Six Main Tasks in Image Processing

Report of Contributions

The six main tasks in image proce ...

Contribution ID: 9

Type: not specified

The six main tasks in image processing: an overview

Thursday 4 May 2023 14:00 (1h 30m)

Modern imaging methods enable us to capture structure and dynamics in unprecedented detail and with high temporal and spatial resolution. The challenge is to make full use of the potential of such "big" imaging data to obtain quantitative results, test hypotheses, and develop new theories and models. Manual or semi-automated image analysis workflows quickly become a bottleneck because they do not scale well with the amount and complexity of the data. This lecture provides an overview of typical automated image analysis workflows using examples from high-resolution microscopy in the life sciences. We will cover the six main tasks, including image reconstruction from raw tomography or localization data, denoising, tracking in time and space, segmentation to extract objects from images, visualization, and explainable AI-based methods. In the last part, we will introduce tools for integrating these different tasks into complete workflows.

Presenter: Prof. KOLLMANNSBERGER, Philip (Heinrich-Heine-Universität Düsseldorf)

Tomographic methods in medical i ...

Contribution ID: 10

Type: not specified

Tomographic methods in medical imaging

Thursday 25 May 2023 14:00 (45 minutes)

In medical imaging, dedicated cameras are used to capture images, and medical images are typically three-dimensional images. These three-dimensional images are generated from a series of datagrams or images of sections and/or projections, which is achieved by tomographic reconstruction. Magnetic Resonance Imaging (MRI), Computed Tomography (CT), Positron Emission Tomography (PET) and Single Photon Emission Computed Tomography (SPECT) are typical examples of different imaging modalities where tomographic reconstruction methods are used. This lecture gives a brief introduction to Fourier transform based reconstruction (MRI), filtered back projection (CT) and iterative reconstruction (PET and CT).

Presenter: Dr LERCHE, Christoph (PET Physics Group at Forschungszentrum Jülich)

Six Main Tasks in ... / Report of Contributions

Restoring noisy microscopy images

Contribution ID: 11

Type: not specified

Restoring noisy microscopy images

Thursday 25 May 2023 14:45 (45 minutes)

Bleaching and phototoxicity in light microscopy, or beam-induced sample damage in electron microscopy, are just some of the many reasons why exposure must be kept low in microscopy. However, limiting exposure can result in noisy image acquisition. These noisy image data are not only tedious to browse, but often make automated image processing difficult or even impossible. In this talk, I will give an overview of different deep learning based image restoration methods that enable high quality image restoration for very noisy image data.

Presenter: Dr BUCHHOLZ, Tim-Oliver (Friedrich Miescher Institute for Biomedical Research, Basel)

Tracking of objects: from one to m ...

Contribution ID: 12

Type: not specified

Tracking of objects: from one to many

Thursday 15 June 2023 14:00 (1h 30m)

I will talk about two separate research areas for tracking objects over time and instances. The first applies to the scenario of tracking an object over time, e.g. a known 3D rigid model. I will introduce Bayesian and particle filters and explain some technical ideas to make them fast and accurate. In the second part of the lecture I will introduce the field of tracking a large set of objects (e.g. cells) over time, and also instances. Since the objects typically do not move randomly, it makes sense to formalize their "structured motion" and formulate this task as a structured prediction problem. To this end, I will introduce efficient solvers for this problem.

Presenter: Prof. ROTHER, Carsten (HCI, Universität Heidelberg) **Session Classification:** Seminar Series

Machine Learning for Image Segm ...

Contribution ID: 13

Type: not specified

Machine Learning for Image Segmentation

Thursday 29 June 2023 14:00 (1h 30m)

The course will introduce current machine learning models for image segmentation, including semantic- and instance segmentation. It will also cover how to apply such models to large data. A respective tutorial at the end of the seminar series will give hands-on experience in training and applying such models.

Presenter: Prof. KAINMÜLLER, Dagmar (Helmholtz Imaging, Max-Delbrück Center, Berlin)

Six Main Tasks in ... / Report of Contributions

Visualizing spatial datasets

Contribution ID: 14

Type: not specified

Visualizing spatial datasets

Thursday 6 July 2023 14:00 (1h 30m)

Join us in our journey through selected methods of telling the story of your dataset through visualizations. In the seminar, we will transform 3D segmentations into effectful Blender renderings.

Presenter: SCHMIDT, Deborah (Helmholtz Imaging, Max-Delbrück Center, Berlin) **Session Classification:** Seminar Series

Explainable Machine Learning

Contribution ID: 15

Type: not specified

Explainable Machine Learning

Thursday 27 July 2023 14:00 (1h 30m)

Explainable machine learning involves two complementary types of questions: (1) Method designers and theorists ask: "Why do deep neural networks work so well? How can we further improve them? How can we provide formal performance guarantees?" (2) Instead, method users ask, "How did the network arrive at its conclusion? What variables determine the result, and in what way? Can the result be trusted?" The talk will introduce both areas and review the current state of our answers.

Presenter: Prof. KÖTHE, Ullrich (Interdisciplinary Center for Scientific Computing (IWR) University of Heidelberg)