Mathematical Image Analysis Group

Image Acquisition Methods

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Saarland University

UNIVERSITÄT DES SAARLANDES

Important Information at a Glance

Lectures

- Tuesday 16:15-18:00 (Building E1.3, HS001)
- *You can attend the live lectures either in person or on Teams. Recordings will be available. Access to Teams and lecture materials will be granted after your registration in the CMS:* `https://cms.sic.saarland/iam23`
- First Lecture: **31.10.2023**

Tutorials

- Discuss class room work assignments in group work.
- You can register for a tutorial group in the CMS.
- Use Teams to find a group or join the group roulette (random assignment)!
- Attendance is not mandatory, but recommended. Assignments are relevant for the exams.

Exams

- closed book: You cannot bring any lecture materials.
- dates: **15.02.2024** and **03.04.2024**, 14:00-16:00
- The better grade counts.
- **Exams require** LSF **registration!** (Starts a few weeks into the semester.)

This flyer intends to answer your most important questions about IAM and should help you to decide if the lecture is interesting for you. For even more details on the organisation of the course, check out our introduction lecture and the guided tour on MS Teams (after registration).

A Word of Welcome

Welcome to my lecture *Image Acquisition Methods* (IAM). This document is intended to provide you with the basic information that you need in this semester. If it manages to awaken your interest in the course, I would be happy to welcome you in the introductory lecture on 31.10.2023. After registration, you will also gain access to a little guided tour that will help you to get more detailed organisational information.

IAM covers the fundamentals of image acquisition and highlights ties to image processing. In this lecture, you will learn basic principles from physics and mathematics that are required to understand different ways to generate images from real-world objects. In addition to well-known techniques such as photography and various medical imaging methods (e.g. computed tomography), you will also encounter more exotic approaches such as holography. Primarily, the lecture is intended for students interested in image processing: Here you learn the origins of images you want to process and the meaning behind abstract pixel data. However, it might also help you to understand image acquisition techniques that you encounter in daily life.

The lecture slides will be available at day one. This allows you to judge early if the lecture is interesting to you. In addition, you can read ahead if you prefer a quicker pace and fill in gaps during the corresponding lectures and tutorials as needed. While we recommend participation in presence, the course can also be attended fully online (except for the exams).

I hope you will enjoy this lecture and look forward to discussing with you. Do not hesitate to ask questions or submit feedback.

– Pascal Peter

Our Staff

Our staff will assist you throughout the lecture to the best of their ability. Feel free to ask us questions and discuss with us in person during the lecture and the tutorials, write in the public Teams channels or write private messages to us on Teams.

Pascal Peter

Ranasadat Khonsari

Teaching Goals

After attending the lecture you should ...

- ... have an overview of a wide range of image acquisition methods.
- ... have an understanding of basic underlying physical and mathematical principles.
- ... understand how different acquisition methods are connected.
- ... know which kinds of artefacts to expect for different methods.
- ... be aware of connections to sub fields of image processing.

Content

In the lecture we will discuss the following topics.

Imaging with Visible Light

- photography, depth imaging, holography, light fields
- fundamentals: electromagnetic radiation, optics, sensors, sampling

Imaging with Invisible Electromagnetic Radiation

- X-Ray and Gamma-Ray Imaging in 2-D
- CT Imaging: Computerised X-Ray Tomography (3-D)
- Radiostronomy, Radar, Terahertz Imaging
- MRI: Magnetic Resonance Imaging

Imaging without Electromagnetic Radiation

- Electron Microscopy
- Acoustic Waves, Sonar, Ultrasound