

Applications of Deep Learning

We offer several projects in which a small team of students develops and evaluates deep learning methods (like language models, computer vision) to address a real research problem within one of our ongoing research projects. Past projects in this series have led to publications led by the involved students at deep learning conferences. We are again aiming for this outcome and will actively support students. The following topics are available:

- **Learning Representations for Spatial Intelligence:** How can we improve the spatial reasoning abilities of LLMs, and how does the choice of spatial representation influence this? As a concrete example, we will investigate generative models for building design and robot navigation supported by building models. More information can be found here: <https://www.mds-lab.de/teaching/spatial-bim/>
- **Learning Anatomical Representations from CT Data:** Develop a probabilistic representation of human abdominal anatomy from 3D CT data with comprehensive anatomical segmentations. Students will explore modern representation-learning approaches such as Variational Autoencoders (VAEs) and Implicit Neural Representations (INRs) to capture anatomical structure and inter-subject variability, with the goal of creating useful anatomical priors for downstream tasks such as anomaly detection and navigation.
- **Improving Generalization of Machine Learning Models:** Machine learning models often do not transfer well to new environments which they were not trained on. Domain Adaptation methods try to adapt models better to a new domain, without additional labeled data. In this project, students will investigate domain adaptation methods for wearable-based human activity recognition, to improve adaptability and stability on new domains, such as different sensor configurations, users, or environments.