

Profile
(1.0 FTE)
Chair: Imaging and Visualization

Leiden Institute of Advanced Computer Science (LIACS)
Universiteit Leiden

1. Description of the Research Area of the Chair

Artificial intelligence and life science are key research areas at Leiden University. Artificial intelligence and computer graphics have made great progress in imaging and visualization algorithms. Computer graphics and visualization are key elements in several domains; medical, architectural, and scientific applications, entertainment, simulations, and virtual training are only a few examples on which the field has had a strong impact. In these contexts, realistic, perceptual, and expressive rendering, visualization of scientific and medical data, interaction and game technologies, and modelling of 3D content are studied.

The field is one of the most vibrant and fast developing research areas in computer science, with thousands of research articles published per year and a steadily growing number of variations, and an even faster growing number of application domains.

Challenges

The aim is to develop methods to efficiently and effectively produce virtual worlds and provide high-quality display solutions. Solutions to produce instructive illustrations with real-world applications (e.g., medical visualization, or flooding simulations) and make use of perceptual findings to increase the effectiveness of the displayed information. This work is multi-disciplinary and combines aspects of various fields, such as physics, parallel programming, algorithms, perception, and numerical methods.

Goal

The goal of the chair of “Imaging and Visualization” is to strengthen the fields of artificial intelligence, machine learning, and data science, with applications in life science and health, both in scientific research and in education. The chair will study fundamental properties of algorithms, in cooperation with our research areas in computer vision and computational bio-imaging, nonlinear optimization, automatic machine learning, reinforcement learning, and data science.

The focus of the chair is to work on foundations of Imaging and Visualization, for example by using visualization methods for understanding the internal learning processes of artificial neural networks, or by using machine learning to extract the internal knowledge and make it human-readable. Applications of imaging and visualization are in other disciplines, such as life science, drug discovery, and other areas of health, in which such foundational approaches can demonstrate their potential.

Typical important research topics in this area are:

- Automatic image analysis design approaches for deep neural network architectures.
- Visual analytics and multivalued image analysis and visualization.

- Visual analytics for high dimensional data.
- Visual analysis of the internal dynamics of deep neural network architectures.
- Automatic knowledge extraction from deep neural networks by using machine learning approaches.
- Applications in life science, drug discovery, health.

2. Profile of the Full Professor “Imaging and Visualization”

The professor shall have:

- excellent research qualities in the field of imaging and visualization and their design or analysis, as evidenced by a strong record of scientific publications,
- an internationally renowned reputation in the field of imaging and visualization,
- affinity with interdisciplinary research,
- the ability to attract prestigious national and international personal grants,
- the ability to initiate international research programs and consortia,
- experience in establishing research programs and supervising and coordinating scientific research,
- the ability to supervise and inspire undergraduate, graduate, and PhD students and researchers,
- excellent communication and social skills,
- significant teaching experience at the undergraduate and graduate level and the willingness to contribute to LIACS’ educational activities in the Bachelor and Master.

3. Embedding

At the level of Leiden University, the chair will contribute to the recently started initiative on Social Science, Humanities, Law, AI and Life Sciences (“SAILS”), in which multidisciplinary research across different faculties, with AI as a core technology, is conducted. SAILS provides ample opportunities for multidisciplinary collaborations, with application domains for visualization and deep learning where new approaches for understanding the decision making in deep neural networks will be very welcome.

At the level of the Computer Science Institute LIACS, the chair will be part of the artificial intelligence and data science focus area. The professor will collaborate with existing groups focusing on computational bio-imaging (Prof. Verbeek), computer vision (Dr. Lew), health analytics (Prof. Kraaij), automatic machine learning (Prof. Hoos), natural and evolutionary computation (Prof. Bäck), and reinforcement learning (Prof. Plaat).

The professor will participate in and initiate research projects of LIACS and will supervise PhD students. The professor will contribute to education programs at the Bachelor or Master level Computer Science.