	Digital Transmission, Signal Processing - Herfet

Our Master Program in VC

→ Advanced lectures in “Wider Area of Visual Computing”

Summer: ‘Optimization for Machine Learning’ (if possible)

Winter: ‘Fundamentals of Signal Processing’

→ ⓘ Advanced Lectures "Wider Visual Computing"

Lect.-No.	Lecture	Type	Activity
158872	Grundlagen der Signalverarbeitung - Klakow	Lecture / Exercise/problem-solving class	

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Our Master Program in VC

→ Seminars in the field of Visual Computing

Summer: TBD

Winter: ‘Explainable Reinforcement Learning on GPUs’, ‘Inpainting-Based Image Compression’ and ‘Adaptive User Interfaces for Mixed Reality - a practical research seminar’

→ ⓘ Seminars "Visual Computing"

Lect.-No.	Lecture	Type	Activity
161341	Explainable Reinforcement Learning on GPUs - Krüger , Mitarbeitende des Lehrstuhls , Kiefer	seminar	
161480	Inpainting-Based Image Compression - Weickert	seminar	
161481	Adaptive User Interfaces for Mixed Reality - a practical research seminar - Feit	seminar	

Our Master Program in VC

5) At least 14 CP (ungraded) from freely selectable modules

- Master's level practical assignments or projects (6 CP)
- Industrial Internship (max. 6 CP)
- Language courses (max. 6 CP)
- Tutoring (typ. 4 CPs)
- Soft skills (e. g. by Zell, max. 3 CP)
- …

Our Master Program in VC

6) 12 CP from the ‘Master’s Seminar’ module

7) 30 CP from the ‘Master’s Thesis’ module

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Tips for the Master Thesis

1. Start early and choose courses strategically

– Attend advanced lectures and seminars on your preferred topics and get to know and work with potential supervisors.

2. Choose a supervisor and first reviewer

– Some chairs and working groups advertise open thesis topics
(Look for information on homepages)

– Approach potential supervisors after a lecture or talk to researchers from the group

Tips for the Master Thesis

3. Attend and complete the Master's seminar

- Offered by your first examiner/supervisor
- Once you have passed the Master's seminar, you can start the work on the actual Master's thesis.
- Great to get into a topic, research previous work, identify the exact goals, get a good impression of what is necessary to finish the thesis, …

4. Register for your Master's thesis and start writing it

- The Master's thesis must be registered at the Examination Office no later than one semester after successful participation in the Master's seminar. If you miss this deadline and have not registered, you will have to attend another Master's seminar.

Tips for Studying

Some Tips for a Successful Study

- Avoid taking more than 30 CP per semester (in particular in first semester)
- Study in groups of 2-3 people

  This also helps enormously with the assignments (but do the work yourself!)
- Try to fill up your categories in a balanced way

  Do not wait with one category until the very end
- Take broader introductory classes in Semesters 1 & 2

  Afterwards take more specialized classes and seminars in Semesters 3 & 4

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Our Master Program in VC

Examination registration

- **Important:** For all examinations you have to register in LSF **one week before the exam** at the latest (final exam and/or re-exam)! A delayed registration is not allowed!
- A withdrawal is possible **one week** before the respective exam at the latest; later only with a medical certificate!
- Only for core lectures: You can improve a grade if you pass the final exam and take part in the re-exam in the same exam period. The better grade counts.
- **For some courses e.g. seminars you also have to register before the course starts (limited number of participants).** Please have a look at the respective website:
  Seminar registration: https://seminars.cs.uni-saarland.de/
- A withdrawal from a seminar registration is only possible three weeks after getting the topic for presentation.

Contact

- **Examination office: Laura Schmigiel**

  Administration and processing of your achievements: Transcript of record, master thesis registration, official certificates, recognition of external academic achievements, etc.

  Building E1.3, room 202

  Office hours: information on website

  Email: **vc@ps-mint.uni-saarland.de**

- **Study Coordinators: Dr. Rahel Stoike-Sy and Barbara Schulz-Brünken**

  Assistance in your study organisation and progress: Questions about the examination and study regulations, academic or personal problems, information about exchange semesters, etc.

  Building E1.3, rooms 209 and 211

  Office hours: Tuesday, Wednesday and Thursday

  Book an appointment: https://www.uni-saarland.de/en/department/department-of-computer-science/department.html

  Email: **studium@cs.uni-saarland.de**

- **SIC System Administration: https://it.cs.uni-saarland.de/**

SIC Saarland Informatics Campus

UNIVERSITÄT DES SAARLANDES

CBI CENTER FOR BIOINFORMATICS

MCI CLUSTER OF EXCELLENCE

DFKI German Research Center for Artificial Intelligence

mpi max planck institut informatik

MAX PLANCK INSTITUTE FOR SOFTWARE SYSTEMS