

saarland-informatics-campus.de

# Saarland Informatics Campus

Introductory Meeting for Master Students  
in Visual Computing

Prof. Philipp Slusallek, dfki, 15.04.2024



UNIVERSITÄT  
DES  
SAARLANDES

**SIC** Saarland Informatics  
Campus

# Visual Computing

## Summer Term 2024

### Introductory Meeting

- **Philipp Slusallek**
- Computer Graphics, Saarland University
  - Agents and Simulated Reality, DFKI

# Overview

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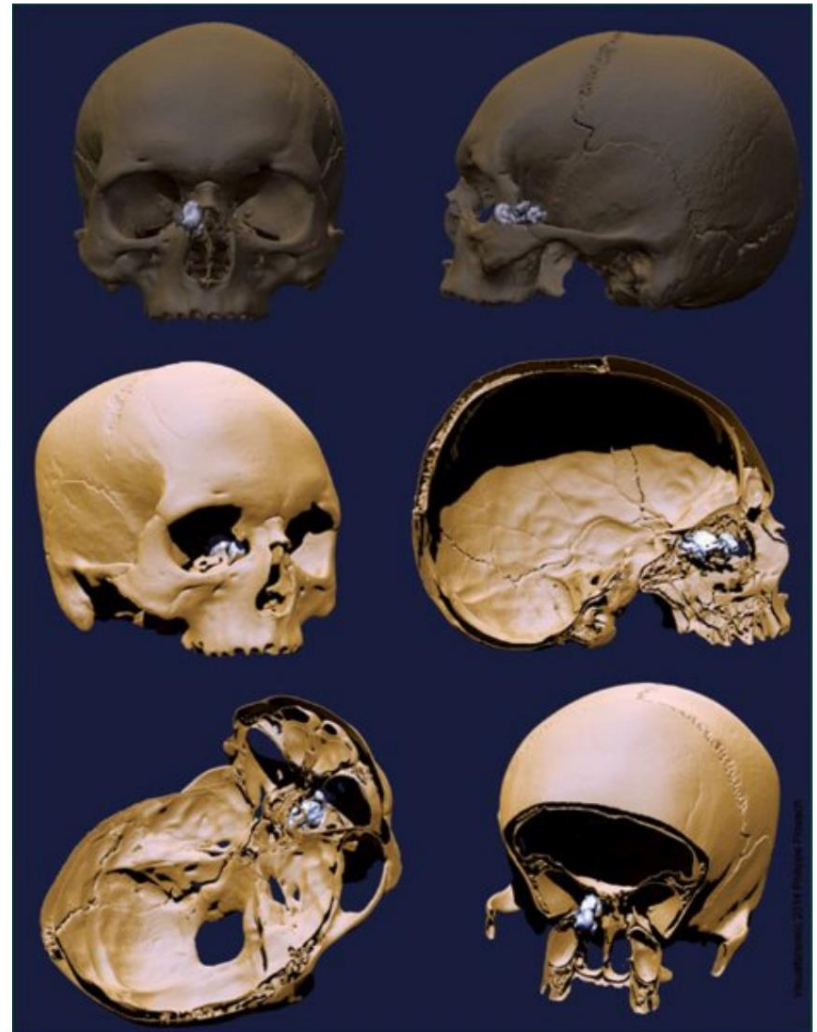
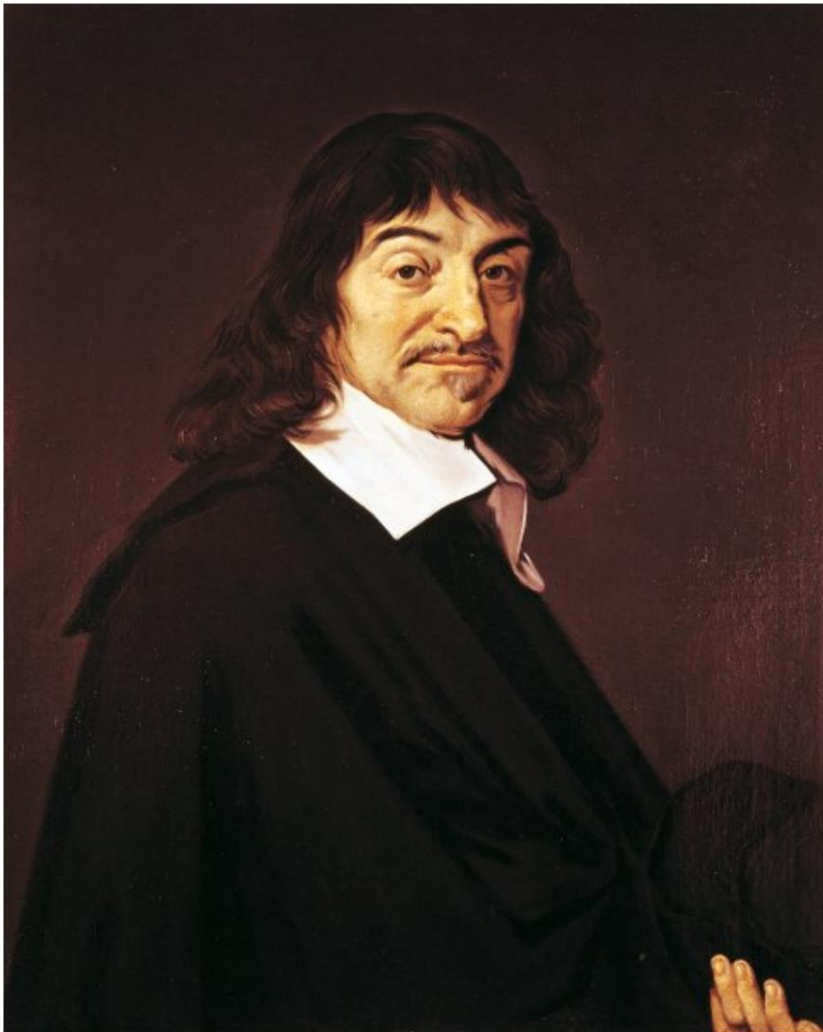
- **What is Visual Computing ?**
  - Our Master Program in Visual Computing
  - What's New ?
  - Some Statistics
  - Ten Tips for a Successful Study Period

