

Mathematical Image Analysis Group Image Processing and Computer Vision Dr. Pascal Peter

Summer term 2023 Saarland University



Important Information at a Glance

Lectures

- Tuesday 10:15-12:00 (Building E2.2, Günter Hotz Lecture Theatre)
- Friday 10:15-12:00 (Building E1.3, HS001)
- The lectures are planned to be hybrid live lectures. This means that you can either attend in person or online. Each session is announced in the Teams Lecture channel which you can access after registration. We encourage you to participate actively by asking questions, but attending lectures is not mandatory. All slides are available in Teams.
- First Lecture: Friday, **14.04.2022**, 10:00 sharp You can ask any general questions you might still have about the course either in this first meeting or already earlier in MS Teams.

Tutorials

- your individual choice: weekly face-to-face tutorials or online
- Discuss class room work assignments in a group of up to 3 students. (12 points)
- Hand in homework assignments in the same group. (24 points)
- You need to register for a tutorial group in Teams.
- Feel free to use the organisation channel to find a group or message Michael Ertel to join the group roulette (random team assignment)!

Exams

- admission: 312/468 tutorial points (13 tutorials)
- closed book: You can bring a handwritten sheet of notes, but no other materials.
- dates: 25.07.2023 and 09.10.2023, 14:00-17:00
- The better mark counts.
- Exams require LSF registration! (Starts a few weeks into the semester.)

In the rest of the document you find very detailed organisational information.

A Word of Welcome

In my own time as a student, IPCV marked my first encounter with visual computing and sparked a research interest that, in the end, determined my career. Therefore, I am looking forward to teaching this lecture for the first time. It is an excellent starting point for anyone who wants to process and analyse digital images in academia or industry since it covers a wide variety of different methods.

This comprehensive document is intended to provide you with the information that you need in this semester. Together with the introductory meeting, it should also help you decide if you want to take this lecture.

Since I am always trying both new didactic and technical instruments for teaching, this semester will be the first fully hybrid iteration

Lecturer

Pascal Peter

of IPCV. You can either attend the course in person with face-to-face lectures and group work, or fully online. Furthermore, we will try some options that allow you to influence some organisational aspects of the lecture and provide you some structured feedback options throughout the semester.

A vital point in every lecture is communication – both with our staff and with your fellow students. Therefore, our tutorials focus on group work with assignments that are not redundant to the homework. During the group work, our teaching staff will be there to assist you.

I hope you will enjoy this lecture and look forward to discussing with you in the lectures.

– Pascal Peter

The Tutor Team

Since our tutorials are designed to be active and an integral part of the lecture, we have a motivated team of tutors to assist you and answer your questions. For organisational issues, please contact our head tutor Michael Ertel via Teams or mail (ertel@mia.uni-saarland.de).

Head Tutor



Michael Ertel



Aseer Ahmad Ansari



Cameron Braunstein Tutors

Soumava Paul





Chengjiangrong Peng



Teaching Goals

After attending the lecture you should ...

- ... have a broad overview of the main areas of visual computing.
- ... understand basic paradigms of visual computing (such as transformations or variatonal approaches).
- ... know a set of tools for solving many common problems in visual computing.
- ... be well-prepared for our advanced lectures or a Bachelor's thesis in our group.

Content

In the lecture we will discuss the following topics.

Foundations and Tansformations

- Degradation in Digital Images
- Colour Perception and Colour Spaces
- Image Tansformtations (Fourier, Cosine and Wavelet transform)
- Image Compression
- Image Interpolation

Image Processing

- Point Operations (e.g. histogram equalisation)
- Linear and Nonlinear Filters (e.g. edge and corner detection)
- Image Enhancement
- Texture Analysis

Computer Vision

- Image Sequence Analysis
- 3-D Reconstruction
- Segmentation
- Object Recognition



Course Participation in Teams

• Find the lecture content by navigating to the *file* tab of the *lecture channel*.

Teams	Ē	IC Lectures Posts Files Notes +	between messages	and files
Your teams		+ New ∨ ⊼ Upload ∨ G Sync	ര Copy link y Downle	oad 🔹 🏟 Open in SharePoint
[MI] Image Acquisition Methods 2021		Lectures > Lectures		
[MI] Advanced Image Analysis 2021		□ ^h Name ∨	Modified \checkmark	Modified By \checkmark
IC [MI] Image Compression 2022		introduction	February 24	Pascal Tobias Peter
General Assignments channels		unit01	March 25	Pascal Tobias Peter
Lectures		unit02	March 25	Pascal Tobias Peter
Organisation Watercooler		unit03	March 25	Pascal Tobias Peter
[MI] Deep Learning for Visual Compu		init04	March 25	Pascal Tobias Peter

- If you want to make sure you get all new messages in teams, enable the channel notifications for all channels (via the \cdot symbols next to the channel name).
- Many lecture slides will be available from day one. Go ahead and look at them in advance if you enjoy a faster pace. However, lecture meetings still focus on one unit each week.
- If you want to participate in lecture meetings online, you can find them in the *lecture channel*.
- The meetings take place every Tuesday and Friday at 14 c.t., which means 14:15 sharp.
- Since active attendance is the goal, the meetings are currently **not** planned to be recorded.

Tutorial Details

Groups

- Organise in groups of up to three students for the tutorials.
- You can use the organisation channel to look for groups.
- Alternatively, join the group roulette by messaging Michael Ertel.
- Once your group has formed, send a message to Michael Ertel to receive your own private channel. (Staff can still read it, though.)
- Each team requires a private channel for submission of assignments.

Homework

- Each week: theory or programming assignments worth 24 points in total.
- Submit to your tutor simply by posting your solutions in your private channel in teams. Both handwritten (scanned) and digitally typeset solutions in pdf format are fine for theory submissions, as long as they are readable.
- Programming only requires basic C knowledge. You only fill in missing lines of code.
- Solutions will be available for all assignments.

Classroom Work

- There are additional assignments each week intended for group work.
- You get 12 points for participation with either of these 3 options:

Option 1: Attend in-person tutorials.

Option 2: Work together online in your private channels and report to your tutor.

Option 3: Submit solution attempts (not graded, do not have to be complete).

- Please tell us as soon as possible if you want to participate in face-to-face tutorials or online, as well as which time slots work for you. A corresponding survey can be found in the *organisation channel* of Teams.
- We will announce the date of the **first tutorials** in Teams after groups have been formed.
- Solutions will be available also for classroom work.

Exam Rules

Detailed Rules for the written Exams. These might be augmented with additional rules such as e.g. covid safety measures towards the end of the exam period.

Please also consider the self-test problems in the assignment channel to get a better idea of the exam contents.

- Written and oral exams will be conducted in person unless stated otherwise.
- All content from the lectures and tutorials is relevant unless explicitly stated.
- The scripts, videos, and tutorial materials contain all content you need to solve the exam. No external sources (e.g. books) are required.
- The time limit for the exam is 180 minutes.
- No pocket calculators or other electronic devices are allowed in the exam.
- The exam is **closed book**. Your only aid should be a handwritten, double-sided DIN A4 paper with formulas and notes from the lecture. **Any additional materials you bring will count as cheating.**
- HISPOS/LSF registration is mandatory. If you cannot register (e.g. Erasmus students) please contact Michael Ertel.
- If you take the exam, you have to stay till the end, you cannot leave early.
- Only write on the paper that is provided by us. If you run out of space or need a scrap sheet, we will provide you additional blank sheets.
- You may not take the exam or any written solutions with you. Also your scrap sheets have to be handed in.