

Our central research topic at VRVis is the key technology **visual computing**. In addition to the acquisition and processing of data, this also involves analyzing and presenting visual information. The challenge grows with complexity and size: the amount of data increases daily. We obtain concrete answers even from the largest data amounts and present them in insightful images. We deal with all disciplines of computer science that fall under visual computing. This includes: visualization, biomedical image processing, virtual reality, human-computer interaction, artificial intelligence, or digital twins, to name but a few.



Selected Topics: AI Research @ VRVis

Shape Reconstruction

Neural representation learning:
Fast Medical Shape
Reconstruction via Meta-learned
Implicit Neural Representation

G. R. De Paolis et al., "Fast Medical Shape Reconstruction via Meta-learned Implicit Neural Representations", Submitted to 4th MICCAI Workshop on Shape in Medical Imaging, 2024.

Multi-modal Image Registration

Multimodal Registration and
visualization of plant in-field data

<https://www.vrvis.at/en/research/research-projects/agri-pet/mri-a-new-imaging-system-to-detect-stress-in-crops-and-increase-yields>

Synthetic Image Data Generation

SMAIL: Super-resolution-based
monitoring for satellite imaging

<https://www.vrvis.at/en/research/research-projects/smail>

MARS-3D: Planetary scientific target detection via deep learning (finding shatter cones in Mars rover images)

Bechtold, A., Paar, G., Garolla, F., Nowak, R., Fritz, L., Traxler, C., Sidla, O. and Koeberl, C., "Planetary scientific target detection via deep learning: A case study for finding shatter cones in Mars rover images." *Meteorit Planet Sci*, 58: 1274-1286, 2023.

Medical Image Registration

Employing similarity to highlight
differences: On the impact of
anatomical assumptions in chest
X-ray registration methods

A. Berg, E. Vandersmissen, M. Wimmer, D. Major, T. Neubauer, D. Lenis, J. Cant, A. Snoeck, and K. Bühler, "Employing similarity to highlight differences: On the impact of anatomical assumptions in chest X-ray registration methods," *Computers in Biology and Medicine*, vol. 154, 2023.

Explainable and Trustworthy AI

Reliable visualization of image-wise
classifier decisions

D. Major, D. Lenis, M. Wimmer, A. Berg, T. Neubauer, and K. Bühler, "On the importance of domain awareness in classifier interpretations in medical imaging," *IEEE Transactions on Medical Imaging*, 2023.

Pointcloud Reconstruction

Urban Point Cloud Segmentation

L.-M. Kellner, "Klassifikation Urbaner Punktwolken Mittels 3D CNNs In Kombination mit Rekonstruktion von Gehsteigen," M.S. thesis, Institute of Visual Computing and Human-Centered Technology, TU Wien, 2021.

Geometric NerF reconstruction from images with depth map of rebar cage

<https://www.vrvis.at/forschung/forschungsprojekte/bewehrungsdokumentation>

AI in Material Science

Size-aware Instance Segmentation
for High-Resolution Microscopy Data

T. Neubauer, A. Berg, M. Wimmer, D. Lenis, D. Major, P. Winter, G. R. De Paolis, J. Novotny, K. Reinharter, D. Lüttner, and K. Bühler, "Multi-scale attention-based instance segmentation for measuring crystals with large size variation," *IEEE Instrumentation and Measurement*, 2023.

Continual Learning

PARMESAN: Parameter-Free
Memory Search and Transduction
for Dense Prediction Tasks

P. M. Winter, M. Wimmer, D. Major, D. Lenis, A. Berg, T. Neubauer, G. R. De Paolis, J. Novotny, S. Ulonska, and K. Bühler, "PARMESAN: Parameter-Free Memory Search and Transduction for Dense Prediction Tasks," arXiv, 2024.