# What is Visual Computing ? (1)

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- **Visual Computing deals with all aspects of computer-based processing and representation of visual information**
  - Image acquisition, image analysis, and image synthesis
- **Important for numerous applications:**
  - Entertainment & Media
  - Industry
  - Health
  - Mobility
  - AI and Robotics

# What is Visual Computing ? (2)



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](http://www.spiegel.de)

# What is Visual Computing ? (3)

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

# What is Visual Computing ? (4)

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4K image, 3840 × 2160 pixels



optimised data, 5 % density



homogeneous 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 ? (5)

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Four images of a stereo image sequence (340 × 480 pixels).

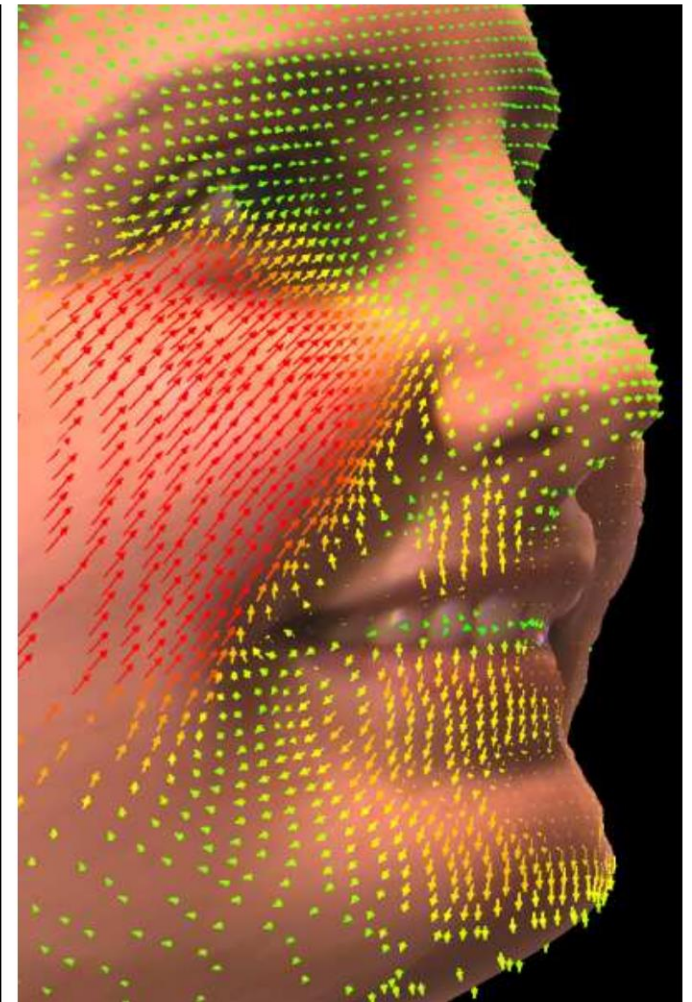
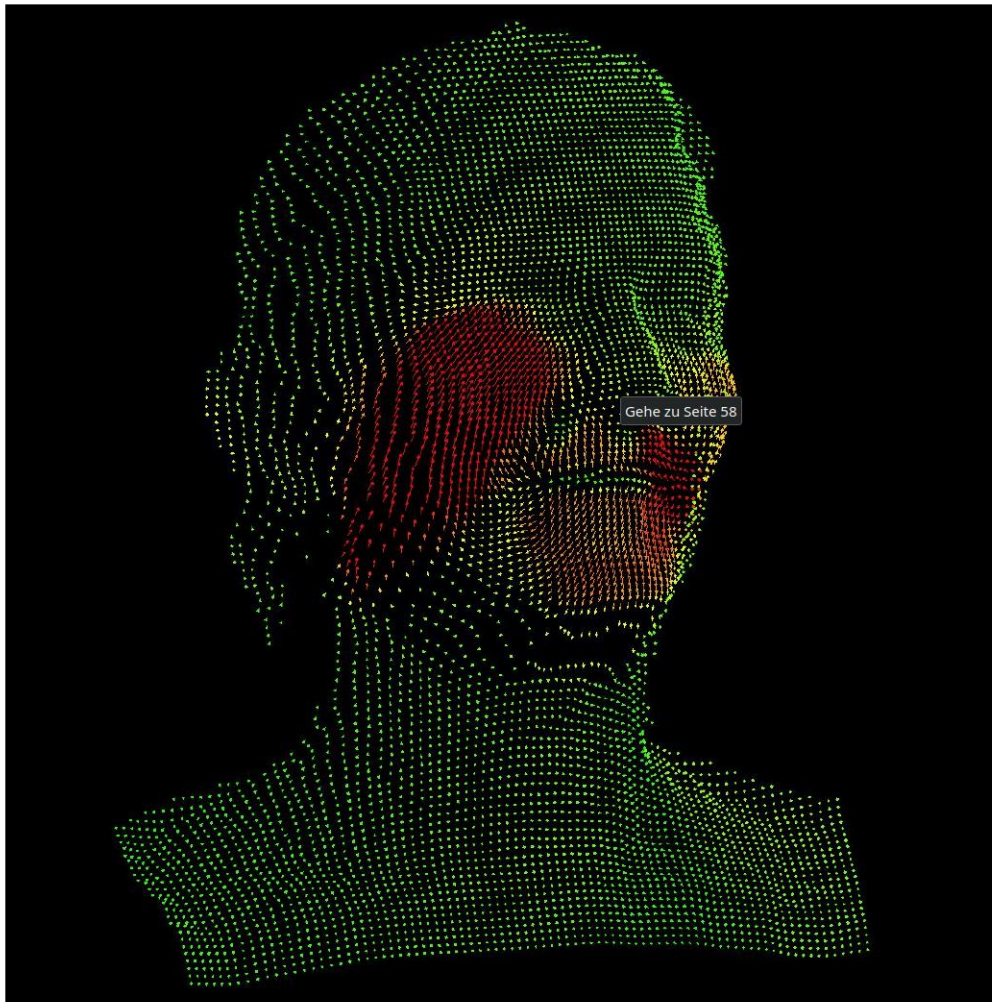
Top: Stereo image pair at time  $t$ .

Bottom: Stereo image pair at time  $t + 1$ .



