The Chair of Imaging and Computer Vision (LFB) conducts pioneering research at the intersection of imaging instrumentation and computational imaging, ranging from the development of novel hybrid imaging systems to advanced image reconstruction and video communication. Building on this broad interdisciplinary expertise, we specifically focus on robust 3D reconstruction of anatomical structures and multimodal image analysis. By combining hybrid machine learning with physical modeling, we develop tailored solutions that bridge the gap between raw imaging data and clinical application, ensuring reliable decision support in complex medical workflows.

Generative AI & Surgical Intelligence for Automated 3D Planning

Join us at the forefront of medical AI technology as part of a new interdisciplinary research consortium. We are developing a fully automated process chain for surgical planning, specifically addressing dysgnathia and extremity surgery. You will work in a strong interdisciplinary team alongside our consortium partners, including clinical experts from major university hospitals (providing data & validation), specialized software partners (responsible for platform integration), and experts in manufacturing technology (focusing on production automation). The project aims to overcome the "data bottleneck" in medical AI. Instead of relying solely on massive manual annotation, we aim to leverage unlabelled data to build intelligent systems that truly "understand" 3D anatomy.

Key Responsibilities:
You will pioneer the application of State Space Models (SSMs/Mamba) to automate complex surgical planning, replacing computationally heavy Transformer architectures.

- Design 3D State Space Architectures: Develop "Volumetric-SSM" backbones (e.g., Mamba) to process high-resolution 3D anatomy (CT/DVT) with linear complexity, capturing global relationships without the bottlenecks of patch-based sliding windows.
- Self-Supervised Pre-training: Create SSL strategies to learn robust anatomical representations from unlabelled data, drastically reducing the need for manual annotations.
- Robustness Analysis: Systematically benchmark SSM efficiency and OOD robustness against JEPAs and Generative models, specifically regarding severe anatomical deformations.
- Semantic & Geometric Integration: Interface high-level states with Multimodal LLMs for a semantic "Safety Layer" and implement geometric algorithms (osteotomy planes, collision analysis) to fully automate the planning process.

Your Profile

- Excellent (top 10%) Master's degree in Computer Science, Physics, Engineering, or a related field with a strong focus on AI/ML.
- Proficient in Python and Deep Learning frameworks (PyTorch). Experience with Self-Supervised Learning (SSL), Transformers, or modern architectures like Masked Autoencoders (MAE) / JEPA is highly desirable.
- Strong understanding of computer vision, representation learning, and high-dimensional geometry.
- Passion for solving medical challenges and ability to work in multidisciplinary teams (engineers, clinicians).

What We Offer

- Contribute to groundbreaking research by transferring state-of-the-art AI concepts (Joint Embedding Architectures) into the medical domain.
- Work with extensive clinical datasets (CT, DVT) provided by our clinical partners for pre-training and validation.
- Collaborative environment with experienced researchers and close links to leading medical technology partners.
- Support for professional development, training, and academic publication.
- Flexible working arrangements promoting work-life balance.

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