

## **Artificial Intelligence in Ultrasound Imaging**

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Over the past years, deep learning has established itself as a powerful tool across a broad spectrum of domains. While deep neural networks initially found applications in the computer vision community, they have quickly spread over medical imaging applications, ranging from image analysis and interpretation to - more recently - image formation and reconstruction. Deep learning is currently also rapidly gaining attention in the ultrasound community.

This course will first cover the basic principles of deep learning, ranging from understanding the relevance of sequential nonlinear transformations for representation learning to log-likelihood based optimization of neural network parameters. Optimization aspects such as the impact of local minima and saddle points in the solution space will also be touched upon. We will then discuss the design of effective neural network architectures, including dedicated solutions that e.g. leverage signal structure through unfolding methods.

The second part will focus on the wealth of opportunities that deep learning brings for ultrasound imaging. Beyond image-level classification and segmentation, we will discuss neural networks for front-end receive processing, including beamforming, clutter suppression, and advanced applications such as super-resolution imaging.