# What is Visual Computing ? (6)

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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 ? (6)

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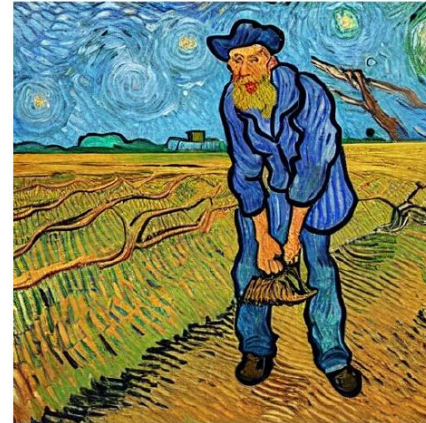
Claude Monet



Max Liebermann



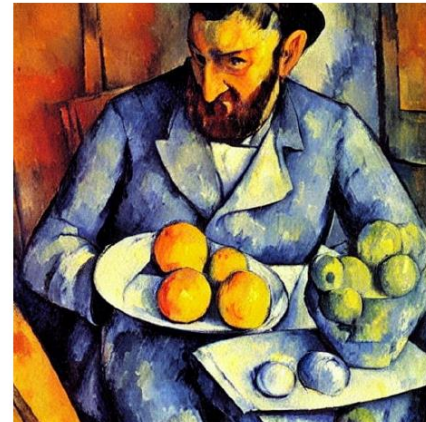
Vincent van Gogh



H. de Toulouse-Lautrec



Paul Gauguin

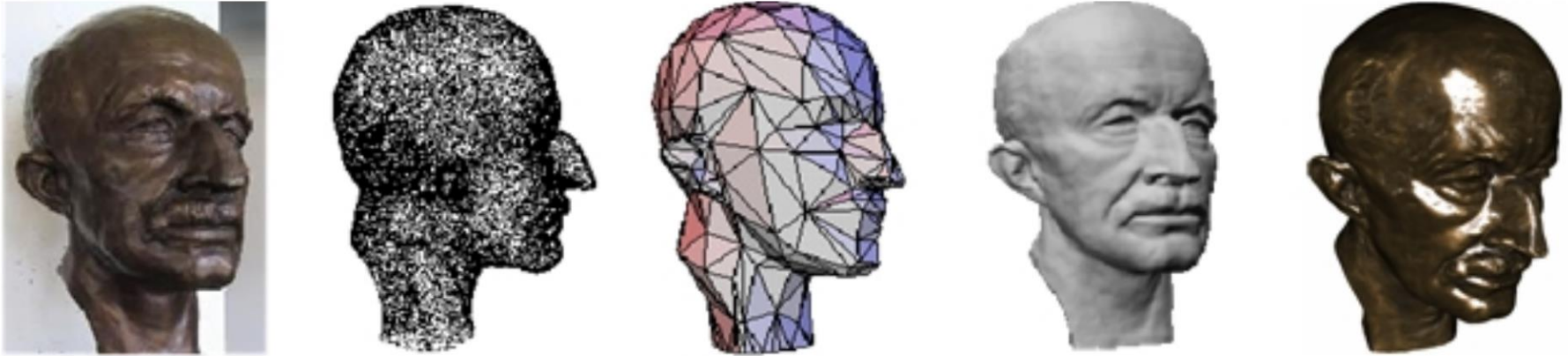


Paul Cézanne

Simulation of the style of impressionistic and post-impressionistic painters with generative deep learning models (probabilistic diffusion). Author: Weickert, using <https://inpainter.vercel.app/paint>.

# What is Visual Computing ? (7)

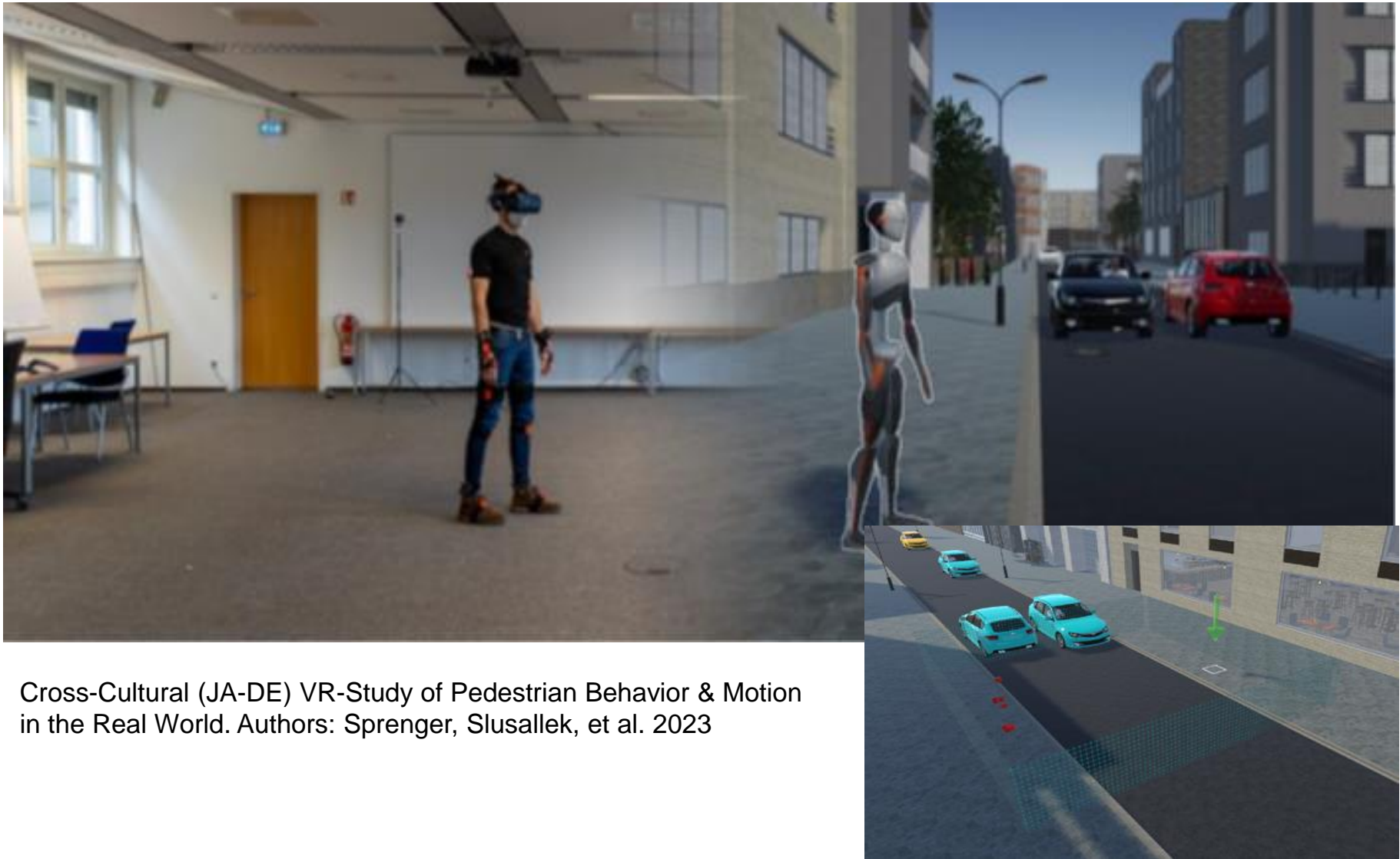
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The Max Planck image shows the entire chain from image acquisition by a 3-D scanner over a surface representation to a realistic 3-D model. Authors: H.-P. Seidel et al.

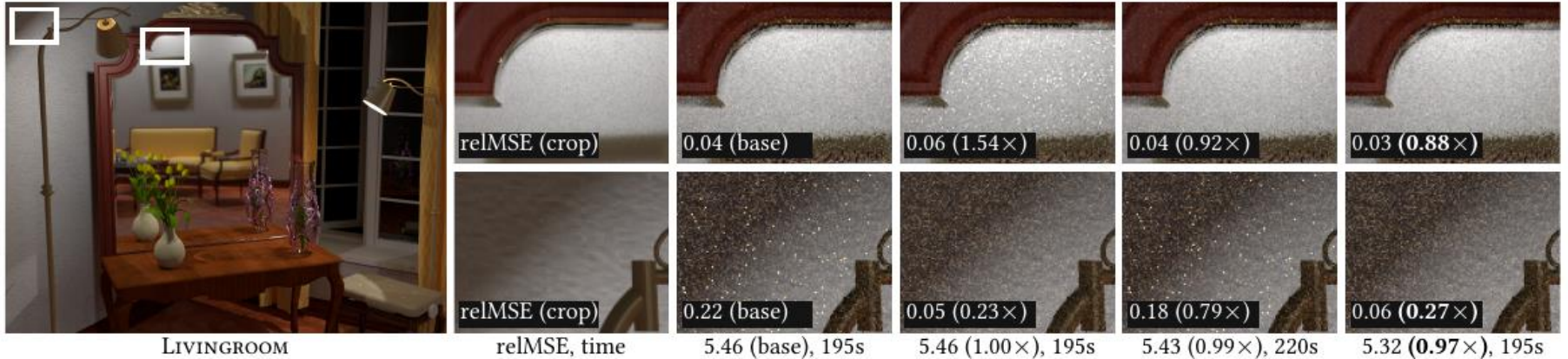
# What is Visual Computing ? (8)

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Cross-Cultural (JA-DE) VR-Study of Pedestrian Behavior & Motion in the Real World. Authors: Sprenger, Slusallek, et al. 2023

# What is Visual Computing ? (9)



LIVINGROOM

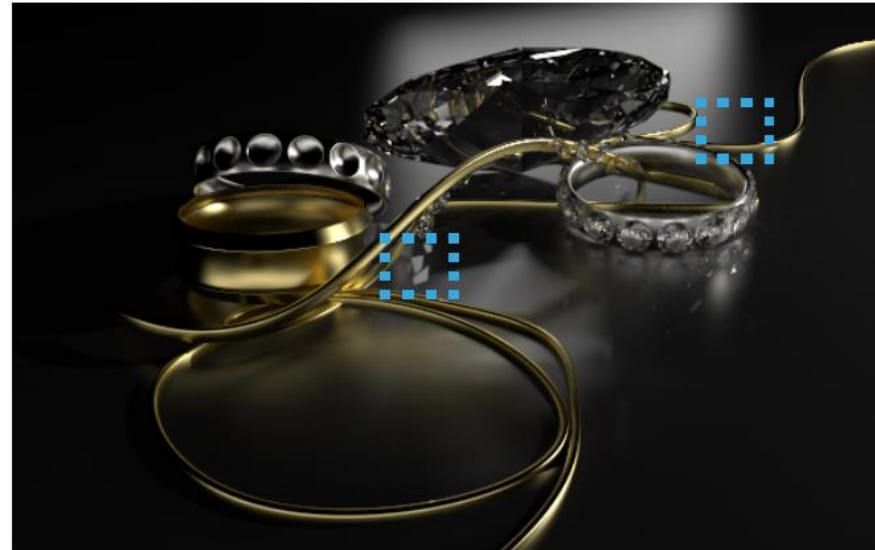
relMSE, time

5.46 (base), 195s

5.46 (1.00x), 195s

5.43 (0.99x), 220s

5.32 (0.97x), 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

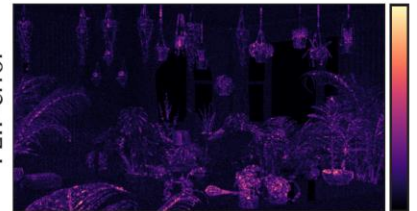
# What is Visual Computing ? (10)



∞-BVH



Base geometry



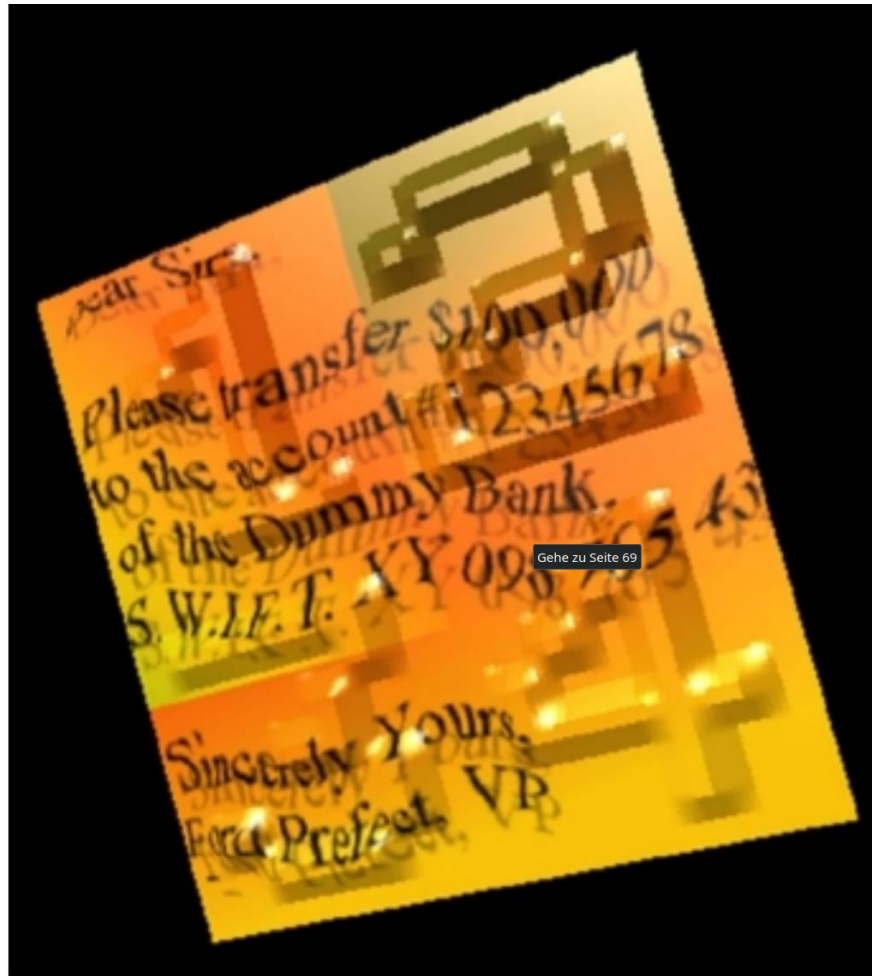
FLIP error

Original scene: 105 MB + 1780 MB  
Our scene: 105 MB + 43 MB

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

# What is Visual Computing ? (11)

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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.

# Our Master Program in VC (1)

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- **Why a Specific Master's Program ?**
  - Visual Computing requires a broad interdisciplinary knowledge from computer science, mathematics, physics, engineering, biology, cognitive science, art, ...
  - not sufficiently covered in traditional, monodisciplinary study programs
  - increasing need for visual computing specialists
- **Excellent job perspectives:**
  - Machine vision, optical industry, medical imaging, automotive industry, robotics, surveillance, telecommunications, multimedia, computer games, media design, ...



# Our Master Program in VC (2)

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- **Visual Computing at Saarland University**
  - Saarbrücken belongs to the leading places in Visual Computing
  - Since WT 2006 / 2007: Master's program in Visual Computing
  - Deals with foundations, algorithms, and applications of computer-based visual information processing
  - International: can be studied in English
  - Publications in top-ranked venues by students
  - Quality over quantity
- **4 semesters, 120 ECTS points, prerequisites:**
  - B.Sc. in Computer Science, Mathematics, Physics, Engineering, or equivalent

# Our Master Program in VC (3)

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- **Five Departments of Saarland University:**
  - Computer Science
  - Mathematics
  - Mechatronics
  - Physics
  - Computational Linguistics
- **Four Research Institutes:**
  - Max Planck Institute for Computer Science
  - Fraunhofer Institute for Biomedical Engineering
  - Fraunhofer Institute for Nondestructive Testing
  - German Research Centre for Artificial Intelligence

# Our Master Program in VC (4)

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- **National and International Embedding**
  - Similar study programs in Germany: Rostock, TU Darmstadt, Siegen, Magdeburg, Koblenz, FH Iserlohn
- **International visual computing activities:**
  - e.g. TU Vienna, UC London, Bourgogne–Girona–Edinburgh, Barcelona, Paris
- **Erasmus exchange program:**
  - Bergen, Linköping, Dublin, Paris, Edinburgh, Tarragona, Ankara, ...
- **Strong interest from other institutions, e.g. Harvard**

# Our Master Program in VC (5)

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- **What's New ?**

- Successful proposal for a DFG Research Training Group on Neuroexplicit AI Models of Language, Vision, and Action
  - Joint initiative of 12 principal investigators
  - 24 new Ph.D. high-profile positions
- New collaboration of MPI-INF with Google:
  - Saarbrücken Research Center for Visual Computing, Interaction and Artificial Intelligence (VIA)
- New collaboration with of Saarland with Intel:
  - Center for the Future of Graphics and Media

# Our Master Program in VC (6)

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- **Some Statistics**

- Admissions and Incriptions

- In each application round, ca. 20 % are admitted
    - Ca. 10 % start as VC students

- **Where Do Our Students Come from?**

- 249 students from 40 different countries so far

Origin	Numbers	Percentage
Saarbrücken (B.Sc. at UdS)	32	12.9 %
Germany (without Saarbrücken)	28	11.2 %
Europe (without Germany)	35	14.1 %
Asia	132	53.0 %
Americas	12	4.8 %
Africa	10	4.0 %

# Our Master Program in VC (7)

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- **What Do Students Do After Their Study?**
  - Ca. 70 %: Ph.D. in Saarbrücken, Germany, or abroad
  - Ca. 30 %: job in industry, almost all of them VC-related
- **Examples**
  - K Lens (3D imaging hardware, Saarbrücken)
  - Carl Zeiss (computational imaging, Oberkochen)
  - LaserSoft Imaging (scanner software, Kiel)
  - Fraunhofer ITWM (seismic image analysis, KL)
  - Dialogika (computer vision for trolley busses, Dudweiler)
  - Google (image retrieval, CV & graphics, Zurich)
  - Google DeepMind (machine learning, London)
  - Intel (computer graphics)

# Tips for Studying

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- **Some Tips for a Successful Study Period**

- Do not take more than 30 CP per semester
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- Study in groups of 2–3 people
  - This also helps enormously with the assignments
- 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 1 & 2
  - I will be happy to give you individual advice

# FAQs

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- **Can I use additional credit points from one category in another one?**
  - Then there would be no need for categories
- **Can I do the same in a regular computer science master's program?**
  - VC is more interdisciplinary
  - MSc in Visual Computing can give advantages for specific jobs and Ph.D. positions
- **Can I combine two master programs?**
  - Yes. Two master theses required
  - 1-2 additional semesters, if related programs are chosen wisely, e.g. CS, Math, or Mechatronics



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YOUR STUDIES

## Study Regulations 2020 for Master of Visual Computing

- *Read your study documents carefully!*
- Examination regulations, subject-specific regulations and study regulations: [Check the website for the joint examination offices of all faculties of Natural Sciences and Technology](#)
- *You have to know your rights and duties as student!*



## Study programme documents

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- ▶ [Examination regulations](#)
- ▶ [Examination regulations \(english\)](#)
- ▶ [Subject-specific + study regulations](#)
- ▶ [Subject-specific regulations \(english\)](#)
- ▶ [Study regulations \(english\)](#)
- ▶ [Module guide](#)

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## YOUR STUDIES

### Control of progress

Full-time students are expected to deliver the following minimum requirements in the Master course of study:

- At least **9 credits after 1 semester**
- At least **30 credits after 2 semesters**
- At least **60 credits after 4 semesters**
- At least **90 credits after 6 semesters**

- In case a student does not meet the minimum requirements for the second time, he/she shall lose the right to participate in examinations.

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Students shall be given the opportunity to make a written statement before the examination board makes the final decision in the matter.

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## YOUR STUDIES

### Examination registration

- **Please notice:** 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 in a core course 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 have also to register before the course starts (limited number of participants):** Please have a look at the respective website because of the conditions for registration.
- 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.
- **Problems?** Please contact the study coordination!

## YOUR STUDIES

### Contacts

- **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 207
  - Office hours: Tuesday, Wednesday and Friday (book an online appointment via MS Teams): <https://www.uni-saarland.de/en/department/department-of-computer-science/department.html>
  - Emails to: [studium@cs.uni-saarland.de](mailto:studium@cs.uni-saarland.de)
- **Examination office: Bianca Fauß and Jacqueline Pennekamp**
- Administration and processing of your programme achievements:
- Transcript of record, registration master thesis, official certificates, recognition of external academic achievements, etc.
- Building E1.3, room 202
  - Office hours: [information on website](#)
  - Emails to: [cs@ps-mint.uni-saarland.de](mailto:cs@ps-mint.uni-saarland.de)
- **SIC System Administration: <https://it.cs.uni-saarland.de/>